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Reviews of Current Literature on Analytical Methodology and Quality Control

No. 16



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NOTICE

This bulletin is prepared monthly by the staff of the Analytical Methodology Information Center (AMIC), Information Systems Department, Battelle, Columbus Laboratories, Columbus, Ohio, under EPA Contract No. 68-01-1832, to inform personnel of the Analytical Quality Control Laboratory and other segments of the National Analytical Methods Development Research Program of recent publications on methodology. Personnel associated with the center are Mr. Ralph Darby, Project Director, Mr. Robert Little, Project Leader, and Miss Verna Holoman, Abstractor.

The 3" x 5" format of the citations and use of card stock is intended to facilitate removal and filing of items of interest. Because of space limitations, the index terms accompanying the citations are selected from a complete list as representative of the important concepts presented in each article.

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REVIEWS OF CURRENT LITERATURE ON
ANALYTICAL METHODOLOGY AND QUALITY CONTROL

No. 16

By

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U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460



NATIONAL ANALYTICAL METHODS DEVELOPMENT RESEARCH PROGRAM
ANALYTICAL QUALITY CONTROL LABORATORY

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ANALYTICAL METHODOLOGY AND QUALITY CONTROL

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Arrangement of the citations following the major research areas of the Analytical Quality Control Laboratory and other segments of the National Analytical Methods Development Research Program. Items which apply to more than one area are cross-referenced.

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1. PHYSICAL AND CHEMICAL METHODS

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Scope: Wet chemical methods; Nutrients; NTA; Trace metals; Helium glow; Chromatography (thin layer, gas, liquid); Spectroscopy (atomic absorption; flame emission, arc-spark, visible, UV, IR, fluorescent); Radiochemistry; Automation of methods; Ion-specific and other probes; Mass spectrometry; Mass spectra; NMR; Instrument-computer interface; Chlorinated hydrocarbons (pesticides, PCB's, other); Trace organics; Petroleum processes (reforming, hydroforming, platforming, catalysts); Petroleum additives; Reduced crudes; Sulfur isotopes; Boiling range determination; Asphatenes and carboids; Weathering; Organometallics; Elemental analysis; Paraffinic distribution; Petroleum wastes; Water quality standards; Effluent monitoring.

2. BIOLOGICAL METHODS

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Scope: Plankton; Periphyton; Macrophyton; Macroinvertebrates; Fish; Sample collection (grab samplers, artificial substrates); Sample processing (preservation, staining, automatic and manual sorting and counting); Organisms identification (taxonomic keys, optical and electron microscopy, gas chromatography, electrophoresis, karyosystematics); Biomass measurements (drying, freeze-drying, ashing, ATP, DNA, chlorophyll measurement, calorimetry); Metabolic rates (primary productivity, respiration, electron transport, nitrogen fixation); Culturing; Biomonitoring; Bioassay; Bioaccumulation of hazardous materials; Community structure (indicator organisms, species diversity, community stability); Mathematical models; Statistical analysis.

3. MICROBIOLOGICAL METHODS

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Scope: Pollution indicators; Waterborne pathogens; Sampling; Detection; Identification; Enumeration; Monitoring; Survival; Automation; Instrumentation; Cell counting; Selective and differential media; Growth factors; Metabolic products; Membrane filter procedures; Microbiological standards; Specific bacteriophage; Fluorescent antibody techniques; Radioactive tracers; Antigen identification; Photomicroscopy; Optical measurements; Data handling, presentation, and interpretation.

4. METHODS AND PERFORMANCE EVALUATION

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Scope: Collaborative testing; Laboratory and analyst performance evaluation; Inter- and intralaboratory quality control; Evaluation of laboratory equipment; Statistical treatment of analytical data; Experimental design.

5. INSTRUMENT DEVELOPMENT

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Scope: Intake systems (methods of sampling, connecting lines, wells, motors, pumps, mode of operation); Sensors (electro-chemical, electro-biological, thermodynamic, mechanical, optical, nuclear); Analyzers (analog and digital amplifiers, output displays); Recording systems (telemetry, data logging, digital data processors).

1. PHYSICAL AND CHEMICAL METHODS

AMIC-6697

"EFFECT OF ION PAIRING ON THE pH OF SEAWATER", Kester, D. R., Limnology and Oceanography, Vol. 17, No. 6, November 1972, pp 959-960.

The author disagrees with Wangersky's statement that the dominant influence on the pH of water not in contact with the atmosphere results from changes in ion pairing caused by pressure. Instead the cause should be attributed to biogenic oxidation and calcium carbonate dissolution.

INDEX TERMS: Hydrogen ion concentration, Water pressure, Calcium carbonate, Ion pairing, Biogenic oxidation.

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verifications of the models under the existing conditions, they were used to project and predict the water quality of Vancouver Lake as will be affected by dredged lake depths and introduced flows from the Columbia River.

INDEX TERMS: Dredging, Water quality, Water analysis, Mathematical models, Forecasting, Enteric bacteria, Nutrients, Phytoplankton, Sediments, Restoration, Vancouver Lake,

AMIC-6783

"CORRELATED STUDIES OF VANCOUVER LAKE - WATER QUALITY PREDICTION STUDY", Bhagat, S. K., Funk, W. H., Johnstone, D. L., Washington State University, Department of Civil Engineering, Pullman, Washington, Report No. EPA-R2-72-111, November 1972, 120 pp.

This study deals with the restoration of water quality of shallow, polluted, and eutrophic lakes. Dredging and removing of lake bottom sediments and introducing better quality water are the restoration measures explored in this study. Vancouver Lake, Washington, which is connected to the Columbia River was used as a test case. The bacterial quality of the Columbia River was assessed by determining total coliforms, fecal coliforms, fecal streptococci, plate counts, Sphaerotilus counts, and pigmented bacteria. Additional determinations were made of BOD, COD, total solids, total volatile solids, suspended solids, volatile suspended solids, phosphates, nitrates, phytoplankton, pH, alkalinity, hardness, sulfates, chlorides, DO, the Pearl-Benson index, temperature and conductivity. Quality of Vancouver Lake sediments was assessed by measuring the organic matter, phosphorus, and nitrogen in sediment core samples. The potential of the sediments to support phytoplankton populations was also evaluated. A few samples were analyzed for trace elements by neutron activation. Hydrologic, hydrographic, hydrodynamic, and water quality information provided by separate but correlated studies, was combined with the aid of mathematical simulation models. Dissolved oxygen was used as an indicator of the overall water quality in the system. Photosynthesis, atmospheric reaseration, biological respiration, and advection were the mechanisms considered in the computation of diurnal changes in dissolved oxygen level. In addition to the DO model, the aquatic life model for computing time-varying levels of phytoplankton and bacteria was also tried. The validity of these models was verified with the actual field data. After

AMIC-6784

"OILY WASTE DISPOSAL BY SOIL CULTIVATION PROCESS", Kincannon, C. B., Shell Oil Company, Houston Refinery, Deer Park, Texas, Report No. EPA-R2-72-110, December 1972, 114 pp.

The effectiveness and cost of the soil cultivation process for disposal of oily wastes from petroleum were investigated. Crude oil tank bottoms, high molecular weight fuel oil (bunker C or No. 6), and a waxy raffinate (an intermediate waxy oil product containing highly paraffinic components) were spread and cultivated into soil. At regular intervals over approximately 18 months, microbiological analyses were made, hydrocarbon types of oil were added to and extracted from the soil and the oil content of soil core samples at depths up to six feet was determined. Also, metals, nitrogen, phosphorus, and sulfur contents of the soil and characteristics of the extracted oils were examined by infrared absorption and gas chromatography and rainfall-runoff relationships were studied. The main results of the investigation were as follows. The oil decomposition rate was about 0.5 lbs/cu ft of soil per month without fertilizers and about 1.0 lb/cu ft/month when fertilized. Major microbiological species active in the soil were members of the genus Arthrobacter, Corynebacterium, Flavobacterium, Nocardia, and Pseudomonas. Differences in decomposition rate and microbial species due to hydrocarbon type were minimal. Infrared and gas chromatography examinations of oil extracted from fertilized and unfertilized soils showed differences in organic acid contents and boiling ranges. Oil and fertilizer chemicals did not infiltrate vertically into the soil at the test location under prevailing conditions. Rainfall runoff water contained 1) up to 100 ppm extractable soils found to be naphthenic acids and 2) up to 150 mg/l ammonia as N when the nutrients were excessive in the soil.

1. PHYSICAL AND CHEMICAL METHODS

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INDEX TERMS: Waste disposal, Microbial degradation, Soil analysis, Oily wastes, Gas chromatography, Rainfall-runoff relationships, Ammonia, Nitrates, Phosphates, Calcium, Magnesium, Sodium, Heavy metals, Resins, Crude oil, Bunker C oil, No. 6 fuel oil, Waxy raffinate, Infrared spectrophotometry, Boiling point, Aromatics, Paraffins, Saturates.

AMIC-6850

"OIL/WATER INTERFACE DETECTOR", Moreau, J. O., Esso Research and Engineering Company, Florham Park, New Jersey, Final Report No. EE-4TMR.72, Contract No. C-1-35049, December 1971, 99 pp. NTIS Report No. COM-72 11295.

A survey of manufacturers was conducted to find all equipment that could differentiate between oil and water on a continuous basis and thus be used as an oil-water interface detector during tanker deballasting. 25 possibly applicable devices were found. Based on manufacturers' information, these devices were evaluated in relation to shipboard conditions such as installation, safety, maintenance, and operation requirements. The device which seems best suited to ballast control applications is the Sensall 440 Series In-Line Interface Sensor which measures sonic attenuation. The Sensall would have a probe detector mounted in the discharge line and would alarm at oil concentrations well below 1 percent. Laboratory and shipboard tests would be required, however, before this device could be recommended for installation aboard ship. The NUS sonic interface detector and the Gallbrith Oil Overboard Discharge Alarm system will also merit further study if they can be modified to meet shipboard safety restrictions.

INDEX TERMS: Oil-water interfaces, Oily water, Electrical equipment, Detectors, Detection limits.

AMIC-6848

"THE APPLICATION OF MULTI-ATTRIBUTE SCALING PROCEDURES TO THE DEVELOPMENT OF INDICES OF VALUE", O'Connor, M. F., University of Michigan, Engineering Psychology Laboratory, Ann Arbor, Michigan, Technical Report No. O37230-1-T, Contract No. N00014-67-A-0181-0034, June 1, 1972, 152 pp. NTIS Report No. AD 746 155.

Multi-attribute scaling procedures were used to develop water quality indices for waters to be used for human consumption and for support of fish and wildlife. Scaling procedures were applied to this task by assessing, from water quality engineers, (1) judgments about which variables should be included in the index, (2) the type of rule for combining the variables, (3) the relative importance weights of the different variables, and (4) a curve describing the functional relation between water quality and each variable. The experimenter used a modified Delphi procedure for obtaining consensus among the engineers for each of the indices. Even after the applications of the Delphi procedure, the engineers disagreed on the importance weights, so a sensitivity analysis applied the different indices to actual measurements on samples of river water. This analysis indicated that the disagreement about the weights was not crucial to the measurement of water quality. The parameters considered as indicators of water quality were: fecal coliforms, phenols, DO, dissolved solids, pH, fluorides, hardness, nitrates, chlorides, alkalinity, turbidity, color, sulfates, temperature, ammonia, and phosphates. An additive equation was used to combine the chosen parameters into a water quality index.

INDEX TERMS: Water quality, Mathematical models, Phenols, Dissolved oxygen, Dissolved solids, Hydrogen ion concentration, Fluorides, Hardness (water), Nitrates, Chlorides, Alkalinity, Turbidity, Color, Sulfates, Temperature, Ammonia, Water quality index, Phosphates, Data interpretation, Fecal coliforms.

AMIC-6854

"PRELIMINARY ANALYSES OF URBAN WASTES, NEW YORK METROPOLITAN REGION", Gross, G. M., State University of New York, Marine Sciences Research Center, Stony Brook, New York, Technical Report No. 5, February 6, 1970, 32 pp. NTIS Report No. AD 746 959.

Preliminary analyses were made of 17 sewage sludge samples from sewage treatment plants serving 11.9 million persons in the New York Metropolitan Region. The sludges consist of about 55 percent organic matter, which, in turn, accounts for about 55 percent of the total oxygen demand of the sludges. About 45 percent of the sludge consists of aluminosilicate material, chemically similar to shale. The samples are enriched, compared to sedimentary rocks and soils, in the following elements; silver (150x), chromium (10x), copper (50x), tin (30x), and zinc (30x). All of these elements are common industrial materials, and are known to be highly toxic to marine organisms; some are carcinogenic. Further studies are required to determine the chemical form in which they occur in the sludges and whether they are released to organisms or to seawater after dumping or deposition of the sludges. These preliminary analyses indicate the semi-quantitative spectrochemical analyses may be useful for determining order-of-magnitude concentrations of at least 24 elements commonly occurring in sewage sludges. Other techniques are required to detect other possible pollutants, with usable precision. Loss on ignition is a useful technique to use in analysis of organic matter (volatile matter) in sewage sludges not containing large amounts of hydrous aluminosilicates.

INDEX TERMS: Sewage sludge, Pollutant identification, Methodology, Alkali metals, Alkaline earth metals, Heavy metals, Rare earth metals, Optical emission spectroscopy, Aluminosilicates.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-6857

"ADSORPTION OF CHLORINATED HYDROCARBONS FROM SEAWATER BY A CROSSLINKED POLYMER", Harvey, G. R., Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, Report No. WHOI-72-86, Contract No. CQ-16020, November 1972, 31 pp. NTIS Report No. PB-213 954.

A synthetic resin, Amberlite XAD2, was evaluated as an adsorption medium for chlorinated hydrocarbons (DDT, DDE, dieldrin, and PCB) in seawater with the objective of developing an analytical method for recovering low concentrations of these compounds. Testing of the resin was conducted with seawater containing dissolved organic carbon (DOC), and DDT, DDE, dieldrin, and PCB. The results with the DOC samples showed that coastal seawater contained about 20 percent hydrophobic organic matter and that at flow rates of 0.7 and 1.4 bed vol./min the resin preferentially adsorbed hydrophobic matter. Recovery of DDE, dieldrin, and DDT from seawater was 125, 108, and 92 percent respectively. The resin showed very good adsorption capacity. Chlorinated hydrocarbons were eluted with acetonitrile and ethanol. Analysis of Woods Hole seawater gave PCB ranges of 7.1 to 35 ppt and DDT ranges of less than 0.1 to 3.3 ppt. Concentrations of PCB's were also determined in water of the North Atlantic Ocean from the surface and various depths. The concentrations averaged 20 ppt. The surface water of the Sargasso Sea contains lower concentrations of PCB than the North Atlantic. The method developed is deemed suitable for seawater analysis and probably for freshwater. It is suggested that the resin could be used for in situ sampling while a ship is underway.

INDEX TERMS: Polychlorinated biphenyls, Adsorption, Separation techniques, Sea water, Water analysis, DDT, DDE, Dieldrin, Amberlite XAD-2, Sargasso Sea.

AMIC-6859

"OILY WATER SEPARATION SYSTEM", Skocypec, R. J., Esso Research and Engineering Company, Florham Park, New Jersey, Final Report No. EE-2TMR.72, Contract No. C-1-35049, January 1972, 54 pp. NTIS Report No. COM-72 10561.

This report describes the evaluation of an oily water separation system for marine use consisting of an AMF-Cuno Super Auto-Klean Filter (Model AK-511) upstream of an Esso Coalescer. The Cuno-Filter was evaluated as a unit for particulate removal while the Esso Coalescer was evaluated as an oil removal device. The system's effectiveness was highly inconsistent due to plugging of the coalescer by wax. The best performances achieved were with two coalescers in series downstream of a surge tank for gross oil removal. Oil removal efficiencies were near 90 percent for these tests over a wide range of influent oil contents. The Cuno-Filter was found to be unsuccessful in removing particulates in this application. However, it should be noted that the Cuno filter was not specifically designed for this application. General application of this type of coalescer where a highly polished effluent is desired is discouraged for dirty ballast water treating because of wax plugging which makes the coalescer inoperative. The coalescer is, however, recommended for removing oils with known low wax contents. Plugging due to suspended solids is not thought to be significant.

INDEX TERMS: Oily water, Separation techniques, Filtration, Ballast water, Performance evaluation, Esso coalescer, Cuno filter.

AMIC-6861

"CORRELATION OF OILS AND OIL PRODUCTS BY GAS CHROMATOGRAPHY", Zafirou, O., Blumer, M., Myers, J., Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, Technical Report No. WHOI-72-55, Contract No. EPA 15080 HEC, July 1972, 101 pp. NTIS Report No. PB 211 337.

Environmental samples of oil and oil products can be correlated with possible sources by comparison of their stable compositional features. Procedures for correlating samples with suspected sources by gas chromatographic analysis under standardized conditions are presented in manual form. A high rate of success for the method in realistic situations is estimated by analyses of artificially aged oils and of potential spill sources found in Greater New York Harbor and Portland, Maine. The method is suitable for routine use for weeks-old oil samples, and for monitoring levels of hydrocarbons in organisms and sediments. Slightly modified, it can be used in low-level and research work studying the fate and effects of petroleum hydrocarbons.

INDEX TERMS: Oil pollution, Chemical analysis, Pollutant identification, Oil spills, Weathering, Methodology, Oily water, Separation techniques, Water pollution, Water analysis, Oil characterization, Oil fingerprinting, Flame ionization gas chromatography, Crude oil, Chemical composition, Fuel oil, Sample storage, Sample preparation, Data interpretation.

AMIC-6878

"GAS-LIQUID-SOLID CHROMATOGRAPHY OF FREE ACIDS", Di Corcia, A., Analytical Chemistry, Vol. 45, No. 3, March 1973, pp 492-496.

The use of gas-liquid-solid chromatography has been extended to the elution of free acids. The coating of the graphitized carbon black, such as graphitized Sterling FT (FT-G), by means of a suitable amount of an involatile stationary phase (FFAP) makes possible the linear elution of free acids at the nanogram level. By varying the liquid/solid ratio, gas-liquid-solid (GLS) columns have been evaluated in terms of selectivity, efficiency, and time of elution for acid compounds. On these bases, GLS columns have been compared with a GL column normally used for the analysis of acids. The results confirm that the surface of the carbon is very effective in separating molecules differing mainly in their geometric structure. In addition, GLS columns retain peak broadening also at high linear carrier gas velocities. On FT-G coated with 0.3 percent FFAP, the separation of C2-C5 fatty acids, including 2-methylbutyric and 3-methylbutyric acids, in a very dilute water solution (approximately 40 ppm) has been obtained in about 1.5 minutes. The separation of the isomers of some aromatic acids has been also performed. (Reprinted from Analytical Chemistry, Vol. 45, No. 3, March 1973, pp 492-496. Copyright 1973 by the American Chemical Society. Reprinted by permission of the copyright owner.)

INDEX TERMS: Organic acids, Chemical analysis, Pollutant identification, Separation techniques, Molecular structure, Selectivity, Efficiencies, Chemical properties, Aromatic compounds, Gas-liquid-solid chromatography, Detection limits, Gas liquid chromatography, Chromatographic columns.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-6933

"STUDIES IN CHEMICAL IONIZATION MASS SPECTROMETRY", Ryan, J. F., University of Virginia, Charlottesville, Virginia, Dissertation Abstracts No. 72-33m 382, 1972, 129 pp. (Complete report not available from AMIC.)

Chemical ionization mass spectrometry (CIMS) was used to distinguish between acids, aldehydes, esters, ethers, and ketones, as well as between primary, secondary, and tertiary alcohols. Two methods were used to identify functional groups present in a sample molecule. The first was based on a determination of the sample's proton affinity relative to that of the source gas. The second method was based on the unique set of ions produced by each functional group in CI spectra using nitric oxide as a source gas. Argon-water source-gas mixtures were used to produce high and low resolution mass spectra which exhibit ions characteristic of both electron impact and chemical ionization methods of ionization. Mass spectra of different functional groups were obtained using trimethylsilyl cation as an ionization reagent. Peaks due to electrophilic attachment were observed in all cases. Finally negative ion chemical ionization mass spectra were recorded using oxygen as a reagent gas.

INDEX TERMS: Organic compounds, Chemical reactions, Methodology, Pollutant identification, Mass spectrometry, Alcohols, Organic acids, Ionization, Chemical analysis, Ethers, Chemical ionization mass spectrometry, CI mass spectra, Aldehydes, Ketones, Esters, Reagents, Mass spectra, CI spectra, Chemical structure, Functional groups.

AMIC-6962

"PROCESSES AFFECTING THE OCEANIC DISTRIBUTION OF CARBON DIOXIDE", Culberson, C. H., Oregon State University, Corvallis, Oregon, Dissertation Abstracts No. 73-3957, 1972, 188 pp. (Complete report not available from AMIC.)

The stoichiometric model of organic decomposition in seawater (Redfield, Ketchum, and Richards, 1963) was used to describe the oceanic distribution of total carbon dioxide. It was assumed that the concentration of total carbon dioxide was the sum of three terms: (1) the initial concentration of carbon dioxide, (2) the increase in carbon dioxide due to the oxidation of organic matter, and (3) the increase in carbon dioxide due to the solution of calcium carbonate. The vertical and horizontal distribution of total carbon dioxide in the Pacific, Indian, and South Atlantic Oceans was shown to conform to this model. The model for the distribution of total carbon dioxide was applied to the vertical distribution of carbon-13 at the North Pacific (1969) GEOSECS intercalibration station (Kroopnick, Deuser, and Craig, 1970). Values of $\delta C-13$ calculated from the stoichiometric model agreed to within plus or minus 3 percent with the measured values at this station. Near-bottom chemical measurements were made on three cruises: YALOC-69 to the Eastern Tropical Pacific, Y6908F off the Oregon Coast, and TT-46 to the Caribbean Sea and North Atlantic. Salinity, oxygen, pH, alkalinity, silicate, phosphate, nitrate, and nitrite were measured at heights from 0.5 to 300 m above the bottom. No measurable salinity, oxygen, silicate, phosphate, nitrate, or nitrite gradients were observed. A statistically significant near-bottom increase in pH and alkalinity was found. However, the increase was small and could have resulted from undetected analytical and/or sampling errors.

INDEX TERMS: Carbon dioxide, Oceans, Model studies, Spatial distribution, On-site data collections, Water chemistry, Stoichiometric models.

AMIC-6982

"OXYGEN-CARBON DIOXIDE-NUTRIENTS RELATIONSHIPS IN THE NORTHEASTERN PACIFIC OCEAN AND SOUTHEASTERN BERING SEA", Alvarez-Borrego, S., Oregon State University, Corvallis, Oregon, Dissertation Abstracts No. 73-7816, 1973, 186 p. (Complete report not available from AMIC.)

The vertical distribution of density, salinity, temperature, dissolved oxygen, apparent oxygen utilization, nutrients, preformed phosphate, pH, alkalinity, alkalinity:chlorinity ratio, 'in situ' partial pressure of carbon dioxide, and percent saturation of calcite and aragonite, for the Southeastern Bering Sea, is studied and explained in terms of biological and physical processes. Some hydrological interactions between the Bering Sea and the North Pacific Ocean are explained. In the Northeastern Pacific Ocean the oxygen-phosphate and oxygen-nitrate relationships for the region of the water column above the oxygen minimum zone vary systematically with latitude. In the entire water column, these slopes vary with depth. An effect on the slopes of the oxygen-phosphate and oxygen-nitrate relationships, similar to that observed when decreasing latitude, is observed when comparing winter versus summer data. The winter slopes are higher than the summer slopes. Multiple regression analysis was applied to the oxygen, phosphate, nitrate, and potential temperature data from stations at different geographic locations in the Pacific and Atlantic Oceans. Confidence intervals for the regression coefficients are consistent with the values predicted by the Redfield model for the $\delta O_2:\delta PO_4$ and $\delta O_2:\delta NO_3$ ratios for biological processes. After the field oxygen, phosphate and nitrate data were found consistent with Redfield's model, preformed phosphates were calculated by using the model, and potential temperature versus preformed phosphates diagrams were constructed for different stations in the Pacific and Indian Oceans to study their

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water masses. In the Northeastern Pacific Ocean the total inorganic carbon dioxide-oxygen relationship varies with depth. Multiple linear regression analysis was applied to express total inorganic carbon dioxide, normalized to constant salinity, as a function of potential temperature and total alkalinity and oxygen normalized to constant salinity. Results of the regression are in agreement with the assumption that total alkalinity changes in the open ocean are only due to salinity changes in calcium carbonate dissolution or precipitation, and with Redfield's model for the prediction of the total inorganic carbon dioxide-oxygen ratio for the biochemical oxidation.

INDEX TERMS: Dissolved oxygen, Carbon dioxide, Nutrients, Pacific Ocean, Model studies, Spatial distribution, Water temperature, Bering Sea, Vertical distribution, Regression coefficients, Multiple linear regression analysis, Seasonal variation.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7010

"LARGER DIAMETER COLUMNS FOR MODERN, HIGH SPEED LIQUID CHROMATOGRAPHY", DeStefano, J. J., University of Delaware, Newark, Delaware, Dissertation Abstracts No. 72-31, 983, 1972, 142 pp. (Complete report not available from AMIC.)

Relatively large internal diameter columns are shown to exhibit superior efficiencies for both retained and unretained solutes when compared to narrow-bore, analytical liquid-liquid (LLC) and liquid-solid (LSC) chromatographic columns. This high level of column performance is ascribed to the 'infinite-diameter' column phenomenon proposed by Knox and Parcher. The controlled surface porosity support used in the LLC studies is shown to be capable of handling only modest amounts of solute without overloading. The totally porous silica adsorbent, Porasil A, used for LSC is found to be better suited for preparative applications because of its higher sample capacity. Sample sizes between 20 and 100 milligrams are demonstrated in two examples of preparative separations. The effects of sample volume and concentration, support particle size, and carrier velocity on column performance are also discussed.

INDEX TERMS: Efficiencies, Separation techniques, Laboratory equipment, Research equipment, Particle size, Chromatographic columns, Column preparation, High speed liquid chromatography, Sample size, Chemical concentration, Liquid liquid chromatography, Liquid solid chromatography, Adsorbents, Porasil A.

AMIC-7030

"ATOMIC FLUORESCENCE CHARACTERISTICS OF COPPER IN VARIOUS PREMIXED FLAMES", Kolihova, D., Sychra, V., *Analytica Chimica Acta*, Vol. 63, No. 2, February 1973, pp 479-482.

The atomic fluorescence of copper revealed that its spectrum consists of 9 resonance lines instead of the previously reported two. Analytical curves of the resonance fluorescence lines measured in the premixed oxygen-argon-hydrogen flame are linear over 4 decades of concentration: from the limit of detection up to a concentration of about 15 micrograms/ml. Detection limits for all the copper lines in the 3 flames studied are tabulated. Interferences from solute volatilization and spectral interferences were found to be insignificant for 1000-fold (by weight) amounts of 28 common cations and anions in the premixed air-hydrogen and shielded air-acetylene flames. The absence of interferences and the high sensitivity of the atomic fluorescence method allowed a rapid direct determination of copper in blood serum to be made after 25-fold dilution of serum with twice-distilled water.

INDEX TERMS: Copper, Physical properties, Chemical analysis, Aqueous solutions, Cations, Anions, Heavy metals, Pollutant identification, Atomic fluorescence spectroscopy, Characterization, Atomic fluorescence spectra, Detection limits, Ionic interference, Chemical interference, Sensitivity.

AMIC-7032

"THE DETERMINATION OF TOTAL NITROGEN IN PLANT MATERIALS WITH AN AUTOMATIC NITROGEN ANALYSER", Fiedler, R., Proksch, G., Koepf, A., *Analytica Chimica Acta*, Vol. 63, No. 2, February 1973, pp 435-443.

A description is given of an automatic analyzer which has been used for the measurement of total nitrogen in chemical compounds and botanical material after the combustion method of Dumas in vacuum. Several chemical compounds and plant materials were analyzed using the nitrogen analyzer. The analysis of chemicals by means of the nitrogen analyzer yielded excellent results which entirely agree with the theoretical nitrogen content of the samples. The standard deviation of a single determination was of the order of 1 percent or less, of the nitrogen content of the sample. In the analysis of plant materials, the values obtained with the N analyzer tended to be slightly higher than those obtained by the Kjeldahl procedure. The standard deviation of the single nitrogen analyzer values was of the order of 1-4 percent of the mean nitrogen content of the samples, and relatively higher for wheat, barely and rice grain. Statistical evaluation of all analytical results showed that the comparative reproducibility and accuracy of the automatic analyzer and the Kjeldahl method were very good.

INDEX TERMS: Nitrogen, Chemical analysis, Plant tissues, Laboratory equipment, Methodology, Nitrogen compounds, Grasses, Wheat, Barley, Research equipment, Rice, Organic compounds, Inorganic compounds, Regression analysis, Automatic nitrogen analyzer, Kjeldahl procedure, Reproducibility, Accuracy, Biological materials, Ammonium sulfate, Am

AMIC-7038

"THE FLUORIMETRIC DETERMINATION OF PHOSPHATE WITH THIAMINE", Holzbecher, J., Ryan, D. E., *Analytica Chimica Acta*, Vol. 64, No. 1, March 1973, pp 147-150.

Phosphate may be determined down to the one ppb level by a fluorimetric method which involves converting the phosphate to hexadimolybdatophosphate by adding ammonium molybdate to an acidified phosphate solution. The hexadimolybdatophosphate is then reacted with non-fluorescent thiamine to produce the highly fluorescent thiochrome, the fluorescence intensity of which is measured at 375 nm. The standard deviation of seven determinations of 50 ppb of phosphate was 3 percent; for 5 ppb the deviation was less than 10 percent. Fifty ppb of phosphate was successfully determined in the presence of a 10,000-fold molar amount of acetate, chloride, nitrate, perchlorate or thiocyanate, or a 1,000-fold amount of bromide, fluoride, or tartrate. Results were also satisfactory with a 100-fold amount of citrate, EDTA, iodide or persulphate. A 10-fold amount of silicate or hexacyanoferrate(III) could be presented but larger amounts increased the fluorescence intensity; an equivalent amount of sulphide strongly quenched the fluorescence. A 10,000-fold molar amount of Ni(II), Mn(II), or Cd(II), and a 1,000-fold amount of Cu(II), Co(II), Ca(II), Zn(II), or Al(III) did not interfere. A 10-fold amount of iron(III) and an equivalent amount of iron(II) could be present, but an order of magnitude increase in concentration decreased the fluorescence. Mercury(II) and mercury(I) markedly increased the fluorescence even at equimolar ratios. Important factors in the determination of phosphate with thiamine are the starting acidity, the thiamine concentration, the molybdenum concentration and the final pH.

INDEX TERMS: Fluorometry, Phosphates, Pollutant identification, Chemical analysis, Aqueous solutions, Methodology, Chemical reactions, Anions, Cations, Heavy metals, Alkaline earth metals, Molybdenum, Trace levels, Thiamine, Chemical indicators, Detection limits, Accuracy, Ionic interference.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7043

"THE DETERMINATION OF MANGANESE IN URINE BY ATOMIC ABSORPTION SPECTROMETRY", Van Ormer, D. G., Purdy, W. C., Analytica Chimica Acta, Vol. 64, No. 1, March 1973, pp 93-105.

An atomic absorption procedure was developed for the determination of urine manganese. Urine samples were digested with a mixture of nitric, sulfuric, and perchloric acids containing molybdate as catalyst. This wet digestion was followed by cupferron extraction into methyl isobutyl ketone to yield stable extracts of urine Mn at concentration levels quantifiable by atomic absorption spectrometry. A two-point standard addition technique was used and involved extracts of buffered, digested aliquots containing 10 and 20 ppb Mn(II) in the aqueous phase. Of the substances tested for extraction interference, only bismuth, antimony, and thallium were found to interfere.

INDEX TERMS: Manganese, Chemical analysis, Methodology, Solvent extractions, Stability, Hydrogen ion concentration, Efficiencies, Atomic absorption spectrophotometry, Urine, Metal chelates, Biological samples, Sample preparation, Preconcentration, Chemical interference, Ionic interference.

AMIC-7052

"THE DIRECT DETERMINATION OF CHROMIUM IN URINE BY SELECTIVE VOLATILIZATION WITH ATOM RESERVOIR ATOMIC ABSORPTION", Ross, R. T., Gonzalez, J. G., Segar, D. A., Analytica Chimica Acta, Vol. 63, No. 1, January 1973, pp 205-209.

Samples of urine were analyzed by the atom reservoir atomic absorption technique for the presence of chromium before and after digestion. The samples were digested by adding 1 ml of nitric acid to 1 ml of urine in teflon vials. The vials were tightly closed to prevent leaks and were placed in an 80 degree oven for 1 and 24 h. After heating, the samples were cooled to room temperature, and then 20 microliters were removed by means of an Eppendorf pipette and injected into the heated graphite atomizer. The relative standard deviation for peak signals calculated from twenty injections of 20-microliter aliquots of urine containing 20 ppb of chromium was 2 percent. For aqueous solutions of the same concentrations the relative standard deviation was 10 percent. These data are in close agreement with the reproducibilities cited in the literature. The detection limit obtained for chromium was 2.5 ppb for 20-microliter urine samples. Injections of up to 100 microliters are possible with this technique, and such injections could increase the sensitivity of the method. The ease of application and shortness of analysis time of this technique promise further applicability toward trace metal analyses in other biological materials.

INDEX TERMS: Trace elements, Chromium, Methodology, Chemical analysis, Heated graphite atomizer, Urine, Atom reservoir atomic absorption spectrophotometry, Sample preparation, Accuracy, Precision, Biological samples, Detection limits.

AMIC-7044

"THE INDIRECT SPECTROPHOTOMETRIC DETERMINATION OF THE SULPHATE ION WITH 2-AMINOPERIMIDINE", Jones, P. A., Stephen, W. I., Analytica Chimica Acta, Vol. 64, No. 1, March 1973, pp 85-92.

A new spectrophotometric determination of the sulphate ion is described which uses 2-aminoperimidine hydrochloride as a precipitating reagent. The excess of the reagent is measured at 305 nm. The procedure deals with sulphate in the range 4-120 ppm, and relies on simple calibration. The relative standard deviation for 50 ppm of sulphate is 3.7 percent. The interference of 100 ppm of phosphate, fluoride and nitrate is only slight in the determination of 50 ppm of sulphate. The method is recommended for the determination of sulphate in rain and surface waters.

INDEX TERMS: Spectrophotometry, Sulfates, Methodology, Surface waters, Rain, Aqueous solutions, Anions, Cations, Chemical reactions, Calibrations, Phosphates, Fluorides, Nitrates, Chemical precipitation, Chemical analysis, Pollutant identification, 2-Aminoperimidine, Sensitivity, Chemical interference, Accuracy, Absorbance.

AMIC-7053

"DIRECT MEASUREMENT OF LESS THAN 1 PART-PER-BILLION FLUORIDE IN RAIN, FOG, AND AEROSOLS WITH AN ION-SELECTIVE ELECTRODE", Warner, T. B., Bressan, D. J., Analytica Chimica Acta, Vol. 63, No. 1, January 1973, pp 165-173.

Soluble fluoride in rain, snow, fog or aerosols can be determined directly in samples containing down to 0.28 ppb by an inexperienced analyst after brief training with a lanthanum fluoride electrode. The method involves little sample handling, 10-ml samples suffice, a determination takes 15-22 min and the technique can be extended over 8 decades of concentrations. Probable uncertainty ranges from 10-20 percent near 0.28 ppb to 3-6 percent above 100 ppb. The general technique compares the rate of change of potential in the unknown with that in nearby standards, and should be useful for trace determinations with other ion-selective electrodes as well. One possible application is the direct determination of other halides in rain. There does not seem to be any intrinsic reason why more dilute samples could not be handled if suitable standards could be prepared.

INDEX TERMS: Fluorides, Rain, Fog, Aerosols, Snow, Ion selective electrodes, Detection limits, Sample preparation, Response time.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7056

"THE EXTRACTION OF THE CHROMIUM(III)-EDTA COMPLEX BY SOLUTIONS OF ALIQUAT-336 IN VARIOUS ORGANIC SOLVENTS", Irving, H. M. N. H., Al-Jarrah, R. H., *Analytica Chimica Acta*, Vol. 63, No. 1, January 1973, pp 79-84.

The percentage of chromium(III) extracted as the complex anion $CrY(H_2O)$ from solutions containing a 10 percent excess of EDTA (H_4Y) by the liquid anion-exchanger Aliquat-336-Cl is shown to increase with change of organic solvent ('diluent') in the order amyl alcohol less than chloroform less than 1,2-dichloroethane less than hexone less than carbon tetrachloride less than benzene less than nitrobenzene less than p-xylene less than hexane. With mixtures of p-xylene and chloroform there is a minimum at 0.4 mole fraction of xylene. The order of solvents can best be correlated with their solubility parameters. With hexane the organic phase separates into two layers of which the one of larger volume (80 percent of total) contains very little extracted ion-pairs. The enhanced concentration of chromium(III) in the organic phase of smaller volume can be exploited analytically.

INDEX TERMS: Chromium, Aqueous solutions, Separation techniques, Anion exchange, Trace elements, Methodology, Organic solvents, EDTA, Metal chelates, Ion exchange resins, Aliquat-336-Cl, Sample preparation.

AMIC-7059

"THE ATOMIC ABSORPTION DETERMINATION OF ZINC WITH A GRAPHITE FURNACE", Clark, D., Dagnall, R. M., West, T. S., *Analytica Chimica Acta*, Vol. 63, No. 1, January 1973, pp 11-18.

The use of a heated graphite furnace has been evaluated for the atomic absorption determination of zinc. Interference and the use of solvent extraction to overcome such have been investigated. Five-microliter aliquots were applied to different points along the furnace. The peak height obtained by heating at lower temperatures varied with the sample position, heating at a higher temperature yielded rather constant peak heights. All the ions tested caused interference when present in large amounts. Many of the interferences can be successfully avoided by using most of the solvent extraction systems. Results of the study of solvent extraction for the elimination of interference show that organic solvents cause no problems with the graphite furnace; no surface tension, viscosity, density or enhanced 'nebulizer' effects were noted. It was also found that the detection limit obtained with aqueous solutions can be lowered by preconcentration in the solvent extraction step, the limiting factor being reagent in solvent blanks. Determinations of zinc were made in the 0.002-1 ppm range.

INDEX TERMS: Zinc, Aqueous solutions, Pollutant identification, Heavy metals, Chemical analysis, Anions, Cations, Alkali metals, Ionic interference, Atomic absorption spectrophotometry, Solvent extraction systems, Heated graphite furnace, Detection limits, Chemical concentration.

AMIC-7057

"STUDIES IN THE COMPLEX FORMATION OF METAL IONS WITH SUGARS. PART I. THE COMPLEX FORMATION OF COBALT(II), COBALT(III), COPPER(II) AND NICKEL(II) WITH MANNITOL", Dolezal, J., Klausen, K. S., Langmyhr, F. J., *Analytica Chimica Acta*, Vol. 63, No. 1, January 1973, pp 71-77.

The complex formation of mannitol with cobalt(II), cobalt(III), copper(II) and nickel(II) in alkaline media (0.1 to 4 M potassium hydroxide) was studied by spectrophotometry. Cobalt(II) and cobalt(III) reacted with mannitol to form 1:1 complexes; the conditional constant (in 4 M potassium hydroxide) of the former complex was found to be 220,000. The reaction of copper(II) with the sugar gave two complexes. In the range 0.5-4 M potassium hydroxide and with the ligand in large excess, a CuM compound was formed; in mixtures with a small excess or with the reactants present in equimolar amounts, the species Cu_2M predominated. In 0.5 M potassium hydroxide, the conditional constant of the latter compound was found to be 63 million. The low stability of the nickel(II) complex(es) with mannitol made it impossible to draw any definite conclusions as to the composition of the species formed in alkaline medium.

INDEX TERMS: Heavy metals, Cations, Spectrophotometry, Alkali-aggregate reactions, Chemical reactions, Chelation, Organic compounds, Chemical analysis, Cobalt, Copper, Nickel, Carbohydrates, Manganese, Mannitol, Complexation, Ligands, Absorbance.

AMIC-7060

"A NEW, SENSITIVE METHOD FOR THE DETERMINATION OF STREPTOMYCIN", Duda, E., *Analytical Biochemistry*, Vol. 51, No. 2, February 1973, pp 651-653.

In order to avoid the difficulties involved in most chemical methods for the determination of streptomycin, a new assay method based on the periodate-thiobarbituric acid method has been developed. This method uses the observation that the reaction product of streptomycin gives a sharp absorption maximum at 415. This maximum is absent from spectra of other compounds tested - including deoxy sugars, streptidine, N-acetyl-glucosamine. A quantity of the streptomycin solution was mixed with potassium metaperiodate in 1 N H_2SO_4 . The mixture was incubated for 15 min at 37 degrees; 2 percent $NaAsO_2$ in 0.5 N HCl was added with shaking; and a 0.3 percent thiobarbituric acid reagent was added after the brownish color disappeared. This mixture was placed in a waterbath for 10 min and the absorbance was measured at 45 nm. The method described gives reproducible results; its sensitivity is equal or better than the sensitivity of other chemical streptomycin assays (the color is stable at least for an hour), and its higher specificity allows its use in cases in which the former methods are not applicable.

INDEX TERMS: Antibiotics (pesticides), Methodology, Assay, Spectrophotometry, Pollutant identification, Aqueous solutions, Chemical analysis, Chemical reactions, Biochemistry, Streptomycin, Thiobarbituric acid, Absorbance, Reproducibility, Sensitivity, Absorption spectra, N-acetyl glucosamine, Streptidine, 2-deoxy-D-glucose.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7061

"MODIFICATION OF AN ISCO DRUM FRACTION COLLECTOR TO PERMIT USE OF STOPPERED TEST TUBES", Printz, M. P., Franz, R. K., Jernberg, N. A., Analytical Biochemistry, Vol. 51, No. 2, February 1973, pp 482-485.

An Isco Fraction Collector has been modified to permit use of stoppered test tubes for collection of column effluents. This unit was developed for and serves a critical function as part of the system used for automated tritium-hydrogen exchange measurements. The primary need for a stoppered test tube fraction collector was (1) to reduce evaporation from 300-microliter column fractions obtained during overnight experiments, and (2) to prevent radioactive cross contamination. However, such a stoppered system should also be valuable for other applications, such as for minimizing evaporation of volatile organic solvents used in either lipid or partition chromatography.

INDEX TERMS: Chromatography, Fraction collector.

AMIC-7072

"TWO INSTRUMENTS FOR ACTIVATION ANALYSIS OF SOLUTIONS BY A DILUTION METHOD", Fowwrier, P. W. F., Aten, A. H. W., Jr., Van Hooideonk, J., International Journal of Applied Radiation and Isotopes, Vol. 24, No. 3, March 1973, pp 147-151.

Two methods are described for the determination of the concentration of a main component in an aqueous solution by activation with a radioactive neutron source. The first method employs a rotating table with eight lucite vessels which contain the unknown and reference samples. The neutron source is contained in a lucite plug filled with paraffin and positioned in the center of the table. The second method employs a cylinder or sphere which contains the sample for activation. The neutron source is placed in the center for sample activation and then replaced by one or more counters for analysis. Corrections necessary for analysis by either method are given. The first technique has the advantage of using less material and of being less susceptible to disturbing influences due to impurities or differences in concentration. The second instrument is easier to obtain since it requires no special equipment except a neutron source, a counter, and glassware.

INDEX TERMS: Aqueous solutions, Neutron activation analysis, Laboratory equipment, Sample preparation.

AMIC-7067

"A RAPID, INEXPENSIVE COULOMETRIC DETERMINATION OF SULPHUR IN PETROLEUM PRODUCTS", Carter, J. M., Analyst, Vol. 97, No. 1161, December 1972, pp 929-936.

A method has been developed for determining sulfur in oil using a combustion chamber and measuring with a coulometric cell the quantity of sulfur dioxide produced. The coulometer used was a Thorn T.E. 110, and the combustion chamber was a modified Gallenkamp C and H microfurnace. With the setup described in this report, it was possible to determine sulfur in oils in the range of 0.01 to 1.0 percent m/m. The advantages of the method are: Samples can be analyzed in triplicate in 5 minutes; a low degree of operator skill is required to operate the equipment; the method has good precision (coefficient of variation of the mean is 1.4 percent); the method should be usable for determining nitrogen in oil; small samples (0.5 microliter) are used; and the cost of the set up is low (600 pounds).

INDEX TERMS: Sulfur, Oil, Laboratory equipment, Recovery, Detection limits, Sample preparation, Precision, Coulometric titration.

AMIC-7073

"TRACE ELEMENT ANALYSIS BY PROTON-INDUCED X-RAY EXCITATION", Young, F. C., Roush, M. L., Berman, P. G., International Journal of Applied Radiation and Isotopes, Vol. 24, No. 3, March 1973, pp 153-163.

The potential for the simultaneous analysis of samples for traces of all elements with an atomic number (Z) greater than or equal to 15 by x-ray fluorescence using 2.5-MeV protons is described along with the advantages and limitations of the technique. Only milligram quantities of material are required and the sensitivity changes quite slowly and smoothly from element to element in contrast to the method of neutron activation. The technique is nondestructive and a minimum or no work in sample preparation is required. The sample must be thin and reasonably uniform. For maximum sensitivity, the sample must be either self-supporting or mounted on a very thin backing. Samples are generally placed in a high vacuum for irradiation although the potential exists to irradiate samples outside the vacuum by passing the beam through a thin window. This technique has been applied to a variety of environmental and biological materials, including air pollution, sediment, plankton, perch blood and liver enzyme, and hemoglobin. For samples of 0.1 mg/sq cm in thickness, sensitivities as small as 0.1 ppm can be expected.

INDEX TERMS: X-ray fluorescence, Trace elements, Pollutant identification, X-ray analysis, Chemical analysis, Environmental samples, Biological samples, Multielemental analysis, Chemical composition, Sensitivity, Detection limits.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7074

"CHEMICAL QUALITY OF THE WATER IN TUCSON BASIN, ARIZONA", Laney, R. L., University of Arizona, Water Resources of the Tucson Basin, Tucson, Arizona, Geological Survey Water-Supply Paper 1939-D, 1972, 46 pp.

#16 The purpose of this phase of the Tucson basin study was to determine the areal and vertical distribution and source of the common chemical constituents in the ground water and surface water and the effects of the geohydrologic environment on the water in the Tucson basin. The common chemical constituents are silica, iron, calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, and fluoride. This report presents an analysis and evaluation of the chemical quality of the ground water in the basin in relation to its environment and delineates the depths above which potable water may be obtained in the aquifer. Changes in the concentration of dissolved constituents in the ground water in recent years are assessed by a comparison of chemical analyses made before and after 1950. Water-quality information is presented for chemical quality and suspended sediment in surface water in the major streams in the basin.

INDEX TERMS: Water quality, Surface waters, Groundwater, Arizona, Santa Cruz River, Pantano Wash, Rillito Creek, Bear Creek, Tanque Verde Creek.

AMIC-7077

"METHOD FOR HIGH-SPEED LIQUID CHROMATOGRAPHIC ANALYSIS OF BENOMYL AND/OR METABOLITE RESIDUES IN COW MILK, URINE, FECES, AND TISSUES", Kirkland, J. J., Journal of Agricultural and Food Chemistry, Vol. 21, No. 2, March/April 1973, pp 171-177.

Residues of benomyl (methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate) and/or methyl 2-benzimidazolecarbamate, methyl 5-hydroxy-2-benzimidazolecarbamate, and methyl 4-hydroxy-2-benzimidazolecarbamate may be simultaneously determined in cow milk, tissues, urine, and feces. The first step in the method consists of hydrolyzing the sample in aqueous acid to convert benomyl to methyl 2-benzimidazolecarbamate and to free the metabolites from conjugates. The freed materials are then extracted into an organic solvent, the extract is cleaned up by a solvent-solvent, partitioning process, and the components are determined in a single scan by high-speed strong cation exchange liquid chromatography. Recoveries of the various components average about 80 percent in cow milk and urine, with average recoveries of about 50-80 percent obtained from tissue samples and feces. Recoveries for the various compounds have been demonstrated at the 0.01-0.02-ppm level in cow milk, at the 0.05-0.1-ppm level in tissues and feces, and at the 0.2-ppm level in urine. No interference with the method was found from a number of other pesticides with tolerances in milk and meat tissues.

INDEX TERMS: Pesticide residues, Fumigants, Carbamate pesticides, Milk, Cattle, Pollutant identification, Chemical analysis, Chlorinated hydrocarbon pesticides, Urea pesticides, Organophosphorus pesticides, Phenolic pesticides, Benomyl, Biological samples, High-speed liquid chromatography, Metabolites, Methyl 2-benzimidazolecarbamate, Methyl 5-hydroxy-2-benzimidazolecarbamate, Methyl 4-hydroxy-2-benzimidazolecarbamate, Tissues, Urine, Feces, Chemical recovery, Chemical interference, Sample preparation, Cation exchange liquid chromatography.

AMIC-7081

"HYDROLYSIS OF AQUEOUS SOLUTIONS OF SODIUM 2,2-DICHLOROPROPIONATE UNDER SELF-INDUCED ALKALINE CONDITIONS", Tanaka, F. S., Wien, R. G., Journal of Agricultural and Food Chemistry, Vol. 21, No. 2, March/April 1973, pp 285-288.

Aqueous solutions of sodium 2,2-dichloropropionate were previously reported as having an approximate pH of 5 to 6. The data obtained in this study show that freshly prepared solutions of greater than about 0.9 M concentration exhibit a basic pH. Upon standing, however, these salt solutions become acidic due to the hydrolysis of the 2,2-dichloropropionate to yield pyruvate and hydrochloric acid. The approximate pH of the sodium 2,2-dichloropropionate solutions is estimated at different concentrations, and the rates of pH change due to hydrolysis are reported for a dilute, intermediate, and high concentration of material under mildly alkaline conditions.

INDEX TERMS: Dalapon, Chlorinated hydrocarbon pesticides, Hydrolysis, Aqueous solutions, Chemical reactions, Chemical degradation, Pollutant identification, Herbicides, Hydrogen ion concentration, Vacuum distillation, Organic acids, Mass spectrometry, Nuclear magnetic resonance, Sodium 2,2-dichloropropionate, Flame ionization gas chromatography, Metabolites, 2,2-Dichloropropionic acid, Gas liquid chromatography, Pyruvic acid, Hydrochloric acid, Infrared spectroscopy, Sodium dalapon,

AMIC-7082

"THE p-VALUE APPROACH TO QUANTITATIVE LIQUID-LIQUID EXTRACTION OF PESTICIDES AND HERBICIDES FROM WATER. 2. SELECTION OF WATER:SOLVENT RATIOS AND NUMBER OF EXTRACTIONS", Suffet, I. H., Journal of Agricultural and Food Chemistry, Vol. 21, No. 2, March/April 1973, pp 288-294.

In this paper, equations are developed from liquid-liquid extraction theory for the number of extractions and water:solvent ratios for maximum recovery for typical p-values (P-value is defined as the fraction of the total solute that distributes itself in the nonpolar phase of an equivolume solvent pair). A computer program analysis of the equations developed indicates that a pesticide which has a p-value greater than or equal to 0.90 in an aqueous solvent system can be extracted from the aqueous phase with 95 percent recovery in no more than 5 successive extractions of at least 50 ml with a total volume of more than 500 ml of solvent. The equations were successfully tested with serial extraction of 2,4-D by separatory funnel and vortex stirring extraction procedures. The contribution to the total error of initial LLE step was estimated to be less than 20 percent for a four-step serial extraction.

INDEX TERMS: Water, Solvent extractions, 2,4-D, Water-solvent ratios, Chemical recovery.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7083

"STRUCTURE ACTIVITY CORRELATIONS OF BIODEGRADABILITY OF DDT ANALOGS", Kapoor, I. P., Metcalf, R. L., Hirwe, A. S., Coats, J. R., Khalsa, M. S., Journal of Agricultural and Food Chemistry, Vol. 21, No. 2, March/April 1973, pp 310-315.

Methoxy-methiochlor (2-(p-methoxyphenyl)-2-(p-methylthiophenyl) - 1,1,1-trichloroethane), methyl-ethoxychlor (2-(p-methylphenyl) - 2-(p-ethoxyphenyl) - 1,1,1-trichloroethane), and chloro-methylchlor (2-(p-chlorophenyl) - 2-(p-methylphenyl) - 1,1,1-trichloroethane) were studied for metabolic pathways in mice and insects (salt marsh caterpillar) and for biodegradability in a model ecosystem which included algae, fish, snails, and mosquitoes. The compounds were radiolabeled and radioassayed by scintillation counting. The metabolic products were identified by chromatography. The distribution of metabolites is shown for each organism. All three compounds are highly degradable with methoxy-methiochlor the most fugitive. With *Gambusia* biomagnifications of un degraded products were 300-fold for methoxy-methiochlor, 333-fold for methyl-ethoxychlor, and 1400-fold for chloro-methylchlor. With snails, the biomagnifications were 3400-fold for methoxy-methiochlor, 42,000-fold for methyl-ethoxychlor, and 21,000-fold for chloro-methylchlor. The percentages of un degraded compound to total ranged from 1 to 25 percent. The pathways of metabolism are illustrated. Methoxy-methiochlor and methyl-ethoxychlor were good substrates for multifunction oxidases and showed biodegradability indices of 2.75 and 1.20, respectively. Chloro-methylchlor was also a satisfactory substrate and showed a biodegradability index of 3.43, compared to 0.015 for DDT.

INDEX TERMS: Fish, Snails, Biodegradation, Algae, Methoxy-methiochlor, Methyl-ethoxychlor, Chloro-methylchlor, Biomagnification, Metabolic pathways, Biodegradability index.

AMIC-7120

"A STUDY OF THE EFFECT OF pH ON THE DETERMINATION OF ZINC BY ATOMIC ABSORPTION SPECTROPHOTOMETRY", Dong, A. E., Applied Spectroscopy, Vol. 27, No. 2, March/April 1973, pp 124-128.

Errors in zinc determinations in natural water by atomic absorption spectrophotometry have been found to result from variations in pH. Consequently, a study was conducted to determine the effect of pH on the analysis of zinc. Comparative analyses were also run on lithium, potassium, and manganese. Foreign species, phosphates and silicates, were added to some of the zinc solutions to study possible chemical interferences. Results showed that lithium, potassium, and manganese absorptions were essentially unaffected by pH changes. However, results with zinc showed that zinc absorption is constant in the pH range of about 2 to 5. Between pH 5 and 10, a sharp decrease in absorption is observed. With an increase above pH 10, zinc absorption levels off to a constant value. Experimental data suggested that pH variation rather than chemical interferences is primarily responsible for the variation of absorption in zinc analysis. Several possibilities, such as sorption of zinc to container walls, zinc hydroxide formation, zinc complex formation, and zinc oxide formation in flame subsequently attacked by hydrogen atoms, have been considered in an attempt to understand the cause of pH-dependent zinc absorption.

INDEX TERMS: Water analysis, Zinc, Hydrogen ion concentration, Potassium, Manganese, Errors, Atomic absorption spectrophotometry, Lithium, Chemical interference.

AMIC-7122

"MASS SPECTROMETRIC IDENTIFICATION OF SOME bis-2,4-DINITROPHENYLHYDRAZONES", Stanley, J. B., Senn, V. J., Brown, D. F., Dollear, F. G., Applied Spectroscopy, Vol. 27, No. 2, March/April 1973, p 141.

This communication describes some features of mass spectra obtained from the bis-2,4-Dinitrophenylhydrazones (2,4-DNPH) of some aldehydes and ketones. The spectra were obtained on a CEC 21-110B mass spectrometer. The presence of M-183 and mass 183 peaks could be diagnostic of bis 2,4-DNPH's, analogous to the characteristic fragmentation peaks of mono-n-aldehyde and n-ketone 2,4-DNPH's.

INDEX TERMS: Organic compounds, Mass spectra, Mass spectrometry, bis-2 4-Dinitrophenylhydrazones.

AMIC-7133

"ANALYSIS OF SOLUBLE BERYLLIUM BY GAS CHROMATOGRAPHY", Taylor, M., Arnold, E. L., Air Force Systems Command, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio, Final Report No. AMRL-TR-71-117, Contract Nos. F33615-71-C-1008, F33615-69-C-1062, August 1972, 36 pp. NTIS Report No. AD 753 112.

A new microanalytical method for the detection and quantitation of beryllium in aqueous samples and biological specimens has been developed. The method, based upon quantitation of chelated beryllium by gas chromatography, was employed to detect beryllium in both in vitro samples and tissues of rats given beryllium by injection. Beryllium was administered in the form of aqueous solutions of beryllium sulfate, and as little as 10 nanograms beryllium per gram of whole blood were detected and quantitated. In vivo studies which compared gas chromatographic analyses with radiometric analyses confirmed the validity of the new microanalytical technique. Preliminary studies were conducted to determine the ability of fluorinated chelating agents to remove beryllium oxide from the lungs of rats.

INDEX TERMS: Beryllium, Aqueous solutions, Calibrations, Biological samples, Tissue, Blood, Electron capture gas chromatography, Detection limits.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7139

"THE MOVEMENT AND IMPACT OF PESTICIDES USED FOR VECTOR CONTROL ON THE AQUATIC ENVIRONMENT IN THE NORTHEASTERN UNITED STATES", Cornell Aeronautical Laboratory, Inc., Buffalo, New York, Report No. TS-00-72-09, Contract No. 68-01-0129, July 1972, 202 pp.

This report summarizes a case study of a specific vectoricide program which covers the kinds and quantities of pesticides used, their route from the point of initial application into the water environment, their ultimate effect on the ecosystem, and the laws and regulations which affect their use. Cape Cod was chosen for this study because it has a long history of mosquito abatement programs which formerly included the use of persistent vectoricides but in recent years has been limited to easily degradable light mineral oil. With this treatment history, the area affords an opportunity to study the long-term effects of vectoricides without interference from effects caused by recent applications. The Bass Hole Marsh in Dennis and the Herring River Marsh in Harwich were selected for intensive study. A literature search was conducted and interviews were held with concerned officials, businessmen and private citizens throughout New England. Additional field work was undertaken in the two marshes to observe the effects of vectoricides on the aquatic environment, and soil and water samples were analyzed to check the general level of vectoricide residues.

INDEX TERMS: DDT, Path of pollutants, Mosquitoes, Pest control, Environmental effects, Dieldrin, Invertebrates, Pesticide toxicity, Microbial degradation, Chemical degradation, Soil analysis, Water analysis, Fish, Food chains, Sediments, Fuel oil, Malathion, Methoxychlor, Naled, Abate, Carbaryl, Species diversity.

AMIC-7140

"THE EFFECTS OF AGRICULTURAL PESTICIDES IN THE AQUATIC ENVIRONMENT, IRRIGATED CROPLANDS, SAN JOAQUIN VALLEY", University of California, Food Protection and Toxicology Center, Davis, California, Report No. TS-00-72-05, Contract No. 68-01-0134, June 1972, 268 pp.

This case study attempts to assess the impact of agricultural pesticides on the aquatic environment of the San Joaquin Valley, and to point out some possible courses of action. The following approaches were used: (1) University scientists and officials of federal, state, and county agencies were interviewed for information and expert opinions. (2) The literature of pesticides was surveyed and reviewed, relying primarily on the unique collection, files, and services of the Environmental Toxicology Library of the Food Protection and Toxicology Center at the University of California at Davis. (3) Information of pesticide use was retrieved from a data bank containing files of detailed records in machine-readable form. The study embraces the following topics: (1) description of the study area; (2) inventory of uses; (3) application techniques and types of pesticide material being used; (4) routes of pesticide entry into the aquatic environment; (5) the degradation, metabolism, and persistence of pesticides in the aquatic environment; (6) impacts of pesticide pollution on the aquatic environment; (7) alternatives to pesticides for pest control; (8) laws and regulations governing agricultural pesticide use in the San Joaquin Valley.

INDEX TERMS: Path of pollutants, Water pollution effects, Pesticide kinetics, Aquatic environment, Water pollution sources, Agricultural chemicals, Pest control, Aquatic life, Aquatic productivity, Legal aspects, Metabolism, Persistence, Degradation (decomposition), Agricultural runoff, Insecticides, Herbicides, Nematocides, Fumigants, Miticides, Pesticide drift, Volatility, Application methods, Piscicides, Pesticide residues, Biodegradation, Path of pollutants.

AMIC-7141

"RESIDUES OF MS-222 IN NORTHERN PIKE, MUSKELLUNGE, AND WALLEYE", Allen, J. L., Lunning, C. W., Harman, P. D., U.S. Bureau of Sport Fisheries and Wildlife, Southeastern Fish Control Laboratory, Warm Springs, Georgia, Investigations in Fish Control Report No. 45, July 1972, 8 pp.

#16 Residues of MS-222 in muscle of northern pike, muskellunge, and walleye following anesthesia at selected temperatures were measured by the modified Bratton-Marshall colorimetric method (Walker and Schoettger, 1967b) and confirmed by thin-layer chromatography (Allen, Lunning, and Harman, 1970). The mean concentration of MS-222 residues at the 0-hour withdrawal interval ranged from 2.4 to 19.5 ppm. The level of MS-222 residues at 0-hour withdrawal was highest in northern pike and lowest in walleye. After 24 hours withdrawal from the anesthetic, residues were detected in only 2 of the 12 northern pike analyzed by thin-layer chromatography, and these two samples were shown to contain less than 2.0 ppm.

INDEX TERMS: Walleye, Colorimetry, Pollutant identification, Freshwater fish, Pikes, Temperature, Chemical analysis, MS-222, Northern pike, Muskellunge, Muscle, Thin layer chromatography, Drugs, Esox masquinongy, Esox lucius, Stizostedion vitreum, Anesthetics, Tricane methanesulfonate, Detection limits.

AMIC-7143

"GAS CHROMATOGRAPHY OF ORGANONITROGEN PESTICIDES, USING A NITROGEN-SPECIFIC DETECTION SYSTEM", Laski, R. R., Watts, R. R., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 2, March 1973, pp 328-332.

A gas-liquid chromatographic system with a nitrogen-specific detector (electrolytic conductivity detector) was investigated for the determination of 95 organonitrogen pesticides. Each compound was chromatographed, using DC-200 liquid phase on a solid support of 80-100 mesh Chromosorb W (HP). Retention times and response data are given for these pesticides.

INDEX TERMS: Pollutant identification, Chemical analysis, Methodology, Urea pesticides, Carbamate pesticides, Chlorinated hydrocarbon pesticides, Triazine pesticides, Organophosphorus pesticides, Phenolic pesticides, Herbicides, Insecticides, Aliphatic pesticides, Acaricides, Fungicides, Gas liquid chromatography, Organonitrogen pesticides, Retention time, Isomers, Electrolytic conductivity detector.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7144

"GAS CHROMATOGRAPHIC DETERMINATION OF ETHYLENE THIOUREA RESIDUES", Haines, L. D., Adler, I. L., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 2, March 1973, pp 333-337.

Residues of ethylene thiourea on food crops were determined by extracting the sample with methanol, partially purifying the extract on an alumina column, and derivatizing the ethylene thiourea extracted with 1-bromobutane in the presence of dimethylformamide and sodium borohydride. The resulting derivative was measured by gas chromatography, using a flame photometric detector. The method is suitable for routine use and is sensitive to 0.01 ppm.

INDEX TERMS: Pesticide residues, Chemical analysis, Pollutant identification, Thiocarbamate pesticides, Fungicides, Methodology, Flame photometric gas chromatography, Ethylene thiourea, Sample preparation, Column chromatography, Sensitivity, Chemical recovery.

AMIC-7147

"REVERSE PHASE THIN LAYER CHROMATOGRAPHY OF SOME AROCLORS, HALOWAXES, AND PESTICIDES", Stalling, D. L., Huckins, J. N., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 2, March 1973, pp 367-372.

The components of Aroclors 1232, 1248, 1254, and 1260; Halowaxes 1099, 1013, and 1014; and several chlorinated pesticides were resolved by reverse phase thin layer chromatography (RPTLC), which permits component separation by partition between a nonpolar stationary phase and a polar mobile phase. R sub f values of resulting spots were calculated for 2 of 4 new solvent systems (mobile phases). RPTLC patterns were reproducible and characteristic of each material examined. The spots were recovered from the plates and characterized by gas-liquid chromatography (GLC) and/or GLC-mass spectrometry. In some cases, single GLC peaks of Aroclor standards were resolved into more than one component by RPTLC, whereas some RPTLC spots of Halowaxes were resolved into as many as 4 GLC peaks. The analysis of environmental residues of chlorinated compounds was facilitated by this technique.

INDEX TERMS: Polychlorinated biphenyls, Pollutant identification, Chlorinated hydrocarbon pesticides, Pesticide residues, Chemical analysis, Separation techniques, Aldrin, Dieldrin, Reverse phase thin layer chromatography, Chlorinated naphthalenes, Aroclor 1232, Aroclor 1248, Aroclor 1254, Aroclor 1260, Halowax 1099, Halowax 1013, Halowax 1014, Solvent extraction systems, GLC-Mass spectrometry, Gas liquid chromatography, p p' DDT, p p' DDE, Chlordane, Isomers, Precision, Reproducibility, Sensitivity, Carassius auratus, Goldfish, Electron capture gas chromatography.

AMIC-7145

"COMPARATIVE STUDIES OF THIN LAYER CHROMATOGRAPHIC SYSTEMS FOR THE SEPARATION AND IDENTIFICATION OF PHOTOALTERATION PRODUCTS OF PARATHION", Joiner, R. L., Baetcke, K. P., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 2, March 1973, pp 338-340.

Twelve thin layer chromatographic systems were compared for the separation of photoalteration products of parathion. R sub f values for each component in each system are presented. Infrared spectra confirmed the identity of separated components. The following 4 systems were designated superior and gave excellent separation of the components: petroleum ether-ethyl ether-glacial acetic acid (80 plus 15 plus 5 and 50 plus 45 plus 5), methanol-chloroform-ammonium hydroxide (24 plus 75 plus 3.5), and methanol-chloroform-petroleum ether (10 plus 20 plus 70).

INDEX TERMS: Separation techniques, Pollutant identification, Methodology, Organophosphorus pesticides, Chemical analysis, Phenolic pesticides, Insecticides, Parathion, Thin layer chromatography, Photodecomposition, *Degradation products, Sample preparation.

AMIC-7148

"DETERMINATION OF AMMONIACAL NITROGEN IN THE PRESENCE OF UREA WITH AN AMMONIA ELECTRODE", Woodis, T. C., Jr., Cummings, J. M., Jr., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 2, March 1973, pp 373-374.

A recently introduced commercial electrode is shown to be suitable for the determination of ammoniacal nitrogen in the presence of urea. The results compare favorably with those of the reduced pressure distillation method. Standard deviations for the electrode method and the reduced pressure distillation method for ammoniacal nitrogen in urea ammonium phosphate are 0.12 and 0.09 percent, respectively.

INDEX TERMS: Ureas, Nitrogen, Ammonia, Methodology, Chemical analysis, Reliability, Ammonia electrode, Ion selective electrodes, Ammonium, Accuracy, Reduced pressure distillation, Urea ammonium phosphate, Urea ammonium nitrate, Urea ammonium polyphosphate, Urea ammonium sulfate, Chemical recovery.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7149

"RAPID, SENSITIVE METHOD FOR DETERMINATION OF MERCURY IN A VARIETY OF BIOLOGICAL SAMPLES", Deitz, F. D., Sell, J. L., Bristo, D., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 2, March 1973, pp 378-382.

A simple, rapid method is described for the routine determination of mercury at levels as low as 2 ng (2 ppb) in a wide variety of biological samples. Vanadium pentoxide-catalyzed wet digestion at 140 C was used for complete oxidation of organic tissue. Mercury was determined by flameless atomic absorption spectrophotometry, utilizing a syringe technique to transfer mercury-containing vapor to the absorption cell. Replicate analyses of samples on different days showed good precision and accuracy. Coefficients of variations for determinations within a day's run ranged from 2 to 17 percent at mercury concentrations of 30 to 40 ppb. Results obtained by this method agreed very closely with those obtained by neutron activation analyses of the same samples. On a routine basis, 2 analysts can analyze 30-40 samples/day.

INDEX TERMS: Mercury, Pollutant identification, Chemical analysis, Milk, Soil analysis, Alfalfa, Biological samples, Flameless atomic absorption spectrophotometry, Accuracy, Sample preparation, Meat, Precision, Detection limits.

AMIC-7151

"DIRECT TITRIMETRIC MICRODETERMINATION OF FLUORODIFEN, LINURON, FANERON, AND PEBULATE", Abbas, S. L., Ghosh, A. K., Rizvi, S. A. I., Saxena, O. C., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 2, March 1973, pp 387-389.

The herbicides fluorodifen, linuron, faneron, and pebulate have been determined in individual standard solutions by direct titration against gallium chloride solution, using different indicators. The same technique was applied to estimation of these herbicides in treated soils. The complex between gallium chloride and fluorodifen or linuron was formed in a 1:3 ratio, whereas the complex with faneron or pebulate was in a 1:1 ratio. Recoveries for fluorodifen, linuron, faneron, and pebulate were 99.9-101.5, 99.0-102.4, 97.1-101.3, and 98.3-101.2 percent, respectively. Treatment with herbicide lowered the pH of the soil.

INDEX TERMS: Herbicides, Volumetric analysis, Pollutant identification, Soil analysis, Chemical analysis, Dyes, Soil contamination, Methodology, Chemical reactions, Urea pesticides, Halogenated pesticides, Fluorodifen, Linuron, Faneron, Pebulate, Chemical indicators, Chemical recovery, Bromocresol green, Catechol violet, Xylenol orange, Organic dyes, Gallium chloride, Metal complexes, Complexation, Phenylurea pesticides.

AMIC-7150

"DRY ASHING TECHNIQUE FOR THE DETERMINATION OF ARSENIC IN MARINE FISH", Leblanch, P. J., Jackson, A. L., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 2, March 1973, pp 383-386.

A dry ashing procedure, followed by the silver diethyldithiocarbamate colorimetric determination of arsenic in marine fish, is presented. The sample was first homogenized and a portion pre-ashed with magnesium nitrate, using infrared heat, followed by ashing in a 500 C muffle furnace. The residue was dissolved in HCl and the arsenic reduced by means of zinc and HCl to arsine, which was complexed with AgDDC and determined colorimetrically at 535 nm. At temperatures of 460 C and above, efficient ashing was obtained. The effect of various volumes of ashing aid (50 percent magnesium nitrate) was also studied. Maximum recovery and precision were obtained when a minimum of 8 ml 50 percent magnesium nitrate was used. Standard recoveries of inorganic arsenic added to NBS orchard leaves and a sample of dry marine fish tissue gave values of 91-98 percent. Analyses of a number of standard NBS orchard leaves and marine fish As-1 and As-2 gave coefficients of variation of 7.0, 6.0, and 8.1 percent, respectively. Results from dry ashing and wet digestion of a number of species of marine fish were not comparable. Levels of arsenic found in different species of marine fish ranged from less than 0.4 to 27.0 micrograms As/g wet weight. Crabs were found to contain elevated amounts of arsenic.

INDEX TERMS: Colorimetry, Marine fish, Pollutant identification, Methodology, Arsenic, Dry ashing, Sample preparation, Silver diethyldithiocarbamate, Chemical recovery, Precision, Detection limits.

AMIC-7152

"CHEMICAL EQUILIBRIUM MODELS OF LAKE KEYSTONE, OKLA.", Falls, C. P., Varga, L. P., Environmental Science and Technology, Vol. 7, No. 4, April 1973, pp 319-327.

A series of equilibrium models were formulated and compared with chemical and physical observations made from May, 1966 to June, 1968. Water properties determined were temperature, dissolved oxygen, dissolved CO2, suspended solids, dissolved solids, pH, and concentrations of Ca, Mg, Sr, Na, K, bicarbonate, carbonate, sulfate, fluoride, silica, sulfide, and chloride. X-ray diffraction of sediments and suspended solids showed the presence of montmorillonite, kaolinite, illite, quartz, and calcite. The models were based on the thermodynamic equilibrium condition of evaporite minerals (halite, gypsum, dolomite, calcite, and SrSO4), clays (kaolinite, sodium montmorillonite, and calcium montmorillonite), and the liquid and gas phases which comprise the Lake Keystone drainage basin. Ten components were calculated by Gibbs phase rule, using analytical data for the total chemical compositions and the available thermochemical data. The model which simulated the experimental data most closely was based on the hypothesis that waters, originally in equilibrium with the common evaporite minerals of the Permian formation within the Arkansas River drainage basin, were diluted by fresher waters not exposed to these minerals as they flowed toward the reservoir. The waters then approached a state of chemical equilibrium with clay minerals which adjusted their final composition.

INDEX TERMS: Mathematical models, Water quality, Sediments, Thermodynamic behavior, Depth, Distribution patterns, Keystone Lake, Chemical equilibrium.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7153

"KINETIC STUDY OF PHOSPHATE REACTION WITH ALUMINUM OXIDE AND KAOLINITE", Chen, Y.S.R., Butler, J. N., Stumm, W., Environmental Science and Technology, Vol. 7, No. 4, April 1973, pp 327-332.

To better define the role of sediments in cycling nutrients in water systems, the quantitative reaction kinetics of phosphate with clay minerals (alumina and kaolinite) were studied at 25 C and 50 C. Reactions were carried out in cylindrical water-jacketed reaction vessels covered with lucite plates to prevent loss of water vapor. Temperature and pH were carefully controlled. Precipitates were examined by electron microscopy and materials were identified by X-ray diffraction. The reaction of aqueous phosphate (approx 0.0003 M) with alumina and kaolinite shows a rapid (12-24 hr) adsorption step followed by a slow process, obeying a first-order rate law, which extends over the next 60 days and probably involves nucleation and growth of a hexagonal $AlPO_4$ phase. For kaolinite with 10.7 sq m/g surface area, solids concentration 7.5 g/l, pH equals 4.6, as well as for alpha- Al_2O_3 with surface area 10 sq m/g, solids concentration 2.5 g/l, and pH equals 4.3, the first-order rate constant at 50 C is 0.022/day. Increasing temperature increases the rate with an activation energy of 2.4 Kcal/mol. Addition of fluoride ion decreases the amount of phosphate initially adsorbed but does not affect the first-order rate. The rate constant increases proportionally to the solid surface available, and decreases with increasing pH to essentially zero at pH more than or equal to 7. Successive addition of phosphate aliquots to the same sample of solid uses up the sites available for the rapid initial step but does not strongly influence the rate of the slow step.

INDEX TERMS: Phosphates, Sediments, Cycling nutrients, Kaolinite, Water temperature, Hydrogen ion concentration, Chemical reactions, Kinetics, Alumina, Rate constants, Activation energy.

AMIC-7154

"IRON-PHOSPHATE COMPOUND IDENTIFICATION IN SEWAGE SLUDGE RESIDUE", Seitz, M. A., Riedner, R. J., Malhotra, S. K., Kipp, R. J., Environmental Science and Technology, Vol. 7, No. 4, April 1973, pp 354-357.

The iron phosphate compound, vivianite ($Fe_3(PO_4)_2 \cdot 8H_2O$), has been identified by use of X-ray powder diffraction techniques, as existing in the dried secondary sludge residue of the Milwaukee Jones Island sewage treatment plant. In identifying this compound, various methods of drying the sludge residue were evaluated. Magnetic separation techniques were used to concentrate and separate vivianite from the bulk of the dried material. Analysis indicated that vivianite existed in a concentration of about 1 wt percent of the dried material.

INDEX TERMS: Pollutant identification, Sewage sludge, X-ray analysis, X-ray diffraction, Methodology, Separation techniques, Sewage treatment, X-rays, Pollutants, Vivianite, X-ray powder diffraction, Sample preparation.

AMIC-7157

"PERSISTENCE OF PARATHION IN SIX CALIFORNIA SOILS UNDER LABORATORY CONDITIONS", Iwata, Y., Westlake, W. E., Gunther, F. A., Archives of Environmental Contamination and Toxicology, Vol. 1, No. 1, February 1973, pp 84-96.

Six California soils, Mocho silt loam, Linne clay, Madera sandy loam, Laveen loamy sand, Windy loam, and Santa Lucia silt loam, were contaminated with parathion with moisture contents of 40 percent saturation or simulated flooding to investigate parathion persistence. The samples were kept in enameled trays fitted with glass covers for periods up to 8 months. Samples were extracted by adding a benzene-acetone mixture, repeated shaking, decanting the supernatant onto a column of sodium sulfate and collecting the eluate. The recovery of parathion was 95-101 percent. The extracts were analyzed by GLC using an alkali flame ionization phosphorus detector and columns (1.52 m x 3.2 mm o.d.) packed with 10 percent OV-101 on 80/100 mesh Gas Chrom Q for parathion in the presence of aminoparathion or a mixture of 15 percent DC-200 and 15 percent QF-1 separately coated on Gas Chrom Q for aminoparathion. The studies show that most parathion applied to soils disappears rapidly but low levels are retained for long periods. The persistence of parathion is partially dependent on soil type. In Mocho silt loam, Linne clay, Madera sandy loam, and Laveen loamy sand, degradation is rapid and is attributed to a combination of hydrolysis and strong microbial activity that overshadows differences in soil type. In contrast, loss from Santa Lucia silt loam and Windy loam soils is slow and is attributed to hydrolysis. The organic matter contents of the six soils correlate well with the parathion persistence. Parathion disappears faster in the soils with lower organic matter. Parathion degradation did not appear to be greatly accelerated by flooding.

AMIC-7157 (Continued)

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INDEX TERMS: Microbial degradation, Hydrolysis, Soil analysis, Separation techniques, Soils, Gas liquid chromatography, Persistence, Parathion, Chemical recovery.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7164

"TRANSIENT AND STEADY-STATE SALT TRANSPORT BETWEEN SEDIMENTS AND BRINE IN CLOSED LAKES", Lerman, A., Jones, B. F., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 72-85.

Several physical and chemical factors in the development of higher salt concentrations in waters of closed lakes were examined quantitatively. The study also considered the conditions required to maintain a steady-state concentration of salts and the time involved in its attainment. The results of a model are applied to saline Lake Abert (Oregon) to illustrate the importance of salt transport from the sediments as a factor controlling the salt concentration in lake brine. In a lake without outflow dissolved salts may migrate across the sediment-water interface in response to a concentration difference between lake and interstitial brine. Transport of salt upward is transient; its direction can be reversed by external input of salt or by depletion of salts stored in the sediments, and a steady-state concentration in lake water is not attainable. Downward transport can be a stationary process if the sedimentation rate is rapid compared with molecular diffusion of salt in interstitial brine, but characteristic rates are too slow to lead to steady-state concentrations within the lifetime of a closed lake. In Lake Abert, diffusional flux upward was much more important than input of salt from other sources; 45 percent of the salt of lake brine in 1963-1964 was added from the sediment pore space during the preceding 25 years, only 0.1 percent from external inflow. The sediment source will dominate input during high water level. Such models permit comparison of salt transport across the sediment-water interface with other input sources at different times of the lake's history.

INDEX TERMS: Mathematical models Sediments, Salts, Lakes, Cycling nutrients, Transport.

AMIC-7165

"PH BUFFERING OF PORE WATER OF RECENT ANOXIC MARINE SEDIMENTS", Ben-Yaakov, S., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 86-94.

The purpose of this study was to examine the chemistry of pore water of anoxic marine sediments and to propose a model to explain the mechanisms controlling the pH. The proposed model shows that the pH is controlled by four processes: (1) the presence of high concentrations of weak acids and bases which are byproducts of organic decomposition; (2) transfer of charge from the nonprotolytic species to the protolytic ions (sulfate to hydrogen sulfide ion); (3) precipitation of metal sulfides; (4) precipitation of calcium carbonate. The first two (which are dependent on bacterial sulfate reduction) will tend to shift the pH of pore waters toward 6.9. Precipitation of sulfide will increase the pH toward 8.3. The upper limit of pH is controlled by precipitation of calcium carbonate, as the concentration of CO₃(--) increases manyfold at the higher pH range. The lower limit of pH in pore water, under these conditions, is controlled by sulfide precipitation and the upper limit is probably controlled by CaCO₃ precipitation. The presence of organic acids in the pore water of anoxic sediments probably has only a minor effect on the pH of the waters. Oceanic data are not inconsistent with the assumptions of the factors controlling pH, and the predicted pH ranges agree with measured values.

INDEX TERMS: Hydrogen ion concentration, Sediments, Mathematical models, Connate water, Decomposing organic matter, Sulfates, Carbonates, Reduction (chemical), Controlling factors.

AMIC-7169

"CHARACTERISTICS OF THE NEARSHORE ENVIRONMENT OFF THE SOUTH COAST OF ANVERS ISLAND, ANTARCTIC PENINSULA", Warnke, D. A., Richter, J., Oppenheimer, C. H., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 131-142.

A study was carried out in Arthur Harbor and vicinity, Antarctic Peninsula, in February and March, 1973, to establish the characteristics of bottom sediments and the overlying water column, to determine the bacterial numbers in water and sediment samples, to relate these quantities to several environmental parameters, and to determine which, if any, of them act as determinants of bacterial distribution. In addition, the possibility of bacterial liberation of nutrients from the surrounding rock outcrops, and their addition to the nearshore nutrient budget, were investigated. The sediments are diamictons and display great lateral variability. Their organic carbon content falls within the range of values for oceanic sediments. Silica concentrations in the interstitial water of these sediments seems to be controlled by biogenic processes of sedimentation. Bacteria are preferentially associated with sediments rich in clay-sized materials and show little or no correlation with organic carbon in these samples; the surface properties of the fine sediment may be important. Bacterial numbers in the water column are similar to those reported for open-ocean areas below 200 m in lower latitudes. Nutrient values are high, but many nitrite values are low relative to nitrate as in lower latitudes before the growth season and in the open ocean below the euphotic zone. These similarities may indicate that primary productivity at the time and place of investigation was low.

INDEX TERMS: Sediments, Distribution patterns, Nutrients, Sea water, Connate water, Bacteria, Water quality, Culture media.

AMIC-7170

"A FIELD FIXATION TECHNIQUE FOR DISSOLVED PHOSPHATE IN LAKE WATER", Shapiro, J., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 143-145.

Natural water samples containing dissolved orthophosphate may be fixed in the field and analyzed for orthophosphate in the laboratory as much as 2 weeks later. This fixation method involves adding reagents to the water sample and extracting the phosphomolybdic acid formed into isobutanol within 30 sec. In the laboratory the phosphomolybdate in isobutanol was washed with dilute HCl, made to volume, and stannous chloride was added to reduce the compound to its blue form. The color was read in a spectrophotometer and compared with standards. Storage of the samples for 7 days results in values that are at most 15 percent different from the initial values; after 2 weeks the greatest deviation was less than 20 percent. With this fixation method, it is not necessary to keep the extract in the dark. No special preservation methods are necessary either for the water samples or the extracts, and instead of carrying water samples back from the field one need bring back only small vials of extract.

INDEX TERMS: On-site investigations, Solvent extractions, Phosphates, Spectrophotometry, Pollutant identification, Chemical analysis, Lakes, Chelation, Chemical reactions, Color reactions, Sample preservation, Orthophosphates, Accuracy, Natural waters, Sample storage, Sample preparation, Isobutanol, Phosphomolybdic acid.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7176

"SEASONAL FLUCTUATIONS OF IONIC COPPER IN KNIGHTS POND, MASSACHUSETTS", Kimball, K. D., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 169-172.

Ionic copper levels in Knights Pond (Mass.) were measured 34 times from April 19, 1971 to March 20, 1972, in order to investigate the copper cycle in this inland pond. DO, pH, temperature, total residue, and Ca-Mg hardness were also measured. Precipitation was measured daily. Copper in samples was complexed with sodium diethyldithiocarbamate, the complex extracted with xylene, and the absorbance of the xylene-chelate determined with a spectrophotometer. Copper concentrations in the pond ranged from below detectability to 105 micrograms/liter over the 11 months. Values were low from summer through late fall, at which time they ascended to their highest level during midwinter and then slowly decreased throughout late winter and spring toward the summer low values again. No significant correlations were found between copper and pH, total residue, or hardness. Moderate linear correlations were found between dissolved oxygen and copper at the surface stations. Copper is apparently concentrated in the vegetation during the growing season and released from the leaf litter by decomposition in the fall. The chemical characteristics of the watershed are unable to completely complex or precipitate this additional copper, resulting in increased concentrations in the pond during fall and winter.

INDEX TERMS: Copper, Path of pollutants, Seasonal, Water pollution sources, Water analysis, Decomposing organic matter, Dissolved oxygen, Hydrogen ion concentration, Water temperature, Hardness (water), Leaves.

AMIC-7183

"WATER. EXAMINATION - ASSESSMENT - CONDITIONING - CHEMISTRY - BACTERIOLOGY - BIOLOGY", Holl, K., Walter de Gruyter, New York, New York, 1972, 389 pp.

This book is concerned with the investigation and quality assessment of primarily drinking water. Due to the interrelationship of potable water with other types of water, including wastewater, those topics are also treated. Those areas of interest that are covered include (1) general on-site investigations and laboratory tests, (2) chemical examination methods, (3) pollution indicators, (4) tap water analysis, (5) examination and assessment of swimming bath water, surface waters, and wastewater, (6) the bacteriology of drinking water, and (7) the biology of water.

INDEX TERMS: Waste water (pollution), Water analysis, Methodology, Potable water, On-site investigations, Laboratory tests, Pollutant identification, Biological properties, Water chemistry, Water properties, Chemical analysis, Water quality, Indicators, Water pollution, Water sampling, Swimming pools, Mineral water, Surface waters, Aquatic microbiology, Domestic wastes, Industrial wastes, Eutrophication.

AMIC-7184

"NEW METHODS FOR THE DETERMINATION OF ELEMENTS IN TRACE AMOUNTS", Belcher, R., Zeitschrift fur Analytische Chemie, Vol. 263, No. 4, March 6, 1973, pp 257-263.

Recent methods for the determination of elements in trace amounts are discussed, which have been mainly developed in the author's laboratories. The review comprises the following sections: reagents and reactions, charge transfer reactions, cathodoluminescence, molecular emission spectroscopy in flames, enzymatic methods, gas-liquid chromatography of metal chelates, mass spectrometry of metal chelates.

INDEX TERMS: Methodology, Pollutant identification, Mass spectrometry, Chemical reactions, Anions, Cations, Trace levels, Chemical elements, Molecular emission spectroscopy, Metal chelates, Gas liquid chromatography, Enzymatic techniques, Cathodoluminescence, Reagents, Chemical indicators, Detection limits, Chemical interference, Ionic interference, Sensitivity, Apoenzymes, Charge transfer reactions.

AMIC-7185

"APPLICATION OF RADIOCHEMICAL METHODS IN ENVIRONMENTAL RESEARCH", Lieser, K. H., Zeitschrift fur Analytische Chemie, Vol. 263, No. 4, March 6, 1973, pp 304-307.

Activation analysis, dilution analysis and indicator methods (C-14, T) are discussed in general. The high sensitivity of radiochemical methods is emphasized. (In German)

INDEX TERMS: Radiochemical analysis, Methodology, Indicators, Chemical analysis, Carbon radioisotopes, Radioactivity, Heavy metals, Alkali metals, Alkaline earth metals, Halogens, Environmental research, Sensitivity, Environmental samples, C-14, Rare earth elements.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7187

"X-RAY PHOTOELECTRON SPECTROSCOPY OF METALS IN AMINO ACID COMPLEXES AND PROTEINS", Jung, G., Ottmad, M., *Zeitschrift fur Analytische Chemie*, Vol. 263, No. 4, March 6, 1973, pp 282-285.

X-ray photoelectron spectroscopy gives information about the oxidation states and the ligands of metal ions in metalloproteins. To interpret the spectra of the metalloenzymes the photoelectron spectra of amino acid complexes were recorded. Drastic differences were noted for the binding energies of Cu and Co in the complexes and in the proteins. This is probably due to metal-metal interactions in the investigated erythrocyte proteins. Sulphur-containing compounds are very suitable for X-ray photoelectron spectroscopic measurements. It could be shown that sulphur is not involved in the binding of the metal ions. (In German)

INDEX TERMS: Amino acids, Proteins, X-ray spectroscopy, Pollutant identification, Metals, Ions, Copper, Cobalt, Sulfur compounds, Chemical analysis, Chemical reactions, X-ray photoelectron spectroscopy, Metal complexes, Organometallics, Photoelectron spectra.

AMIC-7188

"SEPARATION AND PRECONCENTRATION", Irving, H., *Zeitschrift fur Analytische Chemie*, Vol. 263, No. 4, March 6, 1973, pp 264-271.

A general review is given of methods for separation and preconcentration of analytes. Among the methods of preconcentration which were reviewed are ashing, evaporation, freeze concentration, froth flotation, reverse osmosis, adsorption, liquid-liquid extraction, amalgam methods, volatilization, electrodeposition, and ion exchange. Separation methods reviewed included molecular sieves, gel filtration, gel permeation, gaseous diffusion, ultrafiltration, electrophoresis, sublimation, distillation, foam fractionation, absorption chromatography, gas-solid chromatography, scavenging by colloids, crystallization, freeze separation, zone refining, paper, partition, and thin layer chromatography, liquid-liquid extraction, ion exchange, electrodeposition, amalgam methods, and masking and demasking. Several of the techniques are discussed in relation to analysis of water for heavy metals, organic compounds, and other contaminants.

INDEX TERMS: Separation techniques, Water analysis, Organic compounds, Aqueous solutions, Heavy metals, Ion exchange, Evaporation, Reverse osmosis, Adsorption, Preconcentration, Biological samples, Molecular sieves, Freeze concentration, Volatilization, Coprecipitation, Gel filtration, Gel permeation, Ultrafiltration, Electrophoresis, Sublimation, Partition chromatography, Electrodeposition.

AMIC-7189

"2,3-DIHYDROXYNAPHTHALENE AS INDICATOR FOR THE COMPLEXOMETRIC TITRATION OF IRON(III) WITH EDTA", Manku, G. S., *Zeitschrift fur Analytische Chemie*, Vol. 263, No. 4, March 6, 1973, p 335.

2,3-Dihydroxynaphthalene has been used as a metal indicator for the complexometric titration of Fe(III) with EDTA. The pH of the acidic Fe(III) solution (0.1-67 mg) was adjusted to about 2 with ammonia and 1M HCl-sodium acetate buffer (pH 5) and 0.5 percent w/v ethanolic 2,3-dihydroxynaphthalene were then added. The resulting solution was diluted with distilled water and titrated against a 0.010-0.050 M EDTA solution until a sharp color change from purple to colorless was observed. The relative standard deviation for the procedure was 0.8-1.5 percent. Cyanide, sulfocyanide, oxalate, Ni(II), V(IV), vanadate, molybdate, tungstate, uranyl and Cu(II) ions were found to seriously interfere with the procedure. No interference was caused by these ions: bromide, borate, tartrate, citrate, fluoride, Zn, Cd, Ca, Ba, Sr, Mn(II), Mg, and Be. Given amounts of the following ions could be tolerated in relation to a known quantity of Fe(III): Al, Sb, Bi, Co, Zr, Ti, phosphate, thiosulfate, and iodide.

INDEX TERMS: Heavy metals, Iron, Chelation, Methodology, Cations, Volumetric analysis, Chemical analysis, Anions, Alkali metals, Alkaline earth metals, Strontium, Chemical reactions, Pollutant identification, 2,3-Dihydroxynaphthalene, Complexometric titration, EDTA, Chemical indicators, Chemical interference, Complexation, Metal chelates.

AMIC-7190

"MICRODETERMINATION OF FORMIC, OXALIC AND ACETIC ACIDS IN THEIR MIXTURE BY SELECTIVE OXIDATION", Jaiswal, P. K., *Zeitschrift fur Analytische Chemie*, Vol. 263, No. 4, March 6, 1973, pp 335-336.

Formic, oxalic and acetic acids have been determined in their mixture by selective oxidation with Ag(III) and Cu(III) reagents. Ag(III) oxidizes only formic acid under specific conditions. Diperoxidate cuprate(III) solution oxidizes only formic and oxalic acids under verified conditions, whereas ditellurate cuprate(III) solution oxidizes formic, oxalic as well as acetic acids. Thus by the use of these three oxidants the three acids can be determined separately in their mixture. Formic, oxalic and acetic acids require 2, 2 and 8 equivalents of oxidant for their complete oxidation. The quantities of the three acids have been calculated in g.mole. Experiments have been repeated several times with about 0.00002-0.00006 g.moles of substance and results are obtained with plus or minus 0.8 percent deviation. Interferences are observed in the presence of other inorganic and organic substances.

INDEX TERMS: Chemical reactions, Methodology, Organic acids, Oxidation, Chemical analysis, Pollutant identification, Oxalic acid, Acetic acid, Mixtures, Formic acid, Silver, Ditellurate argentate, Diperoxidate cuprate, Chemical interference, Accuracy, Precision, Ditellurate cuprate, Reagents.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7196

"ANION EXCHANGE SEPARATIONS OF THE ELEMENTS EXTRACTABLE WITH TRIBUTYL PHOSPHATE. IV", Koch, W., Korkisch, J., Mikrochimica Acta, Vol. 2, March 1973, pp 225-244.

Methods are described for the separation of elements that can be extracted with TBP with the employment of the strongly basic anion exchanger Dowex 1, X8 in its chloride form and an aqueous-organic mixture of 30 vol. percent TBP, 60 vol. percent methylglycol, and 10 vol. percent of 12 M hydrochloric acid. In particular, separations of uranium were studied from elements that are extracted well by TBP from hydrochloric acid solutions and from those that are only poorly extracted by TBP. The differing adsorption behaviors may be explained through the resulting KLALE-effect. The behavior of the elements in the mixture containing TBP was compared with that in pure aqueous-hydrochloric acid mixtures and the difference was explained through the above effect. Separation-procedures are given for uranium from In(III), Tl(III), Th(IV), Pb(II), Mn(II), Zr(IV), As(III,V), Sn(II,IV), Mo(VI), V(IV,V) and Sb(V). In the separation from bismuth it was possible to establish the existence of a competition of the two differing strongly adsorbed elements for the functional groups of the resin, which leads to the fact that only a part of the uranium is adsorbed. Similarly there was found a reciprocal action between uranium and manganese, whose consequence was that the manganese is preferentially eluted. In addition, a procedure is described for the separation of the elements selenium and tellurium and also for various spectrophotometric methods for the quantitative determination of the studied metal ions in mixtures containing TBP. (In German)

INDEX TERMS: Separation techniques, Solvent extractions, Anion exchange, Methodology, Heavy metals, Ion exchange resins, Tributyl phosphate,

AMIC-7210

"THE MULTISPECTRAL CONCEPT AS APPLIED TO MARINE OIL SPILLS", Estes, J. E., Senger, L. W., Remote Sensing of Environment, Vol. 2, No. 3, October 1972, pp 141-163.

The detection and measurement of oil pollution in the marine environment are receiving augmented attention, as the incidence of oil spills increases with a corresponding demand for information to direct cleanup operations and assign legal responsibility. Owing to the complex behavior of oil on water, its susceptibility to transport and modification forces, and the physiochemical anomalies associated with its presence, both aerial and surface-based sensors are necessary components of a complete and effective monitoring system. Ultraviolet, thermal infrared, and microwave sensors exhibit capabilities potentially good for oil detection. Radar, in particular, possesses excellent promise for mapping an oil slick's area extent since it is operative day or night, under even adverse weather conditions. Since no present remote sensor system can as yet provide accurate information on the type or thickness of an oil slick, complementary data must be collected using surface-based mechanisms. Radiometric, meteorological, and oceanographic information are essential for a valid interpretation of remotely sensed data and a more complete analysis of the oil spill situation. Several potentially operational systems, coordinating remote sensing and surface data collection systems, for monitoring marine oil pollution are discussed, but more research is clearly needed to demonstrate the actual feasibility of any given method.

INDEX TERMS: Oil spills, Remote sensing, Pollutant identification, Physical properties, Data collections, Oil pollution, Aerial photography, Radar, Marine environment, Multispectral sensing system, Data interpretation, Ultraviolet imagery, Thermal infrared imagery, Microwave radiometry, Correlation spectrometry.

AMIC-7199

"DETECTION OF ORGANO-PHOSPHORUS PESTICIDE RESIDUES IN AUTOPSY TISSUE BY THIN-LAYER CHROMATOGRAPHY", Tewari, S. N.; Harplani, S. P., Mikrochimica Acta, Vol. 2, March 1973, pp 321-324.

The present paper describes a method of extracting organophosphorus pesticides from postmortem human tissues (liver), and their separation and identification by thin-layer chromatography. The respective metabolites are also separated. The insecticides used as controls were: ethyl parathion, methyl parathion, malathion, diazinon and meta systox. The liver sample was extracted by homogenizing with anhydrous sodium sulfate and redistilled acetone, filtering, evaporating the solution, extracting the residue with n-hexane, and partitioning with acetonitrile. After evaporation of the acetonitrile layer, the residue was dissolved in ethanol for spotting on thin layer plates. Four solvent systems were evaluated: cyclohexane-acetone (40:5 and 40:15), cyclohexane-ethylmethyl ketone (40:1), and benzene. Benzene was suitable for separation of ethyl parathion, methyl parathion, malathion, diazinon and meta-systox on silica gel thin layers. Rhodamine B was used as the detection reagent. Our solvents were superior for separation of mixtures of metabolites of some of these pesticides.

INDEX TERMS: Separation techniques, Solvents, Diazinon, Thin layer chromatography, Liver, Sample preparation, Ethyl parathion, Methyl parathion, Meta-systox, p-Nitrophenol.

AMIC-7211

"ORGANIC MERCURY COMPOUNDS IN COASTAL WATERS", Fitzgerald, W. F., Lyons, W. B., Nature, Vol. 242, No. 5398, April 13, 1973, pp 452-453.

Determinations of total and inorganic mercury were made on coastal and river waters near Long Island Sound. Two different 100-ml sets of samples were collected in glass bottles and acidified to pH 1.0 with redistilled concentrated nitric acid. One set was analyzed immediately for inorganic Hg; the other was photooxidized for 24 hr and aliquots were analyzed for total Hg. Flameless atomic absorption spectrophotometry was used in both cases. The total Hg concentrations were found to be 0.045-0.078 ppb and those of inorganic Hg were 0.021-0.033 ppb. It is significant that as much as 50-60 percent of the mercury present in those waters may exist either as organic compounds or in association with organic matter.

INDEX TERMS: Mercury, Pollutant identification, Rivers, Heavy metals, Chemical analysis, Water analysis, Sea water, Trace elements, Water sampling, Coastal waters, Organic mercury, Flameless atomic absorption spectrophotometry, Metal complexes, Sample preparation, Long Island Sound, Photooxidation.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7215

"CHLORINATED HYDROCARBON PESTICIDES AND RELATED COMPOUNDS IN ADIPOSE TISSUE FROM PEOPLE OF JAPAN", Curley, A., Burse, V. W., Jennings, R. W., Villanueva, E. C., et al., Nature, Vol. 242, No. 5396, March 30, 1973, pp 338-340.

Japanese autopsy adipose tissue samples were analyzed by electron capture gas chromatography and the following chlorinated hydrocarbons were found: hexachlorobenzene (HCB), polychlorinated biphenyls, dichlorodiphenyl trichloroethane (DDT), dieldrin (HEOD), heptachlor epoxide, and the alpha, gamma, and beta isomers of hexachlorocyclohexane (HCHC). Two-column gas chromatography, Coulson conductometry and 'Florisil' elution patterns were accepted as sufficient confirmation for the presence of all reported compounds except hexachlorobenzene and PCBs. HCB was substantiated by electron capture and electrolytic conductometric gas-liquid chromatography and gas chromatography-mass spectrometry. The presence of PCB's was verified by electrolytic conductivity and gas chromatography-mass spectrometry. All samples analyzed were positive for PCBs. Eighty percent of the samples had a PCB concentration of less than 1.0 ppm.

INDEX TERMS: Chemical analysis, Chlorinated hydrocarbon pesticides, Polychlorinated biphenyls, Pesticide residues, Pollutant identification, Methodology, Dieldrin, DDT, Insecticides, Fungicides, Animal tissues, Adipose tissue, Heptachlor epoxide, Isomers, Metabolites, Hexachlorobenzene, GC-Mass spectrometry, Column chromatography, Sample preparation, Gas liquid chromatography, Lindane, Japan.

AMIC-7216

"RAPID DETERMINATION OF VERY LOW NITROGEN LEVELS IN WATER", Banker, S. F., Bloom, S. D., Dietrich, F. S., Nature, Vol. 242, No. 5395, March 23, 1973, pp 270-271.

There is a new approach to N-14 assay which is associated with the evaporated detritus of less than 4 ml of water. This method, termed charge particle (nuclear) activation analysis (CPAA), has an activation and subsequent decay of minus 5.9 MeV and 71.0 s, respectively. The presence of nitrogen is measured by counting the number of 2.31 MeV gamma rays emitted in the decay reaction. The present overall accuracy is about plus or minus 25 percent at concentrations greater than 20 mg/kg; the test is sensitive down to 20 ng/kg. The testing time per sample is about 3 min without any destruction of the sample. The method has been applied to water samples from Lake Tahoe, the Sacramento River, municipal wells, and public drinking fountains.

INDEX TERMS: Assay, Water analysis, Methodology, Pollutant identification, Radioactivity techniques, Nutrients, Nitrogen, Gamma rays, Chemical analysis, Potable water, Rivers, Municipal water, Neutron activation analysis, Trace levels, Charged particle activation analysis, N-14, Nitrogen radioisotopes, Sensitivity, Detection limits, Lake Tahoe, Sacramento River, Accuracy.

AMIC-7217

"A SIMPLE MODIFICATION OF A FLAME PHOTOMETER FOR ROUTINE TRACE POTASSIUM ANALYSIS", Knolle, W. R., Applied Spectroscopy, Vol. 27, No. 2, March/April 1973, p 142.

A flame photometer was modified for potassium analysis in the ppb range in solution in order to avoid the cost and inconvenience involved in changing the grating and photomultiplier tube on a general purpose instrument. An Instrumentation Laboratory model IL 153 atomic absorption spectrometer was used in the flame emission mode with an RCA 1P21 photomultiplier tube operated at 1200 V. The modification consisted of setting the grating of the spectrometer to zero wave length and using it as a mirror instead of as a monochromator. A first order least squares analysis of the data obtained from standards prepared with deionized water, which had been demineralized and filtered, yielded a correlation coefficient of 0.99991. Five 2-ml samples of dilute HF were analyzed for K, and the calculated standard deviation multiplied by a statistical factor yielded 1.1 ng of K as a detection limit. This easily realizable working limit is 2 orders of magnitude better than that achieved without the modification. This modification should be generally applicable to any emission flame photometer where the detection limit is restricted by photomultiplier tube and grating response.

INDEX TERMS: Potassium, Aqueous solutions, Chemical analysis, Flame photometry, Pollutant identification, Instrumentation, Laboratory equipment, Trace levels, Detection limits.

AMIC-7218

"HEAVY METALS IN BRITISH WATERS", Preston, A., Nature, Vol. 242, No. 5393, March 9, 1973, pp 95-97.

The program of research and development on heavy metals in the marine environment, conducted by the Ministry of Agriculture, Fisheries and Food, has two chief objectives: (1) the establishment and continued monitoring of concentrations in fish and shellfish of commercial importance in Britain to provide a basis for estimates of human intake of heavy metals and (2) to provide data to assist an understanding of the behaviour of heavy metals when they are introduced into the marine environment--the factors determining their geographical distribution, or biological fate, including their effect, if any, on marine resources and the kinetics of their metabolism in representative marine organisms. The results of seawater sampling on a pilot scale around the British Isles -w that contamination is restricted to a few areas, chiefly, but not exclusively, linked to industrial development, and that even in these areas contamination does not spread very far offshore. Monitoring of commercial fish species shows that, except for sedentary shellfish, variations in inshore seawater metal concentrations are not reflected to any great extent in the edible portions of these species. Of course concentrations in inshore fish are sometimes higher than those in offshore fish, especially in the case of Cd, Hg, and Pb. This strongly indicates that metal pollution problems are essentially national or regional problems.

INDEX TERMS: Heavy metals, Sea water, Path of pollutants, Research and Development, England, Coastal waters, Fate of pollutants.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7219

"OCCURRENCE OF SOME CHLORINATED ALIPHATIC HYDROCARBONS IN THE ENVIRONMENT", Murray, A. J., Riley, J. P., Nature, Vol. 242, No. 5392, March 2, 1973, pp 37-38.

Preliminary data are presented on the environmental (air and water) distribution of aliphatic chlorocompounds. The chlorinated hydrocarbons are stripped from 10- to 100-ml water samples by bubbling with nitrogen and are retained in a cooled silicone packed trap for analysis by electron capture gas chromatography. The coefficient of variation of the method was less than 15 percent. Analyses carried out on samples of surface waters from the North East Atlantic showed the presence of significant amounts of the same principal chlorinated hydrocarbons that were detected in the air samples.

INDEX TERMS: Water analysis, Sea water, Pollutant identification, Organic compounds, Ecological distribution, Chemical analysis, Methodology, Atlantic Ocean, Air pollution, Water pollution, Electron capture gas chromatography, Chlorinated hydrocarbons, Aliphatic hydrocarbons, Sample preparation, Accuracy, Methyl chloride, Chloroform, Carbon tetrachloride, Trichloroethylene, Tetrachloroethylene,

AMIC-7225

"HALOGENATED HYDROCARBONS IN AND OVER THE ATLANTIC", Lovelock, J. E., Maggs, R. J., Wade, R. J., Nature, Vol. 241, No. 5386, January 19, 1973, pp 194-196.

A study conducted to compare the observed global distribution of CCl_3F (a propellant solvent) with the predicted distribution from models of the behavior of an ideal inert gas revealed two halomethanes: methyl iodide and carbon tetrachloride. It was found that these 2 compounds and CCl_3F were uniformly distributed both in air and sea. Analyses were made by gas chromatography using a new electron capture detector which is capable of coulometric measurements. All three gases were found in the air and in the sea wherever and whenever they were sought. CCl_3F is one of the few substances present and easily measured in the air which is wholly anthropogenic in origin. CH_3I is probably a singular product of marine biology and may be a key compound in the natural cycle of iodine between the seas and the land. CCl_4 seems very likely to be a product of natural inorganic chemistry, possibly the reaction of methane in the troposphere with chlorine in a complex sequence of reactions. This substance also is passed through the environment in quantities exceeding 1 megaton annually.

INDEX TERMS: Water pollution, Water analysis, Sea water, Atlantic Ocean, Air pollution, Gases, Organic compounds, Pollutant identification, Water pollution sources, Ecological distribution, Halogenated hydrocarbons, Electron capture gas chromatography, Methyl iodide, Carbon tetrachloride, Aliphatic hydrocarbons, Halomethanes.

AMIC-7241

"FAST LIQUID CHROMATOGRAPHY", Hatano, H., Research/Development, Vol. 24, No. 4, April 1973, pp 28-32.

Instrumentation developed in Japan is described, including the latest chromatographs and detectors available. The specific equipment is: (1) an automatic liquid chromatograph, consisting of a chromatographic separation system which utilizes an automatic fractionation mode, a two-wavelength spectrophotometric detector, and an automatic operation system; (2) an automatic amino acid analyzer equipped with three constant-flow delivery pumps and a three-wavelength flow photometric detector in continuous flowing mode; (3) an automatic liquid chromatograph equipped with a three-wavelength flow-spectrophotometric detector selective to wavelengths of 200 and 750 nm; (4) a high speed liquid chromatograph equipped with a high efficiency column for gel-permeation chromatography. It has also been equipped with a differential refractometer operating on Fresnell's principle; and (5) the FLC-1 fast chromatograph equipped with a flow spectrophotofluorimeter. The ultraviolet absorption, differential refractometric, and flow spectrophotofluorimeter. The ultraviolet absorption, differential refractometric, and flow spectrophotofluorimetric detectors have been used with this equipment. Hitachi KLA-5 amino acid analyzers have been used for accelerated analyses of amino acids and related ninhydrin compounds. The Hitachi 634 liquid chromatograph has been used for other organic and biological compounds.

INDEX TERMS: Instrumentation, Laboratory equipment, Research equipment, Organic compounds, Automatic control, Chemical analysis, Pollutant identification, High speed liquid chromatography, Spectrophotofluorimeter, Automatic amino acid analyzer, Ultraviolet absorption detector, Differential refractometric detector, Biological samples, Sensitivity.

AMIC-7246

"MATRIX EFFECT AND GRAIN SIZE DISTRIBUTION IN THE X-RAY FLUORESCENCE ANALYSIS OF SEDIMENTS IN WATERS", Hellmann, H., Zeitschrift fur Analytische Chemie, Vol. 263, No. 1, January 1973, pp 14-19.

The intensity of the fluorescence of heavy metal traces, such as zinc, in waters can be described as a function of grain size distribution. Contrary to that of pure metals, it increases with grain size. For a parameter, the sample component in the grain diameter range below 6 microns is suited best. In the sediments of waste polluted waters, the same parameter is frequently found in close correlation to the zinc content of the samples. The analytical and practical consequences are discussed in the present paper. (In German)

INDEX TERMS: Water analysis, Zinc, Sediments, X-ray fluorescence, Particle size.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7248

"DETERMINATION OF MERCURY CONTENTS IN DIVERSE SAMPLES OF FISH AND OTHER BIOLOGICAL MATERIALS BY NEUTRON ACTIVATION ANALYSIS", Ruf, H., Rohde, H., Zeitschrift fur Analytische Chemie, Vol. 263, No. 2, January 26, 1973, pp 116-120.

Mercury contents in diverse samples of fish and other biological materials have been determined by neutron activation analysis measuring the activity of Hg-197. A method described in the literature was used for the indispensable separation of the mercury activity utilizing the volatility of HgCl₂ and the low electric potential of deposition of mercury metal. The separation of Au-198 usually found in the irradiated materials was accomplished by volatilisation of the mercury metal at 850 C. Seriously high contents of mercury were found in some samples of Japanese canned tuna and in whitefish of the Rhine River. (In German)

INDEX TERMS: Mercury, Fish, Neutron activation analysis, Foods, Biological samples, Sample preparation.

AMIC-7251

"OXYGEN DEMAND OF EFFLUENT FROM A BLEACHED KRAFT PULP MILL", Ogden, J. G., III, Water, Air, and Soil Pollution, Vol. 1, No. 4, September 1972, pp 365-374.

Since the fall of 1967, a 160 hectare former tidal estuary has been dammed and used as a waste water treatment facility for a 500-700 metric tons per day bleached sulfate kraft pulp mill at Abercrombie Point, Nova Scotia. The treatment system is subdivided into a 16 hectare settling pond to remove coarse suspended solids, and a 144 hectare stabilization pond. Volume of the two basins indicates a total detention time of 15 to 25 days, depending upon plant flow rates. Total solids input to the treatment system (determined by evaporation at 105 C) amounts to 1.29 g/l. Settling and oxidation in the basin accounts for approximately 0.29 g/l. Because on plant flow rates of 95 million per day, nearly 100 metric tons of solids are released to the marine environment daily. Determinations indicate that at present loadings, more than 10 metric tons of BOD per day are entering a poorly flushing coastal environment. Chemical Oxygen Demand (COD) values are from 2 to 10 times greater than BOD. Effects of mechanical aeration and massive lime treatment of the effluent for removal of solids and O₂ demand are discussed. Consequences of alternative treatment methods and continued utilization of the treatment basin are considered.

INDEX TERMS: Oxygen demand, Effluents, Pulp and paper industry, Chemical oxygen demand, Biochemical oxygen demand, Organic loading, Water sampling, Water chemistry, Gas chromatography, Industrial wastes, Characterization, Bleached pulp wastes, Gravimetric analysis, Total oxygen demand.

AMIC-7249

"CLEAN-UP OF CRUDE EXTRACTS CONTAINING PESTICIDE RESIDUES BY AN AUTOMATIC APPARATUS BASING UPON THE PRINCIPLE OF 'SWEEP CO-DISTILLATION'", Pflugmacher, J., Ebing, W., Zeitschrift fur Analytische Chemie, Vol. 263, No. 2, January 26, 1973, pp 120-127.

An automatic apparatus has been constructed which cleans up crude extracts basing upon the principle of 'sweep co-distillation' for gas-chromatographic residue analysis of insecticides. With this instrumentation, e.g. crude extracts from 13 crops containing 27 phosphorus pesticides has been cleaned up using unique conditions. Average recovery values reach from 66.4 to 112.4 percent. Concentration levels of the residues had been elected in accordance with the German tolerance list. The apparatus is suitable for further applications. (In German)

INDEX TERMS: Pesticide residues, Automatic control, Laboratory equipment, Research equipment, Gas chromatography, Instrumentation, Insecticides, Organophosphorus pesticides, Methodology, Chemical analysis, Sweep co-distillation, Cleanup, Chemical recovery.

AMIC-7252

"ABSORPTION OF AMMONIA FROM ATMOSPHERIC PLUMES BY NATURAL WATER SURFACES", Calder, K. L., Water, Air, and Soil Pollution, Vol. 1, No. 4, September 1972, pp 375-380.

A simple model is presented that incorporates the major features of atmospheric transport and diffusion of a NH₃ plume together with aqueous absorption as the plume traverses a water surface. The model is based on the well-known concept of the deposition velocity, although empirical data concerning the latter is quite meager. A specific application is considered to the gas release from a NH₃ stripper of a hypothetical sewage treatment plant, and it is concluded that NH₃ absorption by adjacent water masses could be considered.

INDEX TERMS: Ammonia, Absorption, Mathematical models, Path of pollutants, Model studies, Diffusion, Gases, Atmospheric transport, Water surfaces.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7254

"THE DISTRIBUTION OF HEAVY METALS IN SEDIMENTS OF SORFJORD, WEST NORWAY", Skei, J. M., Price, N. B., Calvert, S. E., Høltedahl, H., Water, Air, and Soil Pollution, Vol. 1, No. 4, September 1972, pp 452-461.

Sediment cores were taken from 16 sites in Sorfjord, West Norway and frozen. The surface 2-cm sections were sampled, dried, and ground for chemical analysis by X-ray fluorescence for the presence of Ag, Ba, Bi, Cd, Cu, In, Pb, Sb, Sn and Zn. Unusually high concentrations were found; the concentrations of Zn and Pb reached approximately 10 percent by weight in some sediments. The concentrations of most of the elements were positively correlated, those of Pb, Cd, and Cu with Zn being particularly well developed; correlations also existed between Sb and Zn, and Ag and Cu. The concentrations of the metals in the bottom sediments decreased southwards and northwards from a locality close to a source of industrial waste.

INDEX TERMS: Heavy metals, Bottom sediments, Soil analysis, Pollutant identification, X-ray fluorescence, Distribution, Sampling, Aquatic soils, Chemical analysis, Fjords, Cadmium, Copper, Lead, Zinc, Cores, Water pollution sources, X-ray analysis, Norway, Silver, Barium, Bismuth, Indium, Antimony, Tin, Norway, Sorfjord.

AMIC-7260

"REDUCTION OF MERCURY WITH CYSTEINE IN COMMINUTED HALIBUT AND HAKE FISH PROTEIN CONCENTRATE", Spinelli, J., Steinberg, M. A., Miller, R., Hall, A., Lehman, L., Journal of Agricultural and Food Chemistry, Vol. 21, No. 2, March/April 1973, pp 264-268.

A study was made to determine the effectiveness of cysteine in reducing the mercury content of comminuted fish and fish protein concentrate (FPC). Comminuted fish tissue was extracted with 0.1 M NaCl containing cysteine HCl.H₂O in concentrations ranging from 0 to 0.5 percent. The amount of Hg that could be extracted from the fish was related to the concentrations of cysteine and the pH of the tissue, but the relation was not linear. The most efficient use of cysteine in reducing the Hg content of comminuted fish was obtained when the cysteine-containing extraction solution was percolated through the fish contained in the column. When cysteine was used in an aqueous system, only minimal cysteine (4-8 percent) residues were left in the product, indicating that cysteine does not bind irreversibly with the fish proteins.

INDEX TERMS: Separation techniques, Mercury, Fish, Biological samples, Cysteine.

AMIC-7256

"TITRIMETRIC MICRODETERMINATION OF NICKEL AND COBALT, SEPARATELY AND IN PRESENCE OF EACH OTHER", Saxena, S., Pandey, J. D., Zeitschrift für Analytische Chemie, Vol. 263, No. 3, February 7, 1973, p 208.

A new method for the determination of Ni and Co, separately and in mixture is based on titration with hippuric acid. Xylenol orange (and chromazurol red S) are employed as indicators. Maximum error observed for Ni and Co was 2.0 percent and 1.9 percent, respectively, when determined separately and 1.9 percent and 1.9 percent, respectively, when determined from a mixture. Amounts taken were in the range of about 60-400 mg. The following ions caused interferences: Pb, Fe, Ga, Al, Nd, Gd, Zr, Te, Nb, Re. No interferences are caused by Ti, Mg, Cd, Be, Ca, Ba, Zn, In, Pr, U. A most important precaution in this method is a thorough cleaning of the beakers used with sodium carbonate or chromic acid, since otherwise the exact colour change may be not obtained.

INDEX TERMS: Nickel, Cobalt, Volumetric analysis, Pollutant identification, Heavy metals, Cations, Alkaline earth metals, Ionic interference, Chemical indicators, Accuracy, Rare earth elements, Sensitivity.

AMIC-7265

"ECOLOGICAL SIGNIFICANCE OF THE DISCHARGE OF TREATED WASTEWATERS INTO COASTAL WATERS", Hlavka, G. E., Journal of Milk and Food Technology, Vol. 36, No. 1, January 1973, pp 23-27.

The Southern California Coastal Water Research Project (SCCWRP) is attempting to attain a substantial understanding of the ecology of the coastal waters of Southern California. The goals and objectives of the project are to: (a) determine the input rates and distribution of the substantial and trace-level organic and inorganic materials entering the coastal waters; (b) investigate the natural phenomena of the Southern California Bight in present and recent times; (c) determine the effects of man on the coastal waters and distinguish them from natural phenomena; (d) develop indices of environmental health; (e) develop the capacity to predict man-induced effects on the coastal waters; and (f) determine the methods by which the coastal water environment may be enhanced. The findings should be useful in efforts to limit harmful effects and to promote enhancement of the coastal environment. The major effort thus far has been an information search in 17 task areas of physical and chemical oceanography, marine biology, and environmental engineering. In addition, several new research projects have been started under SCCWRP direction. Discussed are some of the technical problems associated with such an effort such as quantifying the natural fluctuations of physical, chemical, and biological parameters; establishing environmental criteria; and correlating observed effects with pollutant distributions.

INDEX TERMS: Waste water (pollution), Waste treatment, Water pollution effects, Water pollution sources, Water quality standards, Research and development, Waste identification, Multiple-purpose projects, Pollutants, Path of pollutants, Aquatic life, Bioindicators, Water analysis, Ecology, Coastal waters.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7270

"TRACE OIL AS A POLLUTANT IN WATER", Malueg, N. J., Krawczyk, D. F., Journal of Petroleum Technology, Vol. 25, March 1973, pp 243-248.

An approach used by the EPA Regional Laboratory at Redmond, Washington, to trace an oil or a petroleum product found in or on water to a source is delineated. Sample preparation involves extracting a volume of the sample with a solvent, rinsing with distilled water to form an emulsion, and extracting with additional solvent. The solvent is filtered and removed completely by passing clean, dry nitrogen over the solvent-oil mixture in a hot water bath. The oil is then dessicated so that further analysis can proceed. The paper strip and gas chromatographic methods are used for comparing a source with a spill and the chromatographic fluorescence method is used for comparing samples of petroleum products. Infrared scans are used to compare oily water with potential sources. Sulfur and metallic techniques are used to determine sulfur and metal content. All the data collected are compared with data on crude and refined products and some judgment can be made as to whether the sample is a crude or refined product and on the locality of the original crude. The 'fingerprints' of the oil can then be compared with possible sources.

INDEX TERMS: Tracking techniques, Oil spills, Water pollution sources, Pollutant identification, Methodology, Water analysis, Oil characterization, Oil fingerprinting, Sample preparation, Petroleum products, Chemical recovery, Chemical composition, Precision.

AMIC-7271

"REMOTE SENSING TECHNIQUES FOR DETECTING OIL SLICKS", Catoe, C. E., Journal of Petroleum Technology, Vol. 25, March 1973, pp 267-278.

Those signature properties of oil slicks that make them amenable to remote sensing are described with emphasis on those signature properties that are useful in (1) detecting oil films on water surfaces, (2) mapping the areal extent of the slicks, (3) measuring the thickness of the slicks, and (4) identifying oil types. The reflective and fluorescent signatures are correlated with detection in the ultraviolet, visible, infrared, microwave, and radar regions. Remote sensing techniques are considered in two broad categories: imaging techniques (spatial dimension), and nonimaging techniques (spectral dimension). The imaging techniques are panchromatic photography, infrared photography, multispectral photography, ultraviolet imagery, infrared imagery as well as multispectral, optical-mechanical scanner imagery, color photography, infrared color photography, radar, and passive microwave imagery. Nonimaging techniques include infrared radiometry, infrared spectral radiometry, passive radiometry, Fraunhofer line discriminator, Barringer correlation spectrometer, and wide-range image spectrophotometer.

INDEX TERMS: Oil spills, Remote sensing, Pollutant identification, Optical properties, Fluorescence, Reflectance, Methodology, Physical properties, Water pollution, Sea water, Oil films, Oil types.

AMIC-7292

"THE EXTRACTION OF DIVALENT COBALT, COPPER, ZINC AND CADMIUM FROM HYDROCHLORIC ACID SOLUTIONS BY TRI-n-BUTYL PHOSPHATE", Sato, T., Journal of Applied Chemistry and Biotechnology, Vol. 22, No. 12, December 1972, pp 1233-1242.

The partition of divalent cobalt, copper, zinc, and cadmium between hydrochloric acid solutions and solutions of tri-n-butyl phosphate (TBP) in benzene or kerosene has been investigated under different conditions. Further the absorption spectra of both the aqueous and organic phases have been studied, and the infrared spectra of the organic phases have been examined. It was found that the order of the extraction efficiency of TBP for divalent metals is Zn greater than Cd greater than Cu greater than Co for aqueous HCl less than 8 M and Zn greater than Cd greater than Co greater than Cu for aqueous HCl greater than 8 M.

INDEX TERMS: Cations, Cobalt, Copper, Zinc, Cadmium, Solvent extractions, Aqueous solutions, Heavy metals, Separation techniques, Efficiencies, Tri-n-butyl phosphate, Organic solvents, Chemical indicators, EDTA, Xylenol orange, Infrared spectra, Absorption spectra, Hydrochloric acid, Benzene, Kerosene.

AMIC-7293

"VOLUMETRIC DETERMINATION OF NICKEL BY HIGH FREQUENCY IMPEDIMETRY", Bara-Temes, S., Bermejo-Martinez, F., Prieto-Bouza, A., Microchemical Journal, Vol. 17, No. 6, December 1972, pp 625-631.

A method is proposed for the determination of nickel by high frequency impedimetry in the presence of aluminum, iron, calcium, and mercury by the use of TTHA in NaHCO₃ medium. A sample volume containing not more than 6 mg of nickel is placed in the titration cell to which is added 1 ml of one percent sodium bicarbonate solution. The mixture is then removed for 2 min to allow precipitation and then diluted with deionized water to 80 ml. Titration is carried out with 0.01 M disodium salt of TTHA solution. The method is accurate in the presence of not more than 0.0004 mole of noninterfering substances.

INDEX TERMS: Nickel, Volumetric analysis, Aqueous solutions, Chemical analysis, Heavy metals, Methodology, Separation techniques, Iron, Aluminum, High frequency impedimetry, Chemical interference, Accuracy, Alkaline media, Sodium bicarbonate.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7294

"ALPHA-AL2O3 AS AN ADSORBENT IN THIN-LAYER CHROMATOGRAPHY", Korczak, B., Węgrzynek, J., Hable, H., Sliwiok, J., Microchemical Journal, Vol. 17, No. 6, December 1972, pp 632-637.

The utility of laboratory-made alpha-AL2O3 as an adsorbent in the thin layer chromatographic separation of selected organic compounds was determined by the separation of a mixture of test-dyes (butter yellow, Sudan G and indophenol) and calculation of the following coefficients: $R_{sub f}$, L_{pt} , $I_{sub g}$ and t . The comparison was made conducting the same experiments with AL2O3 produced by Woelam. Aluminum oxide was prepared by sieving aluminum hydroxide (USSR) to unify granule diameter and roasting at 1250 C for 5 hr. It was shown to have several advantages common to proper adsorbents for TLC purposes.

INDEX TERMS: Separation techniques, Methodology, Organic compounds, Pollutant identification, Chemical analysis, Adsorbents, Thin layer chromatography, alpha-Aluminum oxide, Alumina, Butter yellow, Sudan G, Indophenol, Organic dyes.

AMIC-7312

"THE USE OF GAS-LIQUID CHROMATOGRAPHY FOR SELECTING EXTRACTIVE SOLVENTS FOR LIQUID EXTRACTION PROCESSES", Abramovich, Z. I., Bondarenko, M. F., Kruglov, E. A., et al., Journal of Chromatography, Vol. 77, No. 1, March 14, 1973, pp 37-40.

Gas-liquid chromatography has been used to investigate the group selectivity of 28 solvents in the separation of cyclic and aliphatic sulfides from the hydrocarbons. The solvents containing -OH and -NH2 groups were found to be the most selective in separating the cyclic sulfides and monocyclic aromatic hydrocarbons. The data obtained allowed an extractive solvent (phenol) to be chosen for separating the cyclic sulfides from the kerosene-gas-oil fractions. With the straight-run petroleum fraction 275-350 degrees the possibility of obtaining the sulfide concentrates with the help of liquid extraction was experimentally confirmed.

INDEX TERMS: Solvent extractions, Selectivity, Separation techniques, Phenols, Alcohols, Nitrogen compounds, Sulfur compounds, Gas liquid chromatography, Organic solvents, Esters.

AMIC-7311

"GAS CHROMATOGRAPHIC SEPARATION, BY CARBON NUMBER AND HYDROCARBON TYPE, OF SATURATED HYDROCARBON MIXTURES AND DIFFERENT NAPHTHAS OVER MOLECULAR SIEVES 13X", Garilli, F., Fabiani, L., Filia, U., Cuse, V., Journal of Chromatography, Vol. 77, No. 1, March 14, 1973, pp 3-10.

A gas-solid chromatographic method is described for separating hydrocarbon mixtures according to hydrocarbon type and carbon number by the use of molecular sieves 13X. Practical applications of this analytical method are reported, including the analysis of the charge and the end-products of a platforming plant, and in addition, some quantitative and qualitative determinations on virgin naphtha from different types of crude oil.

INDEX TERMS: Methodology, Separation techniques, Molecular structure, Chemical analysis, Pollutant identification, Flame ionization gas chromatography, Gas solid chromatography, Naphtha, Mixtures, Aliphatic hydrocarbons, Oil types, Aromatic hydrocarbons, Molecular sieves.

AMIC-7326

"COMPARISON OF FLAME AND FLAMELESS ATOMIC ABSORPTION FOR THE DETERMINATION OF CALCIUM", Cragin, J. H., Herron, M. M., Atomic Absorption Newsletter, Vol. 12, No. 2, March-April 1973, pp 37-38.

Select glacial snow samples from Greenland were analyzed for calcium by both flame and flameless atomic absorption in order to compare the suitability of these techniques. A Perkin-Elmer Model 303 atomic absorption spectrophotometer and a single-element Ca Intensitron hollow cathode lamp were used. Flameless absorption values were obtained with an HGA-70 Graphite Furnace which was modified to interrupt the inert gas flow during atomization. Comparisons of the results from the two methods showed good agreement in reference to standard deviations. The addition of 0.1 percent La to samples gave no increase in absorbance indicating the absence of interferences for flame determinations. Consequently all flame measurements were performed without this additive. Precision was appreciably better with the graphite furnace: average standard deviations are 1.9 micrograms/l for the flame and 0.3 microgram/l for the furnace. Flame and flameless atomic absorption determinations of calcium compare well in the 5 to 20 micrograms/l range. Below 5 micrograms/l calcium, the Graphite Furnace because of its improved precision is preferred to the flame.

INDEX TERMS: Calcium, Methodology, Snow, Aqueous solutions, Chemical analysis, Pollutant identification, Atomic absorption spectrophotometry, Flameless atomic absorption spectrophotometry, Precision, Detection limits, Absorbance, Sensitivity, Graphite furnace.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7327

"SOME OBSERVATIONS ON STANDARD MERCURY SOLUTIONS FOR ATOMIC ABSORPTION SPECTROSCOPY", Odashima, T., Kumagai, Y., Atomic Absorption Newsletter, Vol. 12, No. 2, March-April 1973, p 39.

Measurements made with a Hitachi Model 207 atomic absorption spectrometer showed that the atomic absorption of mercury at 254 nm in air-acetylene flames is greatly influenced by certain types of standard mercury(II) solutions. When mercury(II) chloride was used for standard solutions, rectangular absorption peaks were obtained, but when mercury(II) nitrate was used, there was tailing of the peaks. The tailing effect can be eliminated by adding sufficient quantities of halides such as KCl, KBr, KSCN, or KI.

INDEX TERMS: Mercury, Atomic absorption spectrophotometry, Standard solutions.

AMIC-7330

"THE DETERMINATION OF TRACE METALS AND THEIR SIGNIFICANCE IN CLINICAL CHEMISTRY", Delves, H. T., Atomic Absorption Newsletter, Vol. 12, No. 2, March-April 1973, pp 50-54.

Because of the relationship of both essential and non-essential trace metals to human health and environmental conditions, analysis of trace metals in tissue, blood, urine, and plasma is important. The author reviews his own and others' work in developing methods of analyzing lead in blood and urine, copper in plasma, and copper and zinc in plasma protein fractions. Difficulties with flame AA analysis of lead in blood and urine have been overcome by using flame-assisted microsampling techniques or furnace atomization techniques. Flame microsampling has also been used to determine copper in plasma. Furnace atomization has proven useful for determining less volatile metals and has been used to investigate copper and zinc concentrations in plasma fractions. The sensitivity and precision of this technique are given for Zn, Cd, Mn, Pb, Cu, Co, Fe, and Ni.

INDEX TERMS: Copper, Lead, Zinc, Cadmium, Manganese, Cobalt, Iron, Nickel, Blood, Plasma, Sample preparation, Atomic absorption spectrophotometry, Flame micro-sampling, Furnace atomization, Sensitivity, Precision.

AMIC-7329

"THE APPLICATION OF FLAMELESS ATOMIC ABSORPTION IN HYDROGEOCHEMICAL ANALYSIS", Edmunds, W. M., Giddings, D. R., Morgan-Jones, M., Atomic Absorption Newsletter, Vol. 12, No. 2, March-April 1973, pp 45-49.

A satisfactory procedure for the determination of trace metals in natural waters, based on the use of the heated graphite atomizer (HGA) has been developed. Mn, Fe, Ni, Cu, Co, Cr, Mo, Pb and Cd were investigated in water samples varying from dilute groundwaters to brines. Sample sizes were 10, 20, 50 or 100 microliters and the sample was injected into the furnace in triplicate by applying a constant pressure. Measurements were made using the standard calibration curve and the standard addition procedures. The overall precision varied between plus or minus 5 percent to plus or minus 10 percent at the 10 micrograms/l level; precision for Cu, Co, Mn, Mo and possibly Ni was better than for the other elements. The sensitivity achieved was in general comparable with that quoted for the HGA by other workers, except for cadmium which is approximately ten times less sensitive. The detection limits shown for Co, Cr, Cu, Mn, Mo and Pb are generally of the same order as those quoted by the manufacturers, whereas the limit for Ni is slightly better. Relatively similar detection limits are obtained by solvent extractions. The results of solvent extraction and direct flame analyses of Cyprus groundwater samples showed good agreement in terms of accuracy of the method.

INDEX TERMS: Methodology, Chemical analysis, Water analysis, Brines, Heavy metals, Trace elements, Groundwater, Heated graphite atomizer, Flameless atomic absorption spectrophotometry, Sensitivity, Accuracy, Detection limits.

AMIC-7333

"TRACE ELEMENT DETERMINATION WITH SEMICONDUCTOR DETECTOR X-RAY SPECTROMETERS", Giaque, R. D., Goulding, F. S., Jaklevic, J. M., Pehl, R. H., Analytical Chemistry, Vol. 45, No. 4, April 1973, pp 671-681.

A method of obtaining high sensitivity and accuracy in X-ray fluorescence analysis using semiconductor detector spectrometers is discussed. Mono-energetic exciting radiation is employed to generate characteristic X-rays from trace elements in thin, uniform specimens. Corrections for absorption effects are determined; enhancement effects are omitted as they are negligible for many thin specimens. A single element thin-film standard is used to calibrate for the X-ray geometry, and theoretical cross sections and fluorescent yield data are employed to relate the X-ray yields for a wide range of elements to the thin-film standard. Various corrections which affect the accuracy of the method are discussed including the method for determining X-ray spectral background. Samples of orchard leaves, tissue, blood, and other biological materials are prepared for analysis by freeze- or oven-drying, pulverizing, and pressing into pellets. Rock, glass, and pottery specimens are prepared by pulverizing, collecting on thin filters, and transferring the dust to Millipore filters. Elements in solution are absorbed on cellulose powder, dried, pulverized, and pressed into pellets. Elements in air can be analyzed directly from filter papers. Samples of orchard leaves, rocks, pottery, and air particulate filters were analyzed for metals including Cr, Mn, Fe, Ni, Cu, Zn, As, Br, Rb, Sr, Pb, K, Ca, Ti, V, Ga, and Se. Using a single excitation energy, the concentrations of more than fifteen trace elements may be simultaneously determined during a fifteen-minute interval for concentrations of 1 ppm or less.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7333 (Continued)

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INDEX TERMS: X-ray spectroscopy, Air, Aqueous solutions, Separation techniques, Heavy-metals, Rocks, Blood, Sample preparation, Orchard leaves, Semiconductor detector, Detection limits.

AMIC-7337

"SEPARATION AND CHARACTERIZATION OF DIMETHYLNITROBIPHENYL AND DIMETHYLBIPHENYLAMINE ISOMERS BY CHROMATOGRAPHIC AND SPECTROMETRIC METHODS", Dudley, P. A., Noall, M. W., Desiderio, D. M., Analytical Chemistry, Vol. 45, No. 4, April 1973, pp 703-706.

Diazotized 4-nitro-m-toluidine when coupled with toluene yields a mixture of dimethyl positional isomers of 2',3'-, or 4'-dimethyl-4-nitrobiphenyl. The 2',3-dimethyl-4-nitrobiphenyl isomer is of interest as a precursor for the carcinogen 2',3-dimethyl-4-diphenylamine and the related hydroxamic acid. The 2',3-dimethyl-4-nitro isomer is separated on a preparative scale from the 3,3'- and 3,4'-dimethyl isomers in a cyclohexane-heptane-nitromethane liquid-liquid partition chromatography system. The chromatographic system resolved 2',3-dimethyl-4-biphenylamine from the two corresponding dimethylamine isomers and from the nitro compounds. The 2',3-dimethylnitro or amine isomers may be analyzed by GLC on a 4-mm x 5-foot column of 2 percent OV-17 on Gas Chrom P. The methyl positional isomers of the nitro and amine compounds and their corresponding hydrocarbons have been characterized and compared to reference hydrocarbons by mass spectrometry. The 2',3-dimethyl nitro and amine compounds are additionally characterized by physical constants, IR, and UV spectral data.

INDEX TERMS: Separation techniques, Characterization, GC-mass spectrometry, Sample preparation, Dimethylbiphenyls, Dimethylbiphenylamines, Infrared spectra, Ultraviolet spectra.

AMIC-7336

"TRACE ELEMENT ANALYSIS IN WATER BY PROTON ACTIVATION", Bankert, S. F., Bloom, S. D., Sauter, G. D., Analytical Chemistry, Vol. 45, No. 4, April 1973, pp 692-697.

Charged particle activation analysis (CPAA) has been applied to the measurement of trace amounts of pollutants in calibrated water samples. The activating particles are 14.7 MeV protons in a microampere (or less) beam from the Lawrence Livermore Laboratory 30-inch cyclotron. The short half-life gamma spectrum of the activated sample is assayed in a NaI-Ge(Li) anticoincidence detector system. A fast transit system carries the sample from the bombardment site to the counting position in about 1.8 seconds. As of now, the technique is capable of simultaneously detecting ppm quantities of boron, nitrogen, bromine, selenium, sodium, cadmium, and chromium in concentrated water samples evaporated to dryness on tantalum foils. However, it is applicable to any thin sample which can be fixed to a foil.

INDEX TERMS: Water analysis, Nitrogen, Bromine, Boron, Cadmium, Chromium, Sodium, Sample preparation, Proton activation analysis, Selenium, Detection limits.

AMIC-7338

"ON-THE-FLY GAS CHROMATOGRAPHY-INFRARED SPECTROMETRY USING A CHOLESTERIC LIQUID CRYSTAL-EFFLUENT INTERFACE", Lephardt, J. O., Bulkin, B. J., Analytical Chemistry, Vol. 45, No. 4, April 1973, pp 706-710.

A GCIR system is described which combines the features of trapping and on-the-fly techniques. The heart of the system is a cholesteric liquid crystal film. The system was used to obtain infrared spectra of toluene, chloroform, 1,2-dichloroethane, carbon tetrachloride, nitrobenzene, m-chloroaniline, o-toluidine, o-chloroaniline, and n,n-dimethylaniline. It was found that on-the-fly IR spectra of organic vapors can be obtained with quantities as small as 50 micrograms. The liquid crystal fractionates sample from carrier gas. The technique yields spectra which are solution rather than gas phase spectra, eliminating problems of rotational structure and vapor-liquid frequency shifts. The system can also be used for on-the-fly spectra of organic vapors in an air stream, with comparable efficiency. Color shifts occurring on adsorption and desorption of the effluents onto the liquid crystal film can be monitored to trigger infrared scanning and eliminate delay time errors associated with gas cell operation. The range of the system can be extended by changing the carrier gas to effluent ratio for high boiling materials.

INDEX TERMS: Toluene, Chloroform, 1 2-dichloroethane, Carbon tetrachloride, Nitrobenzene, m-Chloroaniline, o-Toluidine, o-Chloroaniline, N N-dimethylaniline, GC-Infrared spectrometry, Infrared spectra.

1. PHYSICAL AND CHEMICAL METHODS

AMIC-7348

"SELECTIVE DETERMINATION OF HETERO-ORGANICS BY A DUAL-CHANNEL DETECTOR BASED ON FLAME CONDUCTIVITY AND EMISSION", Aue, W. A., Hill, H. H., Jr., Analytical Chemistry, Vol. 45, No. 4, April 1973, pp 729-732.

A simple dual-channel detector was constructed from a regular FID and a spectrometer and used to study ionization and emission processes occurring in hydrogen flames. The response of the system was tested with dodecane, trimethyl-phosphate, di-n-butyl-disulfide, tetraethyl lead, tetraethyl tin and ferrocene under air-rich and hydrogen-rich conditions. The results showed that both emission and ionization responses can be used to determine the metals in the nanogram and picogram ranges, respectively; while the response to carbon is repressed by several orders of magnitude. The method should prove useful for biological and environmental samples.

INDEX TERMS: Iron, Lead, Tin, Phosphorus, Sulfur, Carbon, Gas chromatography, Flame ionization detector, Detection limits, Dodecane, Trimethylphosphate, Di-n-butyl-disulfide, Tetraethyl lead, Tetraethyl tin, Ferrocene, Biological samples, Environmental samples.

AMIC-7358

"IDENTIFICATION OF HEAVIER AROMATIC COMPONENTS IN REFORMED PETROLEUM PRODUCTS BY DIRECT COUPLED CAPILLARY GAS CHROMATOGRAPHY-MASS SPECTROMETRY", Swansiger, J. T., Dickson, F. E., Analytical Chemistry, Vol. 45, No. 4, April 1973, pp 811-813.

The objective of this research was to identify as many components in the C10 and heavier range of reformed petroleum products and to utilize to the fullest extent possible the capabilities of the mass spectrometric interface in identifying the capillary GC peaks. It was possible to isolate the C10-C11 fractions from a typical reformat and the C11-C14 fraction from an alkylated reformat. The major peaks appearing in the capillary GC of the C10-C11 cut (21 peaks) were identified and 95 percent (13 peaks) in the C11-C14 fraction were identified. The C10-C11 fraction was isolated by preparative gas chromatography using a 5-1/2 ft column packed with OV-1 on Chromosorb P. This fraction was injected into a 200 ft column with (m-phenoxy, phenoxy) benzene/squalane and programmed from 50 to 90 C at 1 C per minute. The C11-C14 fraction was isolated by distillation of components boiling above 187 C. The distillate was injected in a 150-ft column coated with polyphenyl ether and programmed from 50 to 160 C at 5 C per minute. Mass spectra were obtained at 70 eV with an ionizing current of 150 micro amps. The GC peaks were scanned at 2 sec per decade for the C10-C11 fraction and 4 sec per decade for the C11-C14 decade. The chromatograms, formulas, compound names, and boiling points of the fractions are listed.

INDEX TERMS: Reformates, GC-mass spectrometry, Boiling point, Gasoline, Kerosene, Oil characterization.

AMIC-7353

"X-RAY MICRODETERMINATION OF CHROMIUM, COBALT, COPPER, MERCURY, NICKEL, AND ZINC IN WATER USING ELECTROCHEMICAL PRECONCENTRATION", Vassos, B. H., Hirsch, R. F., Letterman, H., Analytical Chemistry, Vol. 45, No. 4, April 1973, pp 792-794.

The sensitivity of x-ray fluorescence for the analysis of metal ions in aqueous solutions can be improved by preconcentration of the solutions. A preconcentration procedure has been developed which consists of electrodeposition of the metals to be determined onto a pyrolytic graphite electrode. This separates the reducible metal ions from the dilute solution into a form particularly suitable for analysis by x-ray fluorescence. After deposition, a thin dish is cleaved from the electrode surface and analyzed. The method has been evaluated by analysis of Cu, Hg, Zn, Ni, Co, and Cr in solutions of low electrolyte concentration (approximately fresh water) and with conventional levels of supporting electrolyte. By the criterion of 'total error', all the results fall into the 'excellent' category except for the Cr results which are 'acceptable'. It is concluded that the method is useful for ppm determinations of the metals studied, is amenable to improved sensitivity, and can be modified for analysis of additional metal ions.

INDEX TERMS: X-ray fluorescence, Aqueous solutions, Water analysis, Copper, Mercury, Zinc, Nickel, Cobalt, Chromium, Electrodeposition, Sensitivity, Preconcentration.

AMIC-7359

"SPECTROPHOTOMETRIC DETERMINATION OF SULFATE ION WITH BARIUM IODATE AND THE LINEAR STARCH IODINE SYSTEM", Hinze, W. L., Humphrey, R. E., Analytical Chemistry, Vol. 45, No. 4, April 1973, pp 814-815.

A spectrophotometric method has been developed for the determination of sulfate ions in the low ppm range which involves an ion-exchange reaction with a slightly soluble sulfate and release of an absorbing anion into the solution. Barium iodate and linear starch iodide were used in solutions of sodium sulfate. Two dilution procedures were used to cover larger ranges of concentrations. Sulfate ions were measured over the range of 1-4 ppm with a lower dilution, and the effective molar absorptivity for sulfate was 31,000. With a higher dilution, the range was 4-14 ppm and the molar absorptivity was 9400. Color reactions were stable and the results were reasonably reproducible. A very limited study of interferences showed that bicarbonate, borate, hydroxide, and sulfite ions could not be tolerated while bromide, chloride, and nitrate ions had no effect. Results with barium iodate compare favorably with those from the chloroanilate method.

INDEX TERMS: Aqueous solutions, Sulfates, Spectrophotometry, Sample preparation, Detection limits, Chemical interference.

2. BIOLOGICAL METHODS

AMIC-6610

"A NEW SPECIES OF PSEUDOCODIUM (CHLOROPHYTA, SIPHONALES) FROM THE WEST COAST OF FLORIDA", Daves, C. J., Mathiasen, A. C., Phycologia, Vol. 11, Nos. 3/4, December 1972, pp 273-277.

A new species of *Pseudocodium* (*P. floridanum*) is described from deep waters (37 to 55m) off the west coast of Florida. It is the third described species of *Pseudocodium*, and the first record of the genus from the northern hemisphere. X-ray diffraction studies indicate the presence of beta, 1-4 mannan in its cell walls. The affinities of *Pseudocodium* are discussed.

INDEX TERMS: Systematics, X-ray diffraction, Distribution, Florida, Pollutant identification, Chlorophyta, Marine algae, *Pseudocodium floridanum*.

AMIC-6781

"TRANSFER OF CS-137 FROM DETRITUS TO PRIMARY PRODUCER", Withkamp, M., Oak Ridge National Laboratory, Ecological Sciences Division, Oak Ridge, Tennessee, Report No. CONF-711213-1, December 13, 1971, 12 pp.

A combination of radiotracer, microcosm, and systems analysis techniques was used in evaluating recycling of minerals from detritus back to the vegetation. A greenhouse experiment with microcosms of increasing complexity showed the effects of millipedes and snails on Cs-137 movement from leaf litter to tree seedlings. Millipedes increased the organic matter content of the soil and the concentration and availability of Cs-137. The increase in growth and mineral uptake by plants suggests that millipedes affect both nutrient and Cs-137 kinetics in similar ways. With snails there were smaller increases in Cs-137 turnover in soil and less tree growth than with millipedes. Snails also reduced plant growth by consuming part of the foliage. Gross transfer coefficients for movement of Cs-137 from detritus to plants were determined through analysis of Cs-137 turnover using a simulation model.

INDEX TERMS: Detritus, Cycling nutrients, Tracers, Path of pollutants, Model studies, Vegetation, Ecosystems, Laboratory tests, Radioecology, Systems analysis, Food chains, Trophic level, Plant growth, Animal growth, Snails, Trees, Analog computers, Computer models, Analog models, Decomposing organic matter, Mobilization, Cs-137, Transfer coefficients, Cesium radioisotopes, Paravitrea, Millipedes, Fate of pollutants, *Dixidesmus erasus*, Plants.

AMIC-6703

"MONITORING ZINC CONCENTRATIONS IN WATER USING THE RESPIRATORY RESPONSE OF BLUEGILLS (*LEPOMIS MACROCHIRUS RAFINESQUE*)", Sparks, R. E., Cairns, J., Jr., McNabb, R. A., Suter, G., II, Hydrobiologia, Vol. 40, No. 3, October 30, 1972, pp 361-369.

Polyethylene cannula tubing was inserted into the mouths and opercular cavities of bluegills to measure and record variations in pressures as affected by zinc concentrations. Five fish were exposed to each of three zinc concentrations (3, 6, and 20 mg/l) and six were exposed to 40 mg/l. Fifteen-minute recordings were taken every half hour for three hours and every hour thereafter for 24 hours or until the fish died. Since swimming caused pressure changes, a 3-minute sample which was relatively undisturbed was taken from each 15-minute recording for data analysis. Breaths appeared as regular peaks and valleys on the recordings for both mouth and gill cavities. In five of the six fish exposed to a zinc concentration of 40 mg/l and in four of five fish exposed to 20 mg/l, the breathing rate increased at first, then showed a rapid decrease prior to the death of the fish. Cough frequencies of the control fish were very low, ranging from 0 to 1 cough/min. At the lowest zinc concentration tested, 3 mg/l, the mean cough frequency increased to 2 coughs/min. Mean coughing frequencies at each zinc concentration peaked two to three hours after the zinc was introduced. The maximum coughing frequencies were proportional to the zinc concentration. It is concluded that measuring cough frequency by this method is a good monitoring technique for zinc and probably other heavy metals. However, cannulation of the mouth alone should be sufficient.

INDEX TERMS: Fish physiology, Monitoring, Zinc, Water pollution effects, Respiration, Bioassay.

AMIC-6912

"FRESHWATER ALGAE FROM THE ITASCA STATE PARK MINNESOTA", Meyer, R. L., Brook, A. J., Nova Hedwigia, Vol. 22, Nos. 1-2, 1971, pp 649-658.

Recorded are the Cyanophyta, Rhodophyta, Chloromonadophyceae and Cryptophyceae of the region of Itasca State Park in northwestern Minnesota. The 32 genera and 107 species of Cyanophyta, one species of Rhodophyta, 2 species of Chloromonadophyceae and 4 genera with 12 species of Cryptophyceae are annotated with description of habitat and principle subcommunity.

INDEX TERMS: Aquatic algae, Cyanophyta, Rhodophyta, Aquatic habitats, Systematics, Speciation, Lakes, Ponds, Ecological distribution, Springs, Trophic level, Cryptophyta, Chloromonads, Itasca State Park, Neuston, Epiphytes, Metaphyton.

2. BIOLOGICAL METHODS

AMIC-6980

"DESMIDS FROM SOUTHEAST UNITED STATES OF AMERICA", Forster, K., Nova Hedwigia, Vol. 23, Nos. 2-3, 1972, pp 515-644.

Algae collected by the author from the southern portion of the United States were compared with a collection of the late A. M. Scott from Florida, Mississippi and Louisiana. The desmid flora found expands the floral listing for the area. Of the 260 taxa found, 20 are new descriptions with 19 forms and varieties in the genera: Cosmarium (13), Euastrum (2), Groenbladia (1), Micrasterias (1), Pleurotaenium (1), Stauroastrum (1) and Staurodesmus (1).

INDEX TERMS: Aquatic algae, Speciation, Systematics, Aquatic habitats, Chlorophyta, Southeast U. S., Desmids.

AMIC-6944

"THE UPTAKE, STORAGE, AND RELEASE OF DIELDRIN AND SOME EFFECTS OF ITS RELEASE IN THE FISH, CICHLASOMA BIMACULATUM (LINNAEUS)", Brockway, D. L., University of Michigan, Ann Arbor, Michigan, Dissertation Abstracts No. 73-6797, 1972, 111 pp. (Complete report not available from AMIC.)

The uptake of the pesticide dieldrin from water, its storage in tissues of a tropical fish (Cichlasoma bimaculatum) and its release from storage has been investigated. Several parameters considered to be indicators of the effects on the fish of the release of dieldrin from tissue storage were also measured. Dieldrin in acetone solution was added to water in continuous-flow exposure vessels. The concentration of insecticide in water and fish tissue was measured by electron-capture, gas-liquid chromatography. Blood- and brain-dieldrin concentrations were higher in fish killed by dieldrin than in fish exposed to dieldrin, but not killed. Uptake-release experiments were performed in which fish were exposed to sublethal concentrations (1 or 2 ppb) for up to 34 days. After this exposure, tissue residue levels had nearly reached a plateau. When exposure was terminated, the whole-body residue concentration factors on a wet-weight basis were between 6,000 and 11,000. Whole-body concentrations were higher than brain, and blood concentrations were lowest. After the exposure period, the fish were held in water without dieldrin up to 59 days and subjected to fasting and/or a 5 C temperature rise. During the release period, fasting alone caused only a slow rate of loss of the whole-body dieldrin residues. Fasting plus a 5 C temperature rise produced a more rapid loss of whole-body dieldrin residues. Fish which were fed normally and subjected to the 5 C increase in temperature showed a very rapid loss of dieldrin and little loss of fat. Two types of measurements were made to study the probability of post-exposure sublethal effects: 1) blood- and brain-dieldrin

AMIC-6937

"A STUDY OF THE INFLUENCE OF CALCIUM ON THE EFFECTS OF DDT ON FISHES", Keffler, L. R., University of Mississippi, University, Mississippi, Dissertation Abstracts No. 73-1275, 1972, 131 pp. (Complete report not available from AMIC.)

Investigations were undertaken dealing with a likelihood of a relationship between calcium deficiency and DDT poisoning. Goldfish, Carassius auratus, and golden shiners, Notemigonus crysoleucas, were tested using sixteen different combinations of calcium and DDT concentrations. Because of the possibility of influence by the accompanying anion, three different salts were used as sources of the calcium ion. A series of different experimental tests indicated good probability of the suspected relationship between calcium and DDT. Fishes poisoned with DDT in the laboratory were observed to give evidence of all the symptoms of calcium deficiency. Increasing the concentration of calcium ions in the water from 0 to 200 ppm seemed to alleviate the DDT poisoning symptoms of fishes and decrease the death rate, when the DDT concentration did not exceed 20 ppb. Goldfish were more responsive to treatment than were golden shiners. Of the calcium salts used calcium chloride was more effective than either calcium carbonate or calcium gluconate. Two possible conclusions to be drawn are that DDT is not simply a neurotoxin, and that the calcium differences between hard and soft water may be sufficient to give a survival advantage to fishes in the hard water regions of the country.

INDEX TERMS: Calcium, DDT, Water pollution effects, Bioassay, Poisons, Pesticide toxicity, Freshwater fish, Chlorinated hydrocarbon pesticides, Laboratory tests, Insecticides, Goldfish, Golden shiner, Carassius auratus, Notemigonus crysoleucas.

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concentrations were measured in juvenile fish, and 2) excretion of 17-OHCS hormone metabolites in urine was measured in catheterized adult fish. During the post-exposure period there was not a significant increase in blood- or brain-dieldrin concentration above the final concentration of the exposure phase. The quantity of hormone metabolite excreted in urine was always higher in fish exposed to dieldrin than in controls after the first day of urine collection. The level of hormone excretion, however, decreased continuously in exposed fish after the first day. Under the test conditions utilized in these studies, there was no evidence that dieldrin was released in toxic quantities when a fish was forced to utilize its fat stores.

INDEX TERMS: Absorption, *Dieldrin, Bioassay, Pesticide toxicity, Laboratory tests, Pesticide residues, Path of pollutants, Fish physiology, Freshwater fish, Bioaccumulation, Cichlasoma bimaculatum, Mobilization, Excretion, Metabolites, Hormones, Fate of pollutants.

2. BIOLOGICAL METHODS

AMIC-6998

"THE RELATIONSHIP BETWEEN IONS AND CILIARY ACTIVITY IN THE GILL OF MYTILUS EDULIS", Felton, B. H. D., Fordham University, New York, New York, Dissertation Abstracts No. 73-1475, 1972, 198 pp. (Complete report not available from AMIC.)

Previous authors have reported that ions stimulate or inhibit ciliary activity in *Mytilus edulis*. This investigation attempts to clarify the relationship between the major ions in artificial sea water (ASW) of normal balance to the beating of lateral cilia and other types of cilia in the excised gill of *Mytilus edulis*. ASW was used to perfuse a ganglion-nerve gill preparation. The rate of ciliary beating was determined by timing the metachronal waves with a stroboscope. The effect of Na, K, Ca, Mg and Cl, on the basal beat frequency and on the cilioexcitatory effect of 5-hydroxytryptamine (5-HT), KCl and caffeine was determined. Li, Ba, Mn were studied for the same effects. By replacing the ions in ASW of normal balance with substitutes, such as other ions, choline, gluconate salts, or sorbitol, it was possible to detect the influence of the major ions. Tetrodotoxin (TTX) 0.000016 M does not inhibit ciliary activity of the gill in ASW. In a 1:1 choline/Na ASW, TTX 3 microM (1 microgram/ml) inhibits lateral cilia and blocks the cilioexcitatory effect of KCl. Li 42 mM is cilioinhibitory and also blocks excitation by 5-HT. Nerve stimulation with electrical current is partially blocked by Li. The addition of 5-HT to gills in ASW causes a rapid efflux of Ca from the gill tissue followed by an influx of Ca. The Ca efflux and influx in gill tissue was measured with a Ca selective electrode and also with Ca-45 in a scintillation counter. Caffeine was found to be cilioexcitatory in this investigation, and was tested by the same methods described for 5-HT. When Mn was substituted for Ca in the presence of TTX in 1:1 choline/Na ASW, cilioexcitation by 5-HT and caffeine were not blocked. When Ba or Mn is substituted

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for Ca in ASW, the basal beat frequency is elevated. The effect of excess ions on the basal beat frequency and on the cilioexcitatory effect of 5-HT was also studied. 5-HT, a known cilioexcitatory agent and metabolic activator in *Mytilus* gill, has now been shown to cause a change in the membrane permeability of gill tissue to Ca. 5-HT causes a rapid efflux followed by an influx of Ca from internal stores of the ion in gill tissue. This indicates that the chain of events initiated by 5-HT in gill tissue of *Mytilus edulis* involves Ca release, increased glycolysis, and the formation of ATP which results in cilioexcitation.

INDEX TERMS: Cations, Anions, Inhibition, Water pollution effects, Animal physiology, Halides, Heavy metals, Alkaline earth metals, Alkali metals, Clams, *Mytilus edulis*, Ciliary activity, Excitation.

AMIC-6999

"POPULATION DYNAMICS AND THE EFFECT OF INORGANIC IONS ON CERTAIN MICROCRUSTACEA", Carpenter, C. B., University of Cincinnati, Cincinnati, Ohio, Dissertation Abstracts No. 73-3824, 1972, 108 pp. (Complete report not available from AMIC.)

Some of the primary and most important microcrustacean species were used in a field study of freshwater ponds with reference to seasonal changes in population density and effects of environmental conditions. Samples taken from two fresh-water ponds were analyzed for numbers of microcrustacea per liter of pond water, pH, water temperature, air temperature, dissolved oxygen, total alkalinity (methyl orange), carbonate alkalinity (phenolphthalein), bottom dissolved oxygen, free carbon dioxide and light intensity at the surface of the pond. The representative microcrustacea were *Boasmina longirostris*, *Ceriodaphnia reticulata*, *Daphnia* spp., *Diaptomus* spp., and copepoda nauplius larvae of unidentified species. Because of high negative correlations with the alkalinity parameter laboratory studies were executed to determine the effects of the component ions on the organisms in a controlled testing regime. LD-50 values were determined for nine clones (6 *Daphnia magna*, 2 *Daphnia pulex*, and 1 *Ceriodaphnia reticulata*) when they were exposed to NaCl, KCl, NaHCO₃, KHCO₃, NaOH, KOH, Na₂CO₃ and K₂CO₃. Factorial analysis of the data was used to determine the extent of each main cation and anion effect and any interaction effects. On the basis of the factorial analysis, the negative correlations between the organisms and the alkalinity parameters are valid with respect to information from both lab tests and field data.

INDEX TERMS: Crustaceans, Zooplankton, Bioassay, Sodium compounds, Potassium compounds, Environmental effects, Cations, Invertebrates, Carbonates, Ponds, Waterfleas, Copepoda, Laboratory tests, Freshwater, Population density, Data interpretation.

AMIC-7003

"THE EFFECT OF CALCIUM ON GROWTH AND MORPHOGENESIS OF *CHLORELLA*, *GOLENKINIA*, AND *SCENEDESMUS*", Rahimian, H., Washington State University, Pullman, Washington, Dissertation Abstracts No. 73-73, 1972, 89 pp. (Complete report not available from AMIC.)

Morphogenetic effects of calcium on *Chlorella pyrenoidosa*, *Scenedesmus obliquus*, and *Golenkinia minutissima* strains 929 and 930 were studied, as were the effects of strontium, barium, and ethyleneglycol bisaminoethylether tetraacetic acid (EGTA) on *Scenedesmus*. Inoculated cells were starved in a calcium-free medium for one week before the time of inoculation. Organisms were grown under controlled conditions at a temperature of about 20 C and illuminated with an intensity of 350 ft-c from cool-white fluorescent lamps regulated to provide 16 hours of light and 8 hours of darkness. Cultures were aerated with a mixture of 3 percent CO₂ in air. Growth was measured in terms of increase in the cell population and increase in the amount of fresh and dry matter. The results were as follows: (1) Calcium was shown to be necessary for production of the maximum number of cells in each species studied. (2) In the presence of Ca the cultures yielded a greater weight production and greater dry weight per gram of fresh weight than in the absence of Ca. (3) In the presence of Ca the starch content of cells was greater. (4) The K/Na ratio in the cells was greater in the presence of Ca. (5) The number of cells produced was significantly decreased when Sr or Ba was substituted. (6) Calcium played a role in cell morphology. (7) Calcium was shown to be necessary for colony formation in *Scenedesmus*. (8) Cell size was found to be inversely proportional to the number of cell production. (9) Seta formation in *Golenkinia* was shown to require Ca. (10) In the presence of higher than 0.6 mM of EGTA, a specific chelating agent for Ca, the algal cells died. (11) It is

2. BIOLOGICAL METHODS

AMIC-7003 (Continued)

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hypothesized that Ca is required for activating enzymes involved in wall formation and cell division as well as for maintaining membrane integrity. This has already been established for uridine diphosphoglucose pyrophosphorylase and uridine diphosphoglucose fructose transglycosylase which function in wall formation.

INDEX TERMS: Water pollution effects, Calcium, Plant morphology, Aquatic algae, Plant physiology, Plant growth, Strontium, Ethyleneglycol bisaminooethyl ether tetracetic acid, Barium, Chlorella pyrenoidosa, Scenedesmus obliquus, Golenkinia minutissima.

AMIC-7004

"EFFECTS OF IRON ON ACTIVATED SLUDGE TREATMENT", Carter, J. L., McKinney, R. E., Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 99, No. EE2, April 1973, pp 135-152.

Research was conducted in order to relate the iron ion concentration with the rate of biological metabolism as well as sludge bulking conditions in activated sludge treatment. Five-liter batch activated sludge units were fed glucose and an inorganic substrate using a typical fill and draw procedure. Sodium bicarbonate buffer was used to minimize the precipitation of important elements. Various concentrations of iron were fed during this study. Tests consisting of COD, BOD, MLSS, MLVSS, and sludge volume index (SVI) were conducted to evaluate these systems. Other related parameters such as temperature, pH, dissolved oxygen, and individual ion analysis were periodically measured. Iron was measured using the tripyridine method described in 'Standard Methods'. Rates of metabolism were determined by measuring the soluble COD and MLVSS for various time intervals after feeding. Microscopic observations were conducted regularly throughout the research. This work showed that insufficient iron in activated sludge treatment systems decreases the rate of organic metabolism and causes bulking conditions. Variations in other biological treatment parameters may be associated with iron or other inorganic nutrient limitation conditions.

INDEX TERMS: Activated sludge, Iron, Sewage treatment, Metabolism, Heavy metals, Chemical oxygen demand, Biochemical oxygen demand, Pollutant effects, Substrate utilization.

AMIC-7008

"THE CARBON CYCLE IN THE EPIPLIMNION OF TWO MICHIGAN LAKES", Miller, M. C., Michigan State University, East Lansing, Michigan, Dissertation Abstracts No. 73-5446, 1972, 233 pp. (Complete report not available from AMIC.)

The planktonic communities of two contrasting lakes were examined to quantify budgets and dynamics of dissolved and particulate organic carbon. Rates of primary production, extracellular secretion, particulate carbon sedimentation, input of humic material, heterotrophic uptake of glucose, acetate and glycolate, and oxygen depletion were determined in relation to simultaneous measurements of standing crops of algal carbon, total dissolved, and particulate organic carbon and humic organic carbon. Benthic metabolism affected the planktonic heterotrophs more in the shallower lake. In general, the heterotrophic uptake of small organic molecules varied directly with planktonic algal production and secretion. The size of the particulate organic carbon pool was proportional to the rates of primary production. The size of the dissolved organic carbon pool was apparently related inversely to the amounts of limiting nutrients. In the deeper of the two lakes the inputs of dissolved organic carbon into the surface waters ranked by importance were: autolysis and algal cell rupture, runoff in rainwater, secretion by and decomposition of aquatic plants, phytoplankton secretion, and particulate organic carbon decomposition in the water column. Rates of transfer and organic carbon pools are discussed and a model integrating these results is presented.

INDEX TERMS: Biological communities, Cycling nutrients, Essential nutrients, Carbon cycle, Epilimnion, Water pollution sources, Metabolism, Benthos, Dissolved organic carbon, Particulate organic carbon, Substrate utilization.

AMIC-7065

"BIOLOGICAL NITROGEN FIXATION IN THE GREAT LAKES", Mague, T. H., Burris, R. H., BioScience, Vol. 23, No. 4, April 1973, pp 236-239.

The acetylene reduction technique was used for assessing potential N₂-fixation in lake water samples. Water samples from Green Bay and Lakes Erie, Superior, Huron and Michigan were passed 64-micron silk plankton netting to concentrate the phytoplankton prior to testing. One-ml samples of the concentrate were transferred to glass serum bottles to which acetylene was added directly without other modification of the atmosphere. The bottles were incubated for approximately 30 min; acetylene reduction was terminated by the addition of 5 N H₂SO₄ and the serum stoppers were sealed against possible leakage. Four replicate bottles were prepared from each sampling site, and one was immediately inactivated with acid to serve as a control. The quantity of ethylene was determined by flame ionization after gas chromatographic separation from acetylene on a 1.2 m x 2 mm column of Poropak N run at 75 degrees C. Acetylene reduction by the phytoplankton in Lake Superior, the western end of Lake Huron, and eastern Lake Michigan was barely detectable in September of 1970, but in southern Green Bay of Lake Michigan and the shallow basin of Lake Erie it was comparable in rate to that in eutrophic Wisconsin lakes. Acetylene reduction activity in Green Bay was low in the mouth of the main tributary, increased to a maximum 5-15 km northeast into the bay, and then decreased farther northeast. Vigorous acetylene reduction was always associated with an abundance of heterocystous blue-green algae.

INDEX TERMS: Nitrogen fixation, Great Lakes, Phytoplankton, Water sampling, Oligotrophy, Eutrophication, Nitrogen cycle, Cycling nutrients, Green Bay, Acetylene reduction, Flame ionization gas chromatography, Sample preparation.

2. BIOLOGICAL METHODS

AMIC-7079

"DYNAMICS OF A SALT OF (2,4-DICHLOROPHENOXY)ACETIC ACID IN FISH, WATER, AND HYDROSOL", Schultz, D. P., Journal of Agricultural and Food Chemistry, Vol. 21, No. 2, March/April 1973, pp 186-192.

The uptake, distribution, and dissipation of C-14-labeled dimethylamine salt of (2,4-dichlorophenoxy)acetic acid (DMA-2,4-D) from water by three species of fish was studied concurrently with the dissipation of DMA-2,4-D from water and hydrosol. Fish were exposed to 0.5, 1.0, or 2.0 mg/l. concentrations of herbicide for up to 84 days. Radioactive residues of 2,4-D were determined by radiometric procedures in eight or more tissues and organs. Residues of 2,4-D were determined in muscle and whole-body extracts by gas chromatography. Radioactive residues were found in all fish tissues and organs analyzed, but actual 2,4-D content was negligible in muscle, indicating that most of the C-14-residue was a metabolite(s) of 2,4-D. Residues of 2,4-D declined in water to less than 0.1 mg/l. after 35 days and in hydrosol to less than 0.1 mg/kg after 14 days.

INDEX TERMS: Pesticide toxicity, Water analysis, Bioassay, Hydrogen ion concentration, Radioactivity techniques, Water temperature, Freshwater fish, DMA-2 4-D, Tissue, Bioaccumulation, Sample preparation, Gas liquid chromatography, Channel catfish, *Lepomis macrochirus*, Largemouth bass, Fathead minnow.

AMIC-7142

"METHODS OF ESTIMATING THE HALF-LIFE OF BIOLOGICAL ACTIVITY OF TOXIC CHEMICALS IN WATER", Marking, L. L., Investigations in Fish Control Report No. 46, July 1972, 9 pp.

In the absence of analytical methods, the half-life of biological activity of a chemical (the time required to decrease its toxic activity by one-half) can be estimated by bioassays. The methods presented require the determination of LC50 values (concentration producing 50 percent mortality) for organisms in aged solutions containing unknown residual concentrations. The half-life of biological activity is determined by plotting (1) the percent concentrations remaining in aged solutions or (2) the deactivation indices against aging time on cyclic semilogarithmic graph paper. By the first method, a 5-day half-life for antimycin, a fish toxicant, was determined using resistant channel catfish (*Ictalurus punctatus*) and goldfish (*Carassius auratus*) and for sensitive green sunfish (*Lepomis cyanellus*) and rainbow trout (*Salmo gairdneri*) in soft water at pH 7.5. The second method, using only rainbow trout, also estimated a 5-day half-life for antimycin in soft water at pH 7.5. These methods could be used also to determine the half-life of antimycin at different pH's, temperatures, and light intensities, the factors thought to influence the toxicant's efficacy. The methods are not limited to fish and fish toxicants.

INDEX TERMS: Antimycin A, Piscicides, Bioassay, Water pollution effects, Pesticide toxicity, Methodology, Fish control agents, Rainbow trout, Channel catfish, Pesticide kinetics, Biological activity, Half-life, Green sunfish, Goldfish.

AMIC-7138

"STUDIES AND INVESTIGATIONS OF THE FATE AND EFFECT OF THE SHELL OIL SPILL, PLATFORM B, BLOCK 26, SOUTH TIMBALIER BAY (DECEMBER 1, 1970--NOVEMBER 30, 1971), Resources Technology Corporation, Houston, Texas, Oil and Hazardous Materials Program Series OHM 72 05 001, Contract No. 68-01-0051, January 1972, 116 pp.

This report represents a formal documentation of selected field study activities for one major spill incident which initially occurred offshore Louisiana on December 1, 1970 and lasted until April 16, 1971. The report is based on data and information obtained through three field surveys undertaken by EPA. The purpose of these field studies was to determine the areal extent of the spilled material, the fate of the spill, and the effect of the material on the biota. The geologic, climatic, and oceanographic parameters of the study area and their impact on the biota are defined. A biological and zoogeophysical description of the study area is also presented. The data obtained in this study showed or suggested that: (1) water-dispersable fractions (probably aromatic compounds) from the crude oil spilled were transported through the water column and deposited in sediments at least 60 feet deep; (2) the sedimentary deposits of crude oil contain significant quantities of CCl4 extractables; (3) for the most part, there was little or no correlation between numbers of species present and any other parameters; (4) the fauna was low in number at and immediately around the rig with numerical increases at a one- to two-mile radius from it; and (5) the effects on fish varied from no abnormalities to loss of cells and 'sloughing' and swollen branchial filaments.

INDEX TERMS: Oil spills, Oil pollution, Water pollution effects, Water pollution sources, Marine animals, On-site investigations, Crude oil, Fate of pollutants, Benthic fauna, Species diversity.

AMIC-7156

"UPTAKE AND BIOTRANSFORMATION OF PHENYLMERCURIC ACETATE BY AQUATIC ORGANISMS", Fang, S. C., Archives of Environmental Contamination and Toxicology, Vol. 1, No. 1, February 1973, pp 18-26.

Guppies (*Lebistes reticulatus*), snails (*Helisoma campanulata*), elodea (*Elodea canadensis*), and coontail (*Ceratophyllum demersum*) were exposed to 0.05-0.5 microM of Hg-203-labeled phenylmercuric acetate (PMA) in order to study the uptake and metabolism of the slimicide by aquatic organisms. Studies were carried out in all glass aquaria with aeration at 25-29 C. A gamma-scintillation spectrometer was used to periodically measure radioactivity in samples of water and organisms. After measuring the total Hg-203 content, samples were homogenized in water containing HCl, extracted with benzene, purified according to the Westoo (1968) method, and analyzed by electron capture gas chromatography. Inorganic Hg-203 content was determined by the Clarkson and Greenwood (1970) method. Some guppies and elodea were placed in fresh water after the uptake period to determine PMA loss rate. The organisms tested were found to readily take up PMA. The PMA uptake was related to the time of exposure and the PMA concentration, the absorbed PMA being mainly converted to inorganic mercury. Ethylmercuric chloride was a minor metabolic product. Mercury-203 was not quickly eliminated from the guppy, elodea, and coontail when they were placed in fresh water, the biological half-life of Hg-203 residues ranging between 43 to 58 days.

INDEX TERMS: Bioassay, Absorption, Metabolism, Radioactivity techniques, Radiochemical analysis, Phenylmercuric acetate, Elodea canadensis, *Lebistes reticulatus*, *Helisoma campanulata*, *Ceratophyllum demersum*, Biotransformation, Biological magnification, Bioaccumulation, Metabolites, Excretion, Fate of pollutants, Hg-203, Slimicides.

2. BIOLOGICAL METHODS

AMIC-7158

"AN ANALYSIS OF FACTORS GOVERNING PRODUCTIVITY IN LAKES AND RESERVOIRS", Brylinsky, M., Mann, K. H., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 1-14.

Data collected as part of the International Biological Program from 43 lakes and 12 reservoirs, distributed from the tropics to the arctic, were subjected to statistical analysis to establish which factors are important in controlling production and how they are related. In the whole body of data, variables related to solar energy input have a greater influence on production than variables related to nutrient concentration; in lakes within a narrow range of latitude, nutrient-related variables assume greater importance. Morphological factors have little influence on productivity per unit area in either case. Chlorophyll a concentration is a good indicator of nutrient conditions and when combined with an energy-related variable constitutes a good estimator of primary production. (Reprinted from Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 1-14. Copyright 1973 by the American Society of Limnology and Oceanography, Inc. Reprinted by permission of the copyright owner.)

INDEX TERMS: Primary productivity, Secondary productivity, Limiting factors, Nutrients, Lake morphology, Solar radiation, Statistical methods, Hydrogen ion concentration, Conductivity, Data interpretation, Chlorophyll a.

AMIC-7160

"ENHANCEMENT OF NET PRIMARY PRODUCTIVITY BY HERBIVORE GRAZING IN AQUATIC LABORATORY MICROCOSMS", Cooper, D. C., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 31-37.

The role of herbivore grazing intensity as a factor affecting net primary productivity was investigated by introducing varying biomasses of a starved herbivore (Notropis spilopterus) into replicate autotrophic microcosms. The microcosms consisted of 15 aquaria containing 15 l of sediment from a eutrophic pond. After 20 days, the enhancement of net primary productivity in the experimental microcosms was directly related to herbivore biomass up to a certain density and inversely related above this. The relationship approximates the first derivative of a sigmoid population growth model. Enhancement of primary production under these experimental conditions appears to be due to reductions of standing crop and increased turnover rates of producer populations. The results suggest that these responses were independent of increased nutrient regeneration rates brought about by grazing.

INDEX TERMS: Bioassay, Cycling nutrients, Fish, Grazing, Primary productivity, Biomass, Notropis spilopterus.

AMIC-7159

"DIURNAL PERIODICITY IN THE PHYTOPLANKTON ASSEMBLAGE OF A HIGH MOUNTAIN LAKE", Tilzer, M. M., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 15-30.

Diurnal changes in phytoplankton stratification and photosynthesis of high mountain lakes (Vorderer Finstertaler See) were studied at all seasons. The dominant flagellates usually ascend in the evening and at night and migrate downward with increasing light intensities. Maximum migratory speeds are higher than 1 m/hr and almost independent of cell size. The vertical stratification pattern of flagellates is the result of varying upward and downward migrations, but the vertical stratifications of nonmotile species depend on the turbulence of the water. Over the day the mean photosynthesis of the entire water column varies in about the same proportions as the input of light energy. At a given depth algae seem to be adapted to the daily mean value of light intensity. Near the lake surface, around noon (1000-1400 hours), photosynthesis is considerably reduced due to downward migration, light saturation, and light inhibition--all caused by high light intensities--but at greater depths the utilization of light energy frequently is increased. During low light periods (early morning, evening) suboptimal light intensities in deeper layers of the lake cannot be utilized as effectively. By phototactic vertical migrations, the diurnal shifts of light energy utilization can be partly compensated.

INDEX TERMS: Diurnal distribution, Phytoplankton, Photosynthesis, Light intensity, Migration patterns, Primary productivity, Sample preservation.

AMIC-7163

"DIATOMS IN ALKALINE, SALINE LAKES: ECOLOGY AND GEOCHEMICAL IMPLICATIONS", Hecky, R. E., Kilham, P., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 53-71.

Six diatoms achieved dominance in 26 alkaline, saline lakes in East Africa. There is a pronounced tendency for these species to replace each other as alkalinity increases. Cyclotella meneghiniana is usually dominant in less concentrated lakes and Nitzschia frustulum is favored as the alkalinity exceeds 80 meq/liter. Coscinodiscus rudolfi and Navicula elkab are occasionally dominant at intermediate alkalinities. Navicula elkab is usually subdominant when N. frustulum is dominant. Most of these species when dominant are considered functionally planktonic in these waters. The presence of the cyanophyte Oscillatoria (Arthrospira) platensis in bloom seems to be a prerequisite for N. elkab and N. frustulum to enter the plankton. There is some evidence that the anionic composition of these lakes may be selective for some of the benthonic species. Geochemical data indicate that the production and preservation of diatom frustules appear to control silica concentrations in the waters. Relatively poor correlations were observed between sodium and silica and between pH and silica. These data have important implications for theoretical models of geochemical evolution in closed basins. Little or no dissolution of fossil diatom frustules was observed in the sediments of these highly alkaline, high pH waters. (Reprinted from Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 53-71. Copyright 1973 by the American Society of Limnology and Oceanography, Inc. Reprinted by permission of the copyright owner.)

INDEX TERMS: Diatoms, Saline lakes, Alkalinity, Dominant organisms, Lake sediments, East Africa.

2. BIOLOGICAL METHODS

AMIC-7172

"USE OF A BOD OXYGEN PROBE FOR ESTIMATING PRIMARY PRODUCTIVITY", Czaplewski, R. L., Parker, M., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 152-154.

The accuracy of a BOD oxygen probe for field measurements of primary production by the light and dark bottle oxygen technique has been analyzed. Water samples were taken from various depths with a Van Dorn sampler and subsamples placed in light and dark BOD bottles. DO was measured in each bottle before and after a 6-hr in situ incubation. A single water sample was used to measure DOC and to calibrate the oxygen probe. Preparation time at the beginning of each experiment was 1.4 min per bottle, and the time required to measure DOC at the end of each incubation was 0.6 min per bottle. The light bottle change in DOC for seven photosynthesis vs. depth experiments ranged from minus 0.40 to plus 0.90 ppm and the dark bottle change plus 0.05 to minus 0.70 ppm. The ambient DOC was 7-10 ppm. Variability was reduced by pairing the 2 readings from each bottle; a one-way ANOVA was used to estimate experimental error. A figure is presented with which to estimate the number of replicate bottles needed to obtain a given accuracy in estimating photosynthetic rates. The BOD oxygen probe was shown to be a rapid, convenient instrument when used to estimate primary production, and its accuracy in certain cases may be comparable to that of the Winkler method.

INDEX TERMS: Primary productivity, On-site data collections, Dissolved oxygen, Measurement, On-site tests, Water sampling, BOD oxygen probe, Photosynthetic rates.

AMIC-7173

"PRODUCTION OF THE GIANT KELP, MACROCYSTIS, ESTIMATED BY IN SITU INCORPORATION OF C-14 IN POLYETHYLENE BAGS", Towle, D. W., Pearse, J. S., Limnology and Oceanography, Vol. 18, No. 1 January 1973, pp 155-159.

Incorporation of C-14 by the giant kelp Macrocystis pyrifera was measured in situ by enclosing individual blades within polyethylene bags in a kelp bed. Incubation was carried out in full sunlight for 3 hr. The contents of the bag were removed to an opaque container, transported a dimly lit laboratory, and rinsed in unlabeled seawater. Duplicate samples from 3 sections of each kelp blade were solubilized, mixed with H₂O₂ and added to scintillation fluid for counting. Incorporation was highest in the tips of the blades in the canopy, about 0.315 mg C/g/hr on the basis of wet weight. In the densest part of the kelp bed, total wet standing crop of Macrocystis was about 5.9 kg/sq m, and production of Macrocystis blades in that area was estimated to be at least 6.8 g C/sq m/day, or about 17 g organic matter/sq m/day.

INDEX TERMS: Kelps, Photosynthesis, On-site investigations, Estimating, Plant tissues, Marine algae, Marine plants, Phaeophyta, Primary productivity, Laboratory tests, Radioactivity techniques, Carbon radioisotopes, Methodology, Standing crops, Macrocystis pyrifera, Photosynthetic rates, C-14, Scintillation counting, Sample preparation.

AMIC-7177

"MODIFICATIONS OF THE BIRGE-EKMAN BOX CORER FOR USE WITH SCUBA OR DEEP SUBMERGENCE RESEARCH VESSELS", Rowe, G. T., Clifford, C. H., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 172-175.

The Birge-Ekman box corer has been modified for use by SCUBA divers or deep submergence research vessels, thus allowing control in the precision of sampling. Data suggest that the modified box corer exhibits greater accuracy and precision in estimating the abundance of species and individuals than conventional surface ship samplers or smaller corers used widely for in situ investigations. (Reprinted from Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 172-175. Copyright 1973 by the American Society of Limnology and Oceanography, Inc. Reprinted by permission of the copyright owner.)

INDEX TERMS: Sampling, Equipment, Scuba diving, Shallow water, Deep water, Construction, Design, Birge-Ekman box corer, Research vessels, Precision.

AMIC-7178

"A QUANTITATIVE PUSH-NET SYSTEM FOR TRANSECT STUDIES OF LARVAL FISH AND MACROZOOPLANKTON", Miller, J. M., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 175-178.

A surface plankton sampler that quantitatively samples contiguous segments of a transect has characteristics that include operability in shallow water by two investigators, paired, self-cleaning nets, a minimum of obstructions preceding the nets, and a high ratio of filtering area to mouth area. Flow through each net and the distance traveled are monitored and recorded continuously with modified TSK current meters. At a boat speed of about 3 mph (1.34 m/sec), a sample was obtained in 3 min from a 241-m segment of a 7.2-km transect in Kaneohe Bay (Oahu, Hawaii). At this operating speed, the combination of 505-micron Nitex nets and 333-micron Nitex bags yields fish larvae (2-25 mm) in good condition. Larvae of 92 species of fish (size range, 2-20 mm) have been taken with the gear from Kaneohe Bay over a one-year period. Total sampling time was less than 2 hr with this system. Using the sampling technique being described, small scale variations in the abundance of surface zooplankton can be detected.

INDEX TERMS: Larvae, Distribution patterns, Zooplankton, Fish, Water sampling, Equipment, Hawaii, Spatial distribution, Construction, Design, Invertebrates, Plankton nets, Surface waters, Macroinvertebrates, Push-net sampling system, Francis insularum, Kaneohe Bay.

2. BIOLOGICAL METHODS

AMIC-7201
"SLIME-INHABITING GEOPFUNGI IN A POLLUTED STREAM (WINTER/SPRING)", Ncell, J., Mycologia, Vol. 65, No. 1, January-February 1973, pp 57-66.

Samples were taken biweekly for 4 months (winter to spring) from sites above and below the sewage effluent outfall in Sugar Creek (Missouri). Slime was removed with sterile implements from rocks in and 25 cm from the bank of the channel. After suspension in sterile water, small pieces were plated onto isolation medium. Colonies arising on the isolation medium were transferred to corn meal agar for identification. Species of Penicillium and allied genera were transferred to Czapek's solution agar for identification. Excluding Geotrichum and yeasts (ca. 400 isolates), some 20 genera accounted for approximately 700 isolates. Numbers vary from 220 for Penicillium species to only eight for Curvularia. Species of several interesting genera were isolated only once or twice. These included Rhinoctadiella, Diplodia, Cylindrocladium, Sporothrix, Paecilomyces, and two non-Hyphomycetes, Ceratocystis capillifera, C. moreau and a Coprinus sp. In addition, a few sterile forms and a variety of Phycomycetes were isolated. Of 689 isolates, 290, representing 42 percent of the total, were recovered from the channel; 399, or 58 percent, were recovered near the bank. Distribution of isolates by site and collection date shows temporal and spatial variation between genera. Distinct differences in number and type of isolates between channel and edge sites, and above and below the effluent outfall are noted. Problems of studying geofungi in aquatic systems and the significance of their presence are discussed.

INDEX TERMS: Water pollution, Isolation, Sewage effluents, Aquatic fungi, Missouri, Water sampling, Yeasts, Aquatic environment, Organic loading, Spatial distribution, Temporal distribution, Geofungi, Hyphomycetes, Sugar Creek, Culture media, Selective media, Agars, Phycomycetes.

AMIC-7220
"GEOGRAPHIC DIFFERENCES IN PHYTOPLANKTON SENSITIVITY TO PCBs", Fisher, N. S., Graham, L. B., Carpenter, E. J., Wurster, C. R., Nature, Vol. 241, No. 5391, February 23, 1973, pp 548-549.

An investigation has been made of the toxicity of PCBs to three species of diatoms, comparing clones isolated from the relatively stable Sargasso Sea waters with those from fluctuating estuarine environments. Cells of Thalassiosira pseudonana, Fragilaria pinnata and Bellerophia sp were grown axenically in f/2 medium. Exponentially growing cells were inoculated onto a sterile medium to which 10 ppb PCBs (Aroclor 1254) was added. The cultures were maintained at 20 degrees C and illuminated 14 h/day; one-ml samples were fixed with Lugol's solution and counted with a Speirs-Levy eosinophil counter. Although growth of all seven clones tested diminished with PCB treatment, isolates from the Sargasso Sea invariably were more sensitive than were clones from estuaries and the continental shelf. Both Bellerophia clones were more sensitive than all others tested. Two-way analyses of variance on the logarithmically transformed data showed that, at 95 h, the interaction term between PCB treatment and geographic origin was significant for T. pseudonana, and for Bellerophia sp., indicating algal sensitivity was highly dependent on the sites of isolation.

INDEX TERMS: Polychlorinated biphenyls, Diatoms, Toxicity, Water pollution effects, Phytoplankton, Estuarine environment, Fragilaria pinnata, Thalassiosira pseudonana, Bellerophia, Clones, Marine environment.

AMIC-7224
"GROWTH AND METABOLISM OF OSTREA EDULIS LARVAE", Gabbott, P. A., Holland, D. L., Nature, Vol. 241, No. 5390, February 16, 1973, pp 475-476.

An energy budget has been calculated for Ostrea edulis larvae in terms of growth and metabolism from data on the changes in biochemical composition of the larvae during development and on the losses of body components during short-term starvation experiments. Three batches of larvae reared at the MAFF Fisheries Experiment Station were kept at 20-22 degrees C in aerated seawater, and fed a mixed algal diet of Isochrysis galbana and Tetraselmis suecica. On release day zero and days 4, 8, and 12, samples of approximately 10-15,000 larvae were collected, counted, and analyzed for protein, lipid, and carbohydrate content. Further samples of larvae were taken from the main culture vessels and placed without food in aerated seawater for 48 h before biochemical analysis. On release (days 0-2) the daily loss of body reserves was equivalent to an oxygen consumption rate of 0.0006 microliter O₂ per larva per hr. The daily loss of reserves for days 4-6 and 8-10 was equivalent to oxygen consumption rates of 0.0025 and 0.005 microliter O₂ per larva per hr respectively. The net growth efficiencies K₂ for swimming larvae fell from 78.6 percent on release to 55.5 percent on day 10. The daily food requirements (assimilated ration) to support growth and metabolism represented 64.9 percent and 42.3 percent of the body weight on day 0 and day 10 respectively.

INDEX TERMS: Larvae, Metabolism, Energy budget, Growth rates, Oysters, Efficiencies, Proteins, Carbohydrates, Lipids, Biochemistry, Ostrea edulis, Chemical composition.

AMIC-7226
"EFFECT OF SEAWATER SOLUBLE FRACTION OF KEROSENE ON CHEMOTAXIS IN A MARINE SNAIL, NASSARIUS OBSOLETUS", Jacobson, S. M., Boylan, D. B., Nature, Vol. 241, No. 5386, January 19, 1973, pp 213-215.

Two experiments were conducted to determine the effect of soluble fractions of kerosene in seawater on the food-finding ability of the marine prosobranch snail, Nassarius obsoletus. Experiments were conducted in Y-shaped plastic chambers constructed so that flowing seawater entered at the two arms. One arm was randomly chosen to receive the stimulus, oyster extract in one experiment and scallop extract in the other. Snails were starved for 10 days prior to the test, and their movement was recorded in chambers containing seawater alone, attractant, kerosene extract, or attractant plus kerosene extract. Concentrations of oyster and scallop extracts were 0.33 ppm and 3 ppm, respectively. Kerosene extracts were prepared either by mixing with seawater and separating the aqueous and oil layers or by extracting four times with pentane. Concentrations used in the experiments were 1 and 4 ppm. The results show that minute quantities of seawater-soluble fractions of kerosene interfere with the chemically mediated attraction to food extracts in Nassarius obsoletus. Oil components may disrupt chemically mediated behavior of other organisms. Further study in this area is recommended.

INDEX TERMS: Bioassay, Snails, Water pollution effects, Oil pollution, Animal physiology, Laboratory equipment, Invertebrates, Oil spills, Sea water, Marine animals, Kerosene, Nassarius obsoletus, Benzene, Naphthalene, Macroinvertebrates, Crude oil, Chemotaxis.

2. BIOLOGICAL METHODS

AMIC-7227

"UNSTRUCTURED MARINE FOOD WEBS AND 'POLLUTANT ANALOGUES'", Isaacs, J. D., Fishery Bulletin, Vol. 70, No. 3, 1972, pp 1053-1059.

The several species of fish living in the Gulf of California have been shown to possess quite different concentrations of cesium (and cesium in respect to potassium) than the same species of fish living in the Salton Sea. The Salton Sea fish display simple trophic steps of concentration, whereas those in the Gulf all show about the same levels. These differences are reasonably well explained by simplified trophic models of the two environments. The concentration factor found in the known and describable food chain of the Salton Sea, applied to a model of an assumed unstructured food web in the Gulf, leads to reasonable results. This suggests that study of the concentrations in marine organisms of such natural trace substances as cesium may lead to an understanding of the trophic position of the organisms, and hence constitute 'pollutant analogues' that may yield a better understanding of the existing or potential distribution of pollutants in marine organisms.

INDEX TERMS: Food chains, Food webs, Cesium, Fish, Mathematical models, Trophic level, Path of pollutants, Pollutant analogs, Salton Sea, Gulf of California.

AMIC-7253

"BIOLOGY OF SEA MUSSELS (MYTILUS CALIFORNIANUS (CONRAD) AND M. EDULIS (LINN.)) BEFORE AND AFTER THE SANTA BARBARA OIL SPILL (1969)", Karger, J. R. E., Water, Air, and Soil Pollution, Vol. 1, No. 4, September 1972, pp 381-388.

Effects of the 1969 Santa Barbara Oil Spill on sea mussels were investigated by comparing biomass characteristics of mussel populations in polluted and clean areas before, during, and after the discharge. In accordance with directions outlined by Connell (1971) the following null hypotheses were tested: (a) Mussels collected in August 1969 from areas experiencing oil pollution were not lighter in body weight than those collected from the same locations in previous years. (b) Mussels collected from areas experiencing oil pollution in August 1969 were not lighter in body weight than those collected in subsequent years from the same locations. Animals in exposed areas were not significantly lighter in body weight than those in clean areas. Likewise no deleterious effect in the form of lowered body weights could be detected in mussels from polluted areas in three successive years subsequent to the oil spill. Mussels were not sampled until 7 mo after the initial spill so that any immediate deleterious effect generated by the oil could have been compensated for by the time of examination. It is noted that the spill in question occurred at a time of minimal growth on the part of the sea mussels involved and that an adverse response might have resulted if the oil had washed ashore during a period of heightened growth.

INDEX TERMS: Oil spills, Water pollution effects, Mussels, Oil pollution, Biomass, *Mytilus californianus*, *Mytilus edulis*, Santa Barbara Oil Spill, Macroinvertebrates, Data interpretation.

AMIC-7250

"EFFECTS OF KRAFT MILL EFFLUENT ON A MARINE BENTHIC COMMUNITY", Peer, D. L., Water, Air, and Soil Pollution, Vol. 1, No. 4, September 1972, pp 359-364.

A quantitative survey of a marine benthic community was taken just prior to the discharge nearby of a bleached kraft paper mill and the area was surveyed again 2 yr later. Ten quantitative benthos samples were taken at each of three sites using a 0.1-m Van Veen bottom grab. The contents were sieved through an 0.8-mm mesh and the residue was preserved in a solution of 10 percent formalin and seawater. The animals were hand sorted from the sediment residue, separated into taxonomic groups, counted, blotted, and weighed. It was concluded that: there has been a change in the composition of the benthic community since 1967; some of these changes may be accounted for by the reduction in tidal currents and resulting changes in sediment particle size composition; and the main cause of the changes is the flocculation of material from the mill effluent. It is not known whether the animals are responding to the physical effect of the flocculated material or to toxic compounds contained by it.

INDEX TERMS: Pulp wastes, Water pollution effects, Benthic fauna, Biological communities, Bottom sampling, Sediments, Nematodes, Crustaceans, Annelids, Suspended solids, Marine environment, Data interpretation, Polychaetes.

AMIC-7257

"INVESTIGATIONS ON NUTRIENT FACTORS LIMITING PHYTOPLANKTON PRODUCTIVITY IN TWO CENTRAL VIRGINIA PONDS", Samsel, G. L., Jr., Reed, J. R., Winfrey, H. J., Water Resources Bulletin, Vol. 8, No. 4, August 1972, pp 825-833.

Laboratory and field studies were initiated to evaluate at regular intervals by C-14 and chlorophyll enrichment bioassay some of the nutrients, particularly ammonia, that might limit phytoplankton photosynthesis in two central Virginia ponds. Preliminary comparisons of the phytoplankton, their production, and the chemical characteristics of the water were determined. Ammonia, phosphate, nitrate, iron, carbon dioxide, silica and chloride differed most markedly among the various nutrients analyzed. Investigations were continued to compare the validity of using field and laboratory ecosystem work to predict changes in trophic levels resulting from nutrient enrichment, i.e., eutrophication. Laboratory experiments using aquatic microecosystems and field experiments employing in situ plastic cylinders and battery jars support the view that ammonia is a key factor regulating 'trophic' features in these two ponds.

INDEX TERMS: Limiting factors, Nutrients, Primary productivity, Phytoplankton, Ammonia, Bioassay, Photosynthesis, On-site investigations, Essential nutrients, Chlorophyll, On-site tests, Laboratory tests, Water chemistry, Seston, Ponds, Oligotrophy, Water sampling, Chrysophyta, Chlorophyta, Cations, Aquatic algae, Trophic level, Ecosystems, Anions, Eutrophication, Enrichment, Photosynthetic rates, C-14.

2. BIOLOGICAL METHODS

AMIC-7258

"THE DETERMINATION OF PRIMARY PRODUCTION IN A STREAM USING AN EXACT SOLUTION TO THE OXYGEN BALANCE EQUATION", Hornberger, G. M., Kelly, M. G., Water Resources Bulletin, Vol. 8, No. 4, August 1972, pp 795-801.

A promising technique for recognition of early stages of cultural eutrophication relies on determining production and respiration in streams. The most successful and most widely used method of estimating production of a segment is the upstream-downstream, diurnal curve method introduced by Odum (1956). This technique is equivalent to obtaining an approximate solution to the oxygen balance equation. An exact solution of the balance equation is reported as a method for calculating primary production. Data presented by Owens (1966) are analyzed; effects of depth and oxygen saturation are studied. A major advantage of the method described here is that continuous temporal variation of net production may be rigorously handled. The method is shown to be well suited to studying energy budgets of streams, and thereby the eutrophication process.

INDEX TERMS: Photosynthesis, Eutrophication, Respiration, Streams, Mathematical studies, Data interpretation, Oxygen balance equation.

AMIC-7325 (Continued)

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concluded that no single heavy metal caused acute toxicity. The combined concentration of several of the heavy metals could be deleterious to aquatic organisms.

INDEX TERMS: Waterfleas, Bioassay, Toxicity, Oil wastes, Separation techniques, Heavy metals, Fathead minnow, GC-Mass spectrometry, Atomic absorption spectrophotometry, Ion selective electrodes, *Daphnia magna*, *Pimephales promelas*, Cresols, Dimethyl phenol, Ethyl phenol, Heneicosane, Docosane, Tricosane, Pentacosane, Aliphatic hydrocarbons, Paraffins, Methyl cyclohexane, Methyl ethyl phenol, Propyl phenol.

AMIC-7325

"IDENTIFICATION OF TOXIC COMPONENTS IN OIL REFINERY EFFLUENTS AND DETERMINATION OF THEIR EFFECT UPON THE AQUATIC BIOTA", Dorris, T. C., Burks, S. L., Curd, M. R., Waller, G. R., Broemeling, L. D., Oklahoma State University, Oklahoma Water Resources Research Institute, Stillwater, Oklahoma, Contract No. DI-14-31-0001-3321, September 1972, 113 pp. NTIS Report No. PB-213 493.

The objectives of this research were: (1) to isolate and identify toxins in oil refinery effluents, and (2) to determine ecological effects upon aquatic biota. Toxic organic fractions were isolated from oil refinery effluent samples by solvent extraction, adsorption on activated carbon, and flash evaporation. Toxicity of extracted fractions and effluent samples was determined by microbioassays with *Daphnia magna*. Fish bioassays were performed with fathead minnows (*Pimephales promelas*) to determine the 48-hr median tolerance level of the effluents. Analyses of toxic organic fractions were performed with gas-liquid chromatography to resolve the complex mixtures of compounds. Demonstrably toxic fractions which could be chromatographically resolved were identified by combination gas chromatography - mass spectrometry. Analyses of toxic heavy metals in the effluents were performed by atomic absorption spectrophotometry. Specific ion electrodes were used to determine ammonia, chloride, fluoride, and sulfide concentration in the effluents. Uptake of toxins by fish was measured by atomic absorption analyses of the heavy metals content of the fish. Organic compounds were extracted from the exposed fish by steam distillation-ether extraction and chromatographed to compare with extracts from the effluents. Compounds tentatively identified were cresol, dimethyl phenol or ethyl phenol, heneicosane, docosane, tricosane, and pentacosane. The flash evaporation extracts contained many other compounds which have not yet been identified. The concentration of toxic heavy metals in the effluent samples was generally below published 48 hour LC50 values and it was

AMIC-7368

"PERIPHYTON AND PHYTOBENTHON AS INDICATORS OF WATER QUALITY", Wood, R. D., Mallett, J., Ventura, L., University of Rhode Island, Water Resources Center, Kingston, Rhode Island, Completion Report, Contract No. 14-31-0001-3328, June 1972, 46 pp.

Three Rhode Island rivers, Hunt, Pawcatuck, and Saugatucket, were studied to determine physical and chemical parameters upstream and downstream from pollution sources to determine periphyton and phytobenthon which develop in healthy and polluted waters, and to summarize species and communities indicative of textile mill effluents. Five aspects of the work were (1) field sampling and handling of samples and on-the-spot measurements, (2) bench analysis of water samples, (3) biological analysis of slides with respect to kinds of algae, (4) biological analysis for quantitative evaluation, (5) compilation of data. Specific measurements were: temperature, pH, redox, alkalinity, DO, oxygen saturation, conductivity, phosphates, nitrates, silicates, color, velocity, coliforms, turbidity, and diel periodicity. Biological sampling was done with immersed glass slides supplemented by scraping rocks, sucking organisms from sediment with a cooking baster, gathering epiphytes from twigs and macrophytes, plankton samples from raw water, and macrophytes. One of two duplicate slides was permatized for species identification and the other was scraped for quantitative counts in a Sedgwick-Rafter chamber. Diatoms were mounted with hyrax and studied by phase contrast microscopy. Chlorophyll and pigment were also determined. Data have been collected for correlation analyses of factors and predominate taxa. From approximately 150 microalgae species, nine were detected which were sensitive to textile mill effluents. Of these, the presence of *Scenedesmus dimorphus* and *S. quadricauda* indicated mill pollution.

INDEX TERMS: Bioindicators, Water pollution effects, Aquatic algae, Benthic flora, Periphyton, Diatoms, Pollutant identification, Industrial wastes, Water sampling, Textile mills.

2. BIOLOGICAL METHODS

AMIC-7369

"APPLICATION OF BIOLOGICAL MONITORING SYSTEMS TO SIMULATED INDUSTRIAL WASTE DISCHARGE SITUATION", Cairns, J., Jr., Virginia Polytechnic Institute and State University, Department of Biology and Center for Environmental Studies, Blacksburg, Virginia, Completion Report, Contract No. DI-14-31-000-3547, August 1972, 26 pp. NTIS Report No. PB 213 468.

A method of measuring fish breathing rates and movement was used to determine (1) whether fish could distinguish zinc spills from harmless fluctuations in temperature and water hardness, (2) whether fish exposed to low concentrations (.075 mg/l) of zinc for long periods (up to 41 weeks) could still exhibit warning responses to higher concentrations, and (3) whether they could respond to Zn and Ca (an antagonistic combination) and Zn and Cu (a synergistic combination). The monitoring apparatus consisted of aquaria containing stainless steel electrodes to detect breathing rates and light beams and photocells to detect movements. The results show that calcium at 147 mg/l did not cause continued stress detections. Bluegills did not become incapable of responding to a simulated zinc spill (3 mg/l) after long term exposure (41 weeks) to what is presumed a biologically safe concentration (0.075 mg/l). Calcium (110 mg/l) does act antagonistically with zinc (3.7 mg/l), and copper (0.3 mg/l) does not appear to act synergistically with 1.4 mg/l zinc. A daily change in temperature of 5 degrees C did produce a number of detections when no toxicant was present. However, when the first temperature treatment day is used to establish baseline breathing rates then no detections are obtained on the following treatment days. These biological monitoring techniques should be applicable in field situations for detecting not only heavy metals, but other toxicants as well.

INDEX TERMS: Bioindicators, Calcium, Zinc, Toxicity, Fish physiology, Copper, Water temperature, Monitoring, Sunfishes.

AMIC-7372

"MERCURY POLLUTION OF GOLF COURSE LAKES", Koirtzmann, G. R., Meers, R., Graham, K., Bassett, B., University of Missouri, Missouri Water Resources Research Center, Columbia, Missouri, Completion Report, Contract No. DI-14-31-0001-3525, August 20, 1972, 26 pp. NTIS Report No. PB-213 508.

Fish, water, algae, and bottom sediment obtained from golf course lakes near Columbia, Kansas City, St. Louis and New Bloomfield, Missouri, were analyzed by Flameless AA for mercurial fungicides used in greens treatment. The purpose of the study was to determine the extent of contamination of the lakes, the potential health hazard from eating fish from the contaminated lakes, the route of mercury from green to lake, and the levels of mercury in other lakes to establish background levels. The results indicate that there can be significant pollution of lakes on golf courses from the greens treatment, especially if organically bound mercury is used in the treatment. The flesh of mature largemouth bass is the most sensitive indicator. Bass taken from golf course lakes contain 1-7 micrograms of mercury per gram of wet tissue, depending on size and other factors. Background mercury levels in bass are 0.1-1 microgram/g. Many lakes with no known source of mercury contamination produce mature bass which contain significantly more mercury than the 0.5 ppm recommended by the FDA as the maximum for human food. Smaller bass generally contain less mercury.

INDEX TERMS: Mercury, Lakes, Golf courses, Frogs, Chara, Fish, Sediments, Atomic absorption spectrophotometry, Sample preparation, Spirogyra.

AMIC-7373

"AN ECOSYSTEMATIC STUDY OF THE SOUTH RIVER, VIRGINIA", Cairns, J., Jr., Dickson, K. L., Virginia Polytechnic Institute and State University, Biology Department and Center for Environmental Studies, Blacksburg, Virginia, Virginia Water Resources Center, Blacksburg, Bulletin 54, July 1972, 96 pp. NTIS Report No. PB-213 159.

A biological survey of the fish, macroinvertebrates, algae, aquatic plants, protozoans, and bacteria was conducted on the South River, Virginia, in September 1970, to measure the ecological condition of a system receiving agricultural, domestic, and industrial wastes. Eight sampling stations were located to determine the effects of various wastes on the biota of the South River. The fauna and flora at each station were examined to determine the diversity, density, and distribution of aquatic life in relation to physical and chemical water quality. Results of the study indicated that the discharge of domestic and industrial wastes in Waynesboro, Virginia: (1) exceeded the waste assimilative capacity of the river and caused the dissolved oxygen to be entirely depleted in certain reaches of the river at times of low flow and high temperature; (2) enriched the system by adding nutrients such as carbon, phosphorus, and nitrogen, causing a definite shift in the composition of the flora; and (3) decreased the diversity of fish and macroinvertebrates and caused qualitative shifts in algae, higher plants, bacteria, and protozoans when compared to areas of the South River upstream of Waynesboro. The study indicated that biological recovery was not complete fourteen miles downstream of Waynesboro at Harriston, Virginia.

INDEX TERMS: Water pollution effects, Industrial wastes, Domestic wastes, Agricultural runoff, Water quality, Algae, Fish, Bacteria, Protozoa, Benthos, Heavy metals, Nutrients, Species diversity, Macroinvertebrates.

AMIC-7378

"OBSERVATIONS ON THE TRANSPARENCY OF THE WATERS OF THE PULICAT LAKE WITH PARTICULAR REFERENCE TO PLANKTON PRODUCTION", Kaliyamurthy, M., *Hydrobiologia*, Vol. 41, No. 1, February 28, 1973, pp 3-11.

The relationship of the transparency of the waters of Lake Pulicat to plankton productivity was investigated for the period January 1968 to December 1970. Light penetration was measured at varying times with a Secchi disc 20 cm in diameter from a stationary boat. Simultaneously, plankton was collected by hauling a 50-cm diameter tow net for 15 minutes. The plankton was fixed in 5 percent formalin and counted using a Sedgwick-Rafter counting cell. Marked sectoral and seasonal variations were observed in relation to transparency but no tidal effects were noted. Varying relationships were noted between plankton and the attenuation coefficient 'k' in the two sectors of the lake.

INDEX TERMS: Zooplankton, Phytoplankton, Light penetration, Aquatic productivity, Primary productivity, Secondary productivity, Turbidity, Plankton nets, Aquatic life, Secchi disks, Tidal effects, Estuarine environment, Transparency, Lake Pulicat, Seasonal variation.

2. BIOLOGICAL METHODS

AMIC-7379

"THE EFFECTS OF POLLUTION ON GAMMARUS PULEX (L) SUBSP. PULEX (SCHELLENBERG) IN THE INLET STREAMS OF ROSTHERNE MERE, CHESHIRE", Horough, J. E., Hydrobiologia, Vol. 41, No. 1, February 28, 1973, pp 13-35.

Two inlet streams, Rostherne Brook and the Southern Drain of Dolls Meadow, flowing into Rostherne Mere, Cheshire were sampled for macroinvertebrates, and their physical and chemical conditions analyzed. The physical and chemical factors for these streams were similar, except for the stream beds and the pollution of Rostherne Brook. Both streams had large populations of Gammarus pulex and the life history of this organism was studied. The ratio of adult organism to juvenile differed in the two streams, Rostherne Brook having a higher proportion of adults in winter and juveniles in summer as opposed to the Southern Drain in which a normal life history was exhibited. Experiments showed that these differences were not related to differences in stream bed conditions. It was considered that the different adult to juvenile ratios were therefore caused by pollution in Rostherne Brook. The juveniles were more tolerant to pollution and therefore more able to survive the summer when pollution effects were at a maximum. The life history was altered in Rostherne Brook by pollution. Instead of the dual life history produced by overwintering juveniles and speedy summer maturation, a simple alternation of juveniles and adults was seen. This change in life history enabled Gammarus to survive in the polluted waters of Rostherne Brook.

INDEX TERMS: Water pollution effects, Life history studies, Amphipoda, Physical properties, Chemical properties, Water sampling, Benthic fauna, Juvenile growth stage, Resistance, Freshwater, Macroinvertebrates, Gammarus pulex, Rostherne Brook, Dolls Meadow, England.

AMIC-7380

"PHYTOPLANKTON OBSERVATIONS IN THE EASTERN CARIBBEAN SEA", Marshall, H. G., Hydrobiologia, Vol. 41, No. 1, February 28, 1973, pp 45-55.

In order to obtain phytoplankton and hydrographic data, water samples were taken at 11 sites along transects in Caribbean Sea on two different cruises, January 1969 and January 1970, west of the Lesser Antilles. Another series of collections were made off the coast of Venezuela (January 1968). A total of 88 taxa were noted in these samples, of which there were 44 diatoms, 41 pyrrhophyceans, 2 cyanophyceans and 1 silicoflagellate. Totals of 37 and 38 different phytoplankters were observed during cruises E46K-67-68 and E1-C-70, respectively, with 58 species noted in the extensive samplings of E 50D-68-69. A diatomaceous flora predominated in each series of collections. The phytoflagellates were well represented, but in low numbers. The overall phytoplankton concentrations were low for each of the areas studied during these three January cruises. Even the preliminary data on the coccolithophore concentration does not indicate a major development at this time of the year. The present results indicate a substantial contribution made by the nanoplankton. In this series of January collections they consisted predominately of the diatom Melosira sp. In these offshore waters various species of the genus Rhizosolenia were most abundant. Only one bloom condition was noted and this consisted of Noctiluca scintillans. There were 13 phytoplankters found during each of the three cruises, having a distribution that extended over the eastern Caribbean. These were the diatoms, Coscinodiscus sp., Rhizosolenia alata, R. hebetata semispina, Navicula sp., Thalassiothrix frauenfeldii, Pleurosigma sp., and the pyrrhophyceans, Ceratium fusus, C. trichoceros, C. tripos, Podolampas spinifera. These were in addition to Dictyocha fibula, Skudajella thiebantii, and Richelia intracellularis.

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INDEX TERMS: Marine algae, Phytoplankton, Nanoplankton, Chrysophyta, Cyanophyta, Pyrrophyta, Ecological distribution, Dominant organisms, Caribbean Sea, Silicoflagellates, Coccolithophores, Species diversity.

AMIC-7382

"GROWTH OF A FLOATING AQUATIC WEED, SALVINIA UNDER STANDARD CONDITIONS", Gaudet, J. J., Hydrobiologia, Vol. 41, No. 1, February 28, 1973, pp 77-106.

Experimental flasks containing basal nutrient medium were inoculated with stock cultures of Salvinia minima or S. molesta and placed in growth chambers for investigation of factors affecting growth rates. Determinations were made of total nitrogen, pigments, amino acids, trace elements and C-14 uptake in plants and pH, conductance, DO, NO₃, urea, ammonium, PO₄, SO₄, total iron, K, Na, Mg, and Ca in water. The results obtained were as follows: 1) Growth of the floating aquatic weed, Salvinia, in sterile culture was exponential for at least 2 weeks under standardized conditions. 2) Increase in light intensity or in CO₂ resulted in increases in growth rate, but did not extend the exponential period of growth. 3) This aquatic plant, like many others, discriminates against calcium relative to strontium. 4) In culture Salvinia exhibited luxury consumption of N and P. 5) Because of high C/N ratios, Salvinia may not be a favorable source of animal food, but might be useful in nutrient removal schemes. 6) In sterile culture, Salvinia molesta produced fewer leaves than Salvinia minima, but maintained a significant increase in leaf area and dry weight. This may be correlated with the ability of the first species to rapidly spread over tropical waterways.

INDEX TERMS: Aquatic plants, Floating plants, Ferns, Growth rates, Cultures, Bioassay, Salvinia molesta, Salvinia minima, Culture media.

2. BIOLOGICAL METHODS

AMIC-7383

"STUDY OF THE CHANGES IN THE STRUCTURE OF TWO ALGAL POPULATIONS: AN R-TYPE FACTOR ANALYSIS", Symons, F., Hydrobiologia, Vol. 41, No. 1, February 28, 1973, pp 107-112.

Two algal populations of the same pond were studied over a period of 8 months. For each of those populations an r-type factor analysis has been executed. Three independent species structures were proposed for each of the populations. Characteristic differences between the two populations are discussed under the assumption that one of them should be more self-regulating than the other one. A possible interaction between the development of diatoms and green algae is put forward as a perspective for further research.

INDEX TERMS: Diatoms, Chlorophyta, Plant populations, Biological communities, Species diversity.

AMIC-7388

"PARTITIONING OF A BRACKISH WATER HABITAT BY COPEPOD SPECIES", Heip, C. Hydrobiologia, Vol. 41, No. 2, March 29, 1973, pp 189-198.

A shallow brackish water pond in Belgium was sampled for copepods to study how species attain separation of niches. Samples were taken fortnightly by pushing glass rods 5 cm into the sediment and withdrawing the sample containing the sediment and the water column. Temperatures were also regularly recorded. Samples were fixed with 70 percent alcohol, washed in a trough, and the material washed away was caught in a sieve with 50 mu mesh. Animals were extracted from detritus under a microscope and counted. Copepods were identified to species and females carrying eggs were noted. Eleven species were identified: Halicyclops magniceps, Diacyclops bistetosus, Megacyclops virilis, Canuella perplexa, Tachidius discipes, Amphiascoides debilis, Schizopera compacta, Nitocra typica, Nitocra spinipes, Mesochra lilljeborgi, and Paronychocampus nanus. The successful species show a separation in time with regard to the date of maximum occurrence and the date of maximum reproductive activity. The succession of the five species examined is: Mesochra lilljeborgi, Paronychocampus nanus, Tachidius discipes, Halicyclops magniceps and Canuella perplexa. Moreover, these species and others show a separation in space: C. perplexa is an endopsammic, Paronychocampus nanus a mesopsammic, and Tachidius discipes an epepsammic species. Three cyclopoid species are planktonic. Two other species (Nitocra typica and Mesochra lilljeborgi) are more numerous in the periphyton than in the benthos.

INDEX TERMS: Dominant organisms, Brackish water, Copepods, Succession, Niches, Benthos, Sediments, Sampling, Reproduction, Sample preparation.

AMIC-7386

"THE USE OF FISH AS SENSORS IN INDUSTRIAL WASTE LINES TO PREVENT FISH KILLS", Cairns, J., Jr., Sparks, R. E., Waller, W. T., Hydrobiologia, Vol. 41, No. 2, March 29, 1973, pp 151-167.

The use of movements and breathing rates of bluegill sunfish as in the detection of sublethal concentrations of zinc can be applied to industrial waste lines. Fish movement patterns and breathing rates would be monitored according to methods described in the authors' previous papers. Since industrial waste and water qualities are apt to vary unpredictably, a redundant detection system is desirable. If that monitoring system were automated the rate of data acquisition and analysis could be greatly speeded up. At an actual industrial site, a monitoring unit would be located on each waste stream in the plant and on the combined waste stream. The experimental fish in each unit would be exposed to waste diluted with water from the river above the plant, and control fish would be exposed to upstream water alone. The information from each monitoring unit could be analyzed by a central data processor, and when there was a warning response, the industry could tell which waste stream was at fault. If the problem was outside the plant, the control fish would show responses. It is likely that 'fish sensors' in continuous monitoring units at industrial sites can warn of developing toxic conditions in time to forestall acute damage to the fish populations in streams. (See also AMIC-3231, 3232 and 7369.)

INDEX TERMS: Industrial wastes, Toxicity, On-site data collections, Water pollution effects, Methodology, Movement, Bioindicators, Automatic control, Effluents, Water pollution control, Bluegills, Biomonitoring, Breathing.

AMIC-7393

"ECOLOGY OF YELLOWSTONE THERMAL EFFLUENT SYSTEMS: INTERSECTS OF BLUE-GREEN ALGAE, GRAZING FLIES (PARACOEENIA, EPHYDRIDAE) AND WATER MITES (PARTNUNIELLA, HYDRACHNELLAE)", Wiegert, R. G., Mitchell, R., Hydrobiologia, Vol. 41, No. 2, March 29, 1973, pp 251-271.

Studies of succession, population dynamics and species intersects of alkaline hot spring effluent communities in the Lower Geyser Basin of Yellowstone National Park have been used to define the 3 basic elements in the biological interactions of the characteristic algal-bacterial-arthropod ecosystems. The 3 major biotic elements in these communities were (1) an algal mat comprising several species of filamentous blue-green algae, (2) a primary biophage, the brine fly Paracoenia turbida, which feeds on the algal mat as both larva and adult, and (3) a red water mite, Partnuniella thermalis, whose larvae are parasitic on adult Paracoenia. Additional animals are found in this simple community; some other genera of brine fly (Ephydra, Lamproscatella), a parasitic wasp (Pteromalidae, Urolepis), and lycosid spiders are present throughout their life cycle. Other species are important components of the system (i.e. the predaceous dolicoopodid flies), but they spend only part of their life cycle in or on the mat. The dominant primary producers were grazed by ephyrid flies. These in turn harbored larvae of the water mite Partnuniella. The high intrinsic rate of increase of the fly enabled it to exploit temporary cool spots in the mat. The lower fecundity and longer life cycle of the mite restricted its ability to exploit temporarily suitable habitat. Thus the intersect of mites with flies is a sensitive measure of stability in the algal mat. Springs with a variable-flow pattern and consequent mat instability had both a lower mean incidence of parasitism and a lower mean larval load per fly. The data support the hypothesis that the abundance and relative densities of organisms in higher trophic

2. BIOLOGICAL METHODS

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levels can be predicted from knowledge of the growth and stability patterns of the filamentous blue-green algal mat in thermal spring effluents.

INDEX TERMS: Hot springs, Ecosystems, Aquatic bacteria, Aquatic algae, Biological communities, Succession, Ecology, Trophic level, Parasitism, Predation, Stability, Arthropods, Population dynamics, Species interaction.

AMIC-7405

"ALGAL RESPONSE TO DETERGENT PHOSPHATE LEVELS", Francisco, D. E., Weiss, C. M., Journal Water Pollution Control Federation, Vol. 45, No. 3, March 1973, pp 480-489.

Algal assays were performed on treated wastewaters, some containing phosphate detergents and others containing a non-phosphate detergent. The controls for the bioassay were established using raw wastewater. Each test and control culture was prepared in triplicate, with a total volume of 100 ml in a flask seeded with 1000 cells/ml of the test alga, *Selenastrum capricornutum*. The flasks were capped loosely with aluminum foil, incubated at 24 C under 400 ft-c of cool-white fluorescent illumination, and swirled once daily. Growth response of the test alga was determined at 3, 5, 7, 10, and 14 days by hemocytometer counting. For growth comparison, the standard algal assay medium (NAAM) was used. In general, phosphate detergent wastewater allowed the same growth as did non-phosphate detergent wastewater at each level of treatment. Tertiary treatment for phosphorus removal resulted in much less growth than secondary treatment. Tertiary-treated phosphorus detergent wastewater allowed significantly greater growth than the non-phosphorus wastewater at a concentration of 2 percent. Simply removing detergent phosphates from wastewater apparently will not control eutrophication, except where the receiving water is very strongly phosphorus-limited and wastewater is the principal phosphorus source, but may allow significantly better tertiary phosphorus removals.

INDEX TERMS: Aquatic algae, Detergents, Phosphates, Bioassay, Waste water (pollution), Water pollution, Eutrophication, Nutrients, Plant growth, Sewage treatment, Tertiary treatment, Water sampling, Water analysis, Physicochemical properties, *Selenastrum capricornutum*.

AMIC-7403

"TOXIC EFFECTS OF MERCURY ON THE ACTIVATED SLUDGE PROCESS", Ghosh, M. M., Zagger, P. D., Journal Water Pollution Control Federation, Vol. 45, No. 3, March 1973, pp 424-433.

A study to determine the toxic effects of mercury on the activated sludge process was made in the laboratory under controlled batch-fed conditions. The threshold mercury concentrations that were required to inhibit biological activities were between 2.5 and 5.0 mg Hg (2 plus) /l, when the food: microorganism ratio was 1.0 and the mixed liquor volatile suspended solids concentration was 2,000 mg/l. However, at dosages as high as 10.0 mg Hg (2 plus) /l, recovery occurred within a few hours. Chemical oxygen demand reduction was obtained in the samples having higher mercury concentrations, but the demand reduction and growth of sludge were both reduced from the conditions present in the nonstressed studies.

INDEX TERMS: Mercury, Activated sludge, Toxicity, Chemical oxygen demand, Biomass, Aerobic conditions, Heavy metals, Reduction (chemical), Growth rates, Artificial substrates, Absorption, Oxygen, Volatile suspended solids, Substrates utilization.

AMIC-7420

"THE REACTIONS OF ROACH (*RUTILUS RUTILUS* (L.)) TO CHANGES IN THE CONCENTRATION OF DISSOLVED OXYGEN AND FREE CARBON DIOXIDE IN A LABORATORY CHANNEL", Stott, B., Cross, D. G., Water Research, Vol. 7, No. 5, May 1973, pp 793-805.

Experiments were carried out with roach (*Rutilus rutilus*) in a laboratory channel to determine their behavior in relation to levels of dissolved oxygen and free carbon dioxide. The channel was made by joining 9 iron-framed glass aquaria by PVC pipe set in marine plywood at the end of the aquaria. The sides of the aquaria were covered with polyethylene sheeting to prevent the fish seeing out. Dechlorinated, deoxygenated water was used and N₂ was bubbled through aerators to replace the air above the channel. Before experiments on avoidance reactions were started between 25 and 30 roach, 10-12 cm long, were introduced into the apparatus, confined to an area consisting of either tanks 1-4, or 1-5, and fed on *Tubifex* and *Daphnia*. The fish were kept in the original area for at least 5 weeks before a homing experiment was attempted. This consisted of opening the gate at the downstream end of the area and driving the fish to tanks 8 or 9 with a hand net and the light from a torch. All the gates in the channel were then closed and the fish allowed about 1 h to settle down before all the gates were re-opened by remote control. Subsequently the positions of the fish were noted at intervals of about 2 h. Falling concentrations of dissolved oxygen in the channel caused the roach to move downstream to better oxygenated water by means of a predominantly appropriate response. When an aerated water flow was restored the fish quickly reoccupied their original position. Fish newly introduced into the channel responded in a similar manner except that they did not return to the original position. Roach acclimated to a reduced level of dissolved oxygen needed a rather lower oxygen level to cause the downstream movement. An increase in the amount of free carbon

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<p>AMIC-7420 (Continued) Card 2/2</p> <p>dioxide together with a reduction in oxygen content induced fish to respond to higher levels of oxygen than if the oxygen only was reduced.</p> <p>INDEX TERMS: Dissolved oxygen, Carbon dioxide, Water pollution effects, Bioassay, Fish behavior, Channels, Anaerobic conditions, <i>Rutilus rutilus</i>, Avoidance reactions, Roach.</p>	<p>AMIC-7467 "TOXICITY, RESIDUE DYNAMICS, AND REPRODUCTIVE EFFECTS OF PHTHALATE ESTERS IN AQUATIC INVERTEBRATES", Sanders, H.O., Mayer, F.L., Walsh, D.F], <u>Environmental Research</u>, Vol. 6, No. 1, March 1973, pp 84-90.</p> <p>Scuds (<i>Gammarus pseudolimnæus</i>), glass shrimp (<i>Palaemonetes kadiakensis</i>), crayfish (<i>Orconectes nais</i>), waterfleas (<i>Daphnia magna</i>), aquatic sowbugs (<i>Asellus brevicaudus</i>), and three species of immature aquatic insects, damselfly nymphs (<i>Ischnura verticalis</i>), burrowing mayflies (<i>Hexagenia bilineata</i>), and midge larvae (<i>Chironomus plumosus</i>) were collected from streams and ponds in Missouri for use in studying the bioaccumulation, biomagnification, and toxicity of di-2-ethylhexyl and di-n-butyl phthalates. Acute toxicity tests were conducted for 96 hours under static conditions as TL50 values. Accumulation experiments were conducted in an intermittent-flow system. The phthalate esters were labeled with C-14 for radiometric analysis of water and organisms. Reproductive tests were conducted with <i>Daphnia</i> in the intermittent-flow system with concentrations of 3, 10, and 30 ppb. The acute toxicities were low and ranged from 2.1 mg/liter to greater than 32 mg/liter. Residue accumulation was rapid resulting in body residues 70-13,600 times that of the water concentration. Phthalate residues were essentially gone after 10 days in fresh water. A reproductive impairment of 60 percent occurred in <i>Daphnia magna</i> exposed continuously to 3 ppb of di-2-ethylhexyl phthalate.</p> <p>INDEX TERMS: Crayfish, Midges, Mayflies, Toxicity, Bioassay, Reproduction, Di-n-butyl phthalate, Di-2-ethylhexyl phthalate, Biological magnification, Scuds, Glass shrimp, <i>Palaemonetes kadiakensis</i>, Aquatic sowbug, Bioaccumulation, Plasticizers, <i>Daphnia magna</i>, <i>Gammarus pseudolimnæus</i>, <i>Orconectes nais</i>, <i>Asellus brevicaudus</i>, <i>Ischnura verticalis</i>, <i>Hexagenia bilineata</i>, <i>Chironomus plumosus</i>.</p>
<p>AMIC-7457 "AN ESTIMATOR FOR THE SIZE OF AN ANIMAL POPULATION", Holgate, P., <u>Biometrika</u>, Vol. 60, No. 1, April 1973, pp 135-140.</p> <p>A method of estimating animal populations which is popular among zoologists is to take the total of the ages of animals that die during a given year as an estimator of population size. In this note the bias and variance of the estimator are investigated for a stationary model, and for one based on a branching process. A numerical illustration is given.</p> <p>INDEX TERMS: Statistical methods, Animal populations, Estimating, Data interpretation.</p>	<p>AMIC-7479 "SOME TRACE ELEMENT CONCENTRATION VARIATIONS OBSERVED IN MARINE ORGANISMS THAT SUGGEST CAUTION IN SAMPLING", Folsom, T. R., Hodge, V. F., Wong, K. M., Kishore, R., Quinn, V. P., Scripps Institute of Oceanography, Soledad Marine Radioactivity Laboratory, La Jolla, California, Report No. TID-26198, May 24-26, 1972, 14 pp.</p> <p>Data were accumulated on accumulations of Hg, Se, Zn, Pb, Pb-210, and Po-210 in elk kelp, Zn, Se, and Po-210 in albacore, Po-210 in skipjack, Po-210, Pb-210, Hg, Se, and Zn in dolphins, and Po-210 in horse clams, bubble snails, brown turban snails and sea hares. Analysis of these data shows that concentrations of metals vary greatly from one organ to another. If whole-body residues or residues in organs not specific for certain elements are measured, errors much larger than those from analytical procedure may result. Consequently, it is only possible to draw valid conclusions from data which have been obtained with normal, averaged, or otherwise standardized conditions.</p> <p>INDEX TERMS: Bioindicators, Mercury, Zinc, Lead, Data interpretation, Selenium, Bioaccumulation, Albacore tuna, Dolphins, Polonium, Scandium, Horse clam, Bubble snail, Turban snail, Sea hare, Skipjack tuna, Elk kelp.</p>

3. MICROBIOLOGICAL METHODS

AMIC-7105

"SIMPLIFIED GAS CHROMATOGRAPHIC PROCEDURE FOR IDENTIFICATION OF BACTERIAL METABOLIC PRODUCTS", Carlsson, J., Applied Microbiology, Vol. 25, No. 2, February 1973, pp 287-289.

A rapid and simple procedure is described for analysis of fermentation products from anaerobic bacteria grown in glucose broth. A 1-ml sample of the culture is drained through cation-exchange resin in a Pasteur pipette. The effluent fluid is directly analyzed isothermally in a gas chromatograph for volatile fatty acids (C2 to C6) as well as for lactic, pyruvic, and succinic acids. This procedure is considered to be suitable for routine use in clinical bacteriology.

INDEX TERMS: Anaerobic bacteria, Separation techniques, Gas chromatography, Cultures, Methodology, Coliforms, Enteric bacteria, Pollutant identification, Fatty acids, Lactic acid, Pyruvic acid, Succinic acid, Sample preparation, Lactobacillus acidophilus, Bifidobacterium eriksonii, Eubacterium limosum, Chromatograms, Glucose broth.

AMIC-7112

"ULTRASTRUCTURE OF STAPHYLOCOCCUS EPIDERMIDIS AFTER FREEZE-ETCHING AND THIN SECTIONING", Gilchrist, J. E., DeVoe, I. W., Canadian Journal of Microbiology, Vol. 19, No. 2, February, 1973, pp 294-295.

Staphylococcus epidermidis was isolated from a gradient plate and freeze etched for examination of ultrastructure. Typical of Staphylococcus, the cell walls consisted of three layers: a dense outer layer, a rather electron translucent middle layer, and a very dense layer next to the cytoplasmic membrane. Numerous mesosomes of both the vesicular and laminar types were evident in thin sections. Single vesicular structures that appeared to be invaginations of the trilaminar cytoplasmic membrane were also observed.

INDEX TERMS: Pollutant identification, Separation techniques, Electron microscopy, Staphylococcus epidermidis, Ultrastructure, Freeze etching, Thin sectioning.

AMIC-7108

"STUDIES OF THE CELL ENVELOPE OF VIBRIO PARAHAEMOLYTICUS", Deneke, C. F., Colwell, R. R., Canadian Journal of Microbiology, Vol. 19, No. 2, February 1973, pp 241-245.

Components of the cell envelope of Vibrio parahaemolyticus were investigated. Vibrio parahaemolyticus is an estuarine microorganism associated with diseases of marine and estuarine animals and seafood-borne enteritis in man. Purified lipopolysaccharide (LPS), isolated using a 45 percent phenol extraction procedure, was found to contain lipid A fraction to 27 percent of the LPS by weight. In the lipid A fraction, glucosamine was the only amino sugar to be presented, and a high molar ratio of phosphate to amino sugar (2.5:1) was noted. Two hydroxy fatty acids, hydroxydodecanoic and hydroxymyristic, were identified among the fatty acids by gas-liquid chromatography. A role of the lipopolysaccharides in the salt requirement of marine bacteria is suggested.

INDEX TERMS: Separation techniques, Marine bacteria, Pollutant identification, Pathogenic bacteria, Gas chromatography, Foods, Cultures, Gas liquid chromatography, Vibrio parahaemolyticus, Fatty acids, Seafoods.

AMIC-7174

"THE VALIDITY OF THE APPLICATION OF SIMPLE KINETIC ANALYSIS TO HETEROGENEOUS MICROBIAL POPULATIONS", Williams, P. J. LeB., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 159-165.

It is shown by use of a mathematical model that heterogeneous populations do not adhere to the Michaelis and Menten equation; at low substrate concentration, observed rates are higher than predicted ones. The discrepancy between observed and predicted values increases as the population becomes more diverse. If kinetic analysis based on the Michaelis and Menten equation is used to determine the rate of turnover of substrates in natural waters, the rate may be underestimated unless measurements are made at very low added substrate concentrations.

INDEX TERMS: Mathematical models, Aquatic bacteria, Growth rates, Metabolism, Nutrients, Population, Absorption, Data interpretation, Substrate utilization.

3. MICROBIOLOGICAL METHODS

AMIC-7175

"CONTAMINATION OF SURFACES BY BACTERIAL NEUSTON", DiSalvo, L. H., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 165-168.

A method was developed by investigating primary bacterial fouling of glass both underwater and at the air-sea surface. A sampler called the MT or mousetrap device was constructed for the investigations. This device basically consisted of a plexiglass case fitted with doors which could be actuated by the springs and bars of a 9 by 18 cm rattrap. The sampling surfaces were marbles mounted on the stainless steel inside the case. When the sampler was lowered into the water, the doors were opened by shifting the sampler weight to a door control line. After a specified period of time, the doors were closed, the sampler retrieved and the marbles removed and treated to remove fouling organisms for counting. In two replicate experiments, bacteria were counted from: (a) marbles lowered and raised through the air-sea interface, (b) marbles lowered through the interface but protected by the MT device, (c) water samples obtained at the air-sea interface, and (d) water samples obtained beneath the surface. Interface water samples were collected with sterile stainless steel screens 25 sq cm, having 1-mm openings and a wire thickness of 0.4 mm. It was found that interfacial water samples contained about one order of magnitude higher viable counts than subsurface waters, and marbles contacting the air-sea interface retained almost three orders of magnitude more bacteria than protected marbles. It was found that there were daily fluctuations in bacteria retained. The measurements show that rapid irreversible sorption of over 1000 bacteria/cm occurred within 1-2 minutes of immersion in natural waters typically containing 1000-100,000 colonies/ml. It is suggested that the rapidity of this attachment could aid in the linkage of particles near the sea surface and act as a mechanism for the formation of organic aggregates.

AMIC-7175 (Continued)

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INDEX TERMS: Air-water interfaces, Sampling, Fouling, Marine bacteria, Viable counts.

AMIC-7206

"AGAR-PLUG CUTTER AND INOCULATION DEVICE", Kurtzman, R. H., Jr., Mycologia, Vol. 65, No. 1, January-February 1973, pp 236-239.

An agar-plug cutting device is described which can be made in a wide variety of sizes and can be sterilized by any ordinary means. The device is constructed from a cutoff No. 18 syringe needle, a serum stopper, and an antibiotic assay cup or other short length of stainless steel tubing. The tubing which serves as a cutter is drilled lengthwise to allow the syringe needle to be inserted. A second, larger hole is drilled lengthwise in the tubing, but only to a depth of about 2 mm. The serum stopper is placed over the needle to provide an air-tight seal so that when the cutter is inserted into the agar, the vacuum created by withdrawing the needle will retain the plug in the tubing. The needle is also used to eject the plug onto the plate to be inoculated. A control unit was also developed to improve the use of the device. Using the completed device, it was possible to inoculate 50 plates in 10 minutes.

INDEX TERMS: Laboratory equipment, Agar-plug cutter, Inoculation.

AMIC-7207

"FROZEN PREPARED MICROBIOLOGICAL CULTURE MEDIA", Witlin, B., Mycopathologia et Mycologia Applicata, Vol. 49, Nos. 2-3, March 15, 1973, pp 137-139.

Thirty culture media were stored in a freezer at -5 C and -20 C and evaluated at weekly intervals for periods of one year. After storage, the media were removed, observed for physical appearance, thawed at room temperature, inoculated with test organisms (Streptococcus, Staphylococcus, Enterobacter, Salmonella, Pseudomonas, Proteus, Candida, Trichophyton, Neisseria, Corynebacterium, Mycobacterium) and incubated. With the exception of blood agar, the frozen and thawed media were satisfactory with regard to appearance, consistency, and as a substitute for biochemical reactions. Consequently, single freezing of culture media provides a practical and convenient method for preserving and storing noncellular substrates for long periods.

INDEX TERMS: Storage, Bacteria, Freezing, Culture media.

3. MICROBIOLOGICAL METHODS

AMIC-7223

"BACTERIAL IDENTIFICATION BY MICROCALORIMETRY", Boling, E. A., Blanchard, G. C., Russell, W. J., Nature, Vol. 241, No. 5390, February 16, 1973, pp 472-473.

Seventeen species from 10 genera of Enterobacteriaceae were grown on brain-heart infusion (BHI) medium and analyzed by microcalorimetry as a means of differentiating species. The profiles were recorded on a strip chart recorder for periods up to 14 hrs. Using the curves, it was possible to discriminate between all the species tested. Profiles are included for Enterobacter aerogenes, Klebsiella, Proteus vulgaris, Enterobacter cloacae, Escherichia coli, and Proteus rettgeri. Streptococcus faecalis was also among the bacteria investigated. Microcalorimetry promises to be a rapid and specific means of characterization of Enterobacteriaceae and possibly other bacteria.

INDEX TERMS: Pollutant identification, Cultures, Streptococcus, E. coli, Speciation, Separation techniques, Microcalorimetry, Enterobacter aerogenes, Klebsiella, Proteus vulgaris, Enterobacter cloacae, Proteus rettgeri.

AMIC-7261 (Continued)

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the zygomycetes, was used to test these 3 diagnostic reagents for cross-reactivity. Evaluations of the mixed Candida reagent, the mixed Aspergillus reagent, and the zygomycete reagent in tissue sections showed good sensitivity and specificity for their respective diseases. Blind studies using tissue sections showed that these reagents provided a rapid, reliable and reproducible procedure for the detection and identification of these fungi in tissue. Trypsin digestion of tissue sections prior to FA staining was evaluated and found to enhance greatly the staining results in most of the tissues tested. In no case did digestion reduce fluorescence, or affect sensitivity or specificity. The feasibility of counterstaining by FA fungi in tissue sections previously stained with conventional histological stains was evaluated.

INDEX TERMS: Pathogenic fungi, Pollutant identification, Human diseases, methodology, Reliability, Fluorescent antibody techniques, Reagents, Candida spp, Aspergillus spp, Zygomycetes, Antisera, Animal tissues, Staining, Candidiasis, Aspergillosis, Histology, Sample preparation, Serotypes.

AMIC-7261

"APPLICATION OF THE FLUORESCENT ANTIBODY TECHNIQUE TO THE DIFFERENTIATION OF ASPERGILLUS SPECIES, CANDIDA SPECIES AND ZYGOMYCETES IN PARAFFIN SECTIONS OF FORMALIN-FIXED TISSUES", Williams, E. R., University of North Carolina, Chapel Hill, North Carolina, Dissertation Abstracts No. 73-4899, 1972, 129 pp. (Complete report not available from AMIC.)

The results of this study showed that it is possible to differentiate the Candida spp., Aspergillus spp. and zygomycetes in paraffin sections of formalin-fixed tissues through the use of fluorescent antibody (FA) procedures with 2 diagnostic reagents. Hyperimmune antisera were produced against C. albicans serotype A, C. albicans serotype B, C. krusei, C. parapsilosis, C. tropicalis, C. pseudotropicalis, A. flavus group (A. oryzae), A. fumigatus, Rhizopus arrhizus, R. oryzae, Absidia corymbifera, and Mucor pusillus. Antisera demonstrating indirect fluorescent antibody (IFA) titers of 1:8 or higher and their corresponding preimmunization sera were labeled with fluorescein isothiocyanate. Subsequent testing of the labeled antiglobulins and their corresponding preimmunization globulins on cultures of homologous and heterologous fungi demonstrated that 8 of the 13 reagents prepared were unsuitable for further evaluation. A mixed screening reagent for the diagnosis of candidiasis and aspergillosis was prepared by using a mixture of labeled A. fumigatus and C. pseudotropicalis adsorbed with R. arrhizus and A. ramosa. A second reagent for the identification of candidiasis was prepared by mixing labeled C. albicans serotype A and C. krusei. A third confirmatory reagent for the identification of zygomycosis was prepared against R. arrhizus antiglobulins. This latter reagent will identify all of the medically important zygomycetes with the exception of M. pusillus. An extended list of medically important fungi, those other than the Candida spp., Aspergillus spp. and

AMIC-7266

"DISTRIBUTION OF VIBRIO PARAHAEMOLYTICUS IN THE NATURAL ENVIRONMENT", Liston, J.; Baross, J., Journal of Milk and Food Technology, Vol. 36, No. 2, February 1973, pp 113-117.

Vibrio parahaemolyticus has been isolated widely from marine environments but appears to be most abundant in inshore and estuarine areas when ambient temperatures rise seasonally to levels permitting growth of the organism. Japanese and U.S. studies of coastal areas have shown a direct relationship between temperature and abundance of Vibrio parahaemolyticus and this correlates with the seasonal incidence of Vibrio parahaemolyticus food poisoning in Japan. The organism has been isolated from water, sediment, plankton, fish and shellfish. In North America it seems to be most abundant in molluscan shellfish and in waters of high organic content. Counts of 10-200/ml of water, 1-7/g of sediment and up to 100,000/g of oyster tissue have been reported for North American inshore areas. Limited information on market seafood samples indicates very low incidence of Vibrio parahaemolyticus on fin fish in Europe and North America and high incidence in Japan during summer months. Limited data on market samples of frozen and fresh shellfish in U.S.A. suggest sporadically high incidence on shrimp, crabmeat, oysters, and clams.

INDEX TERMS: Distribution patterns, Water pollution effects, Water pollution sources, Path of pollutants, Shellfish, Foods, Sea water, Estuarine environment, Vibrio parahaemolyticus, Tissue, Macroinvertebrates.

3. MICROBIOLOGICAL METHODS

AMIC-7267

"VIBRIO PARAHAEOLYTICUS METHODOLOGY FOR ISOLATION FROM SEAFOODS AND EPIDEMIC SPECIMENS", Fishbein, M., Wentz, B., Journal of Milk and Food Technology, Vol. 36, No. 2, February 1973, pp 118-123.

The newly revised procedure in the Bacteriological Analytical Manual of the Food and Drug Administration for the analysis of Vibrio parahaemolyticus in seafood samples and epidemic specimens, media and test reagent formulations, enrichment and isolation procedures, and the biochemical and serological diagnostic criteria of Vibrio parahaemolyticus are presented. The biochemical schema for the separation of other interfering marine vibrios is included.

INDEX TERMS: Pathogenic bacteria, Isolation, Analytical techniques, Methodology, Pollutant identification, Marine bacteria, Public health, Human diseases, Enteric bacteria, Anaerobic bacteria, Fish, Shellfish, Crustaceans, Marine animals, Epidemics, Vibrio parahaemolyticus, Seafood, Feces, Culture media, Biochemical tests, Vibrio alginolyticus, Marine environment, Selective media, Enrichment.

AMIC-7272 (Continued)

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INDEX TERMS: Water analysis, Zooplankton, Cultures, Water temperature, Distribution patterns, Sediments, Niches, Seasonal, Vibrio parahaemolyticus, Culture media.

AMIC-7272

"ECOLOGY OF VIBRIO PARAHAEOLYTICUS IN CHESAPEAKE BAY", Kaneko, T., Colwell, R. R., Journal of Bacteriology, Vol. 113, No. 1, January 1973, pp 24-32.

The seasonal incidence of Vibrio parahaemolyticus was studied to determine its ecological niche in the natural environment; its habitat and role in the natural cycles of plankton, water, and sediment; and the mechanisms by which it survives the winter. Samples of sediment, plankton, and water were collected monthly from the Rhode River in Chesapeake Bay. For total viable counts, YE and SWYE media were used. Vibrio parahaemolyticus was isolated on TCBS medium. Bacterial counts were made for unfiltered water, filtrates, zooplankton, and sediments. The incidence of Vibrio parahaemolyticus and related vibrios was found to be correlated with water temperature. The vibrios could not be detected in the water column during the winter months, although they were present in sediment. From late spring to early summer, when water temperatures were 14 plus or minus 1 C, vibrios over-wintering in sediment were released from the bottom communities and attached to zooplankton, proliferating as the temperature rose. The number of vibrios in and on plankton was reflected in the water column bacterial population densities at water temperatures of ca. 19 C. Interaction between sediment, water, and zooplankton was found to be essential in the natural estuarine ecosystem. The bacterial population associated with zooplankton was found to be predominantly on external surfaces and was specific, differing from that of the sediment. Vibrio spp. and related organisms comprised the total bacterial population associated with zooplankton in summer months. The ecological role of Vibrio spp., including Vibrio parahaemolyticus, was found to be significant, with respect to their property of chitin digestion and in relation to the population dynamics of zooplankton in Chesapeake Bay.

AMIC-7274

"DIFFERENTIATION OF SOME ENTEROCOCCI BY GAS CHROMATOGRAPHY", Amstein, C. F., Hartman, P. A., Journal of Bacteriology, Vol. 113, No. 1, January 1973, pp 38-41.

If enterococci are to be useful as indicators of fecal pollution in foods, it will be necessary to differentiate fecal and non-fecal types. A method was attempted which involved determining relative fatty acid compositions of 37 enterococci by gas chromatography. Streptococcus faecalis, Streptococcus faecium, and Streptococcus faecium var. casseliflavus, and a motile yellow-pigmented streptococcus, contained very low levels of C sub 19:0 cyclopropane fatty acid and four unidentified components, compared to the other strains of enterococci examined. The studies clarified the relationships between existing species and varieties, but showed no significant differences in the fatty acid patterns of enterococci grouped according to plant, animal, or human source.

INDEX TERMS: Pollutant identification, Gas chromatography, Streptococcus, Separation techniques, Bioindicators, Fatty acids.

3. MICROBIOLOGICAL METHODS

AMIC-7275

"OSMOTIC REVERSAL OF TEMPERATURE SENSITIVITY IN *ESCHERICHIA COLI*", Bilsky, A. Z., Armstrong, J. B., *Journal of Bacteriology*, Vol. 113, No. 1, January 1973, pp 76-81.

Forty temperature-sensitive mutants, unable to grow on tryptone or nutrient agar at 42 C, were isolated from *Escherichia coli* K-12. When 0.5 percent NaCl was added to the medium, 32 grew at the nonpermissive temperature. Several were tested with different amounts of NaCl added to tryptone broth; all grew best when the osmolality of the medium was between 400 and 1,000 milliosmolal. One of the mutants was studied in more detail. Sucrose, inositol, KCl, and MgCl₂, as well as NaCl, permitted growth at 42 C. Glycerol, however, had no effect. When shifted from 30 to 42 C without osmotic protection, the mutant stopped growing but did not lyse, die, or leak significant amounts of intracellular material. In a similar shift experiment, a second mutant leaked all of its trichloroacetic acid-soluble pools into the medium. The majority of the mutants were hypersensitive to certain antibiotics, indicating possible cell envelope defects.

INDEX TERMS: Temperature, Pollutant identification, Osmosis, Antibiotics (pesticides), Stability, Isolation, Environmental effects, Mutants, *E. coli* K-12, Sensitivity, Bacterial physiology, Biochemical tests.

AMIC-7281

"INTERACTIONS OF *TETRAHYMENA PYRIFORMIS*, *ESCHERICHIA COLI*, *AZOTOBACTER VINELANDII*, AND GLUCOSE IN A MINIMAL MEDIUM", Jost, J. L., Drake, J. F., Fredrickson, A. G., Tsuchiya, H. M., *Journal of Bacteriology*, Vol. 113, No. 2, February 1973, pp 834-840.

A study was made of the food web formed from a protozoon, two bacteria, and a glucose minimal medium in chemostat culture. The system was also divided into simpler parts, first by omitting the protozoon to obtain a competition system, and then by omitting one or the other of the bacteria to obtain two food chains. In the competition studies, one bacterium was displaced by the other at all holding times used. In the food chain studies, sustained oscillations of the population densities of predator and prey developed at short holding times, and then changed to damped oscillations at longer holding times. In addition, the level of residual glucose remained high at long holding times. A new model of microbial growth is necessary to explain these results. In the food web studies, predation of the protozoon on the two bacteria stabilized the competition between the latter and allowed their coexistence in the same habitat. Thus, Gause's principle was circumvented.

INDEX TERMS: *E. coli*, Food webs, Competition, Food chains, Predation, Trophic level, Minimal media, Glucose, *Tetrahymena pyriformis*, *Azotobacter vinelandii*, Continuous cultures, Species interaction.

AMIC-7276

"RADIATION-RESISTANT MUTANTS OF *SALMONELLA TYPHIMURIUM* LT2: DEVELOPMENT AND CHARACTERIZATION", Davies, R., Sinskey, A. J., *Journal of Bacteriology*, Vol. 113, No. 1, January 1973, pp 133-144.

A series of repeated exposures to gamma irradiation with intervening outgrowth of survivors was used to develop radioresistant cultures of *Salmonella typhimurium* LT2. Stepwise increases in resistance to both ionizing and ultraviolet irradiation were obtained independently of the presence or absence of integrated P22 prophage. Single clonal isolates, representing parent and radioresistant populations, retained the general characteristics of the LT2 parent, including serological properties, phage typing, antibiotic sensitivities, mouse virulence, and most biochemical test reactions. Resistant cells were generally larger and contained 1.8 to 2.1 times more ribonucleic acid and protein than parent cells, but deoxyribonucleic acid (DNA) contents were similar. Heterogeneity in the populations with respect to release of H₂S, utilization of carbon sources, and growth on minimal medium is considered to be ancillary, rather than causally related, to increased radioresistance. The resistant isolates displayed an increased ability to reactivate gamma-irradiated P22 phage. DNA polymerase I and polynucleotide-joining enzyme activities were elevated in extracts of radioresistant cells relative to parent cells. It is suggested that the observed increases in radioresistance result from a selection of mutations leading to an increased capacity to repair DNA.

INDEX TERMS: Resistance, Radiation, Pollutant identification, Biochemical characteristics, Mutants, Bacterial physiology, *Salmonella typhimurium* LT2, Characterization.

AMIC-7286

"METHOD FOR EXPOSING BACTERIAL CULTURES ON SOLID MEDIA TO A DEFINED GAS MIXTURE USING NYLON BAGS", Hill, S., *Laboratory Practice*, Vol. 22, No. 3, March 1973, p 193.

In order to avoid any alteration of bacterial growth, a method has been devised for using nylon bags in the exposure of bacterial cultures on solid media to a defined gas mixture. The bags ensure a constant gas composition throughout the incubation period. Large numbers of cultures can easily be handled and growth can be observed without exposing the cultures to air. A description is given of the apparatus which has been used successfully for investigating the effect of O₂ concentration on colony formation of *Derxia gummosa* grown on solid N-free media (Hill, 1971). The obligate anaerobes *Clostridium pasteurianum* and *Desulfovibrio desulfuricans* have been grown on solid media in nylon bags: *Clostridium pasteurianum* on thioglycollate medium (Oxoid Ltd, England) under N₂ plus 1 percent CO₂ and *Desulfovibrio desulfuricans* on Baars's medium (Pankhurst, 1966) under N₂.

INDEX TERMS: Cultures, Bacteria, Methodology, Gases, Mixtures.

3. MICROBIOLOGICAL METHODS

AMIC-7306

"LOW COST MULTICHANNEL SCANNING pH-STAT", Kuenen, J. G., Cuperus, P., Harder, W., Laboratory Practice, Vol. 22, No. 1, January 1973, pp 36-38.

A scanning pH-stat is described which can control the pH in 12 cultures. The instrument consists of a commercial on/off pH controller connected to a generator giving a pulsating DC voltage which operates a magnetic valve. Opening the valves results in either the addition of alkali or acid to the culture. The scanner functions as a multiposition switch connecting a specific pH electrode to the corresponding magnetic valve. Depending on the capacity of the switch any number of electrodes and magnetic valves can be accommodated. In the system constructed, 12 positions were used. A time basis generator operates a solenoid which actuates the 12 position switch to monitor each culture and provide pH correction. The scanner has proved to be essentially trouble free during more than two years of operation.

INDEX TERMS: Cultures, Hydrogen ion concentration, Control systems, Automatic control, pH stat.

AMIC-7395

"ENUMERATION AND DIFFERENTIATION OF WATER BACTERIA WITH PHOSPHORUS-32", Khanna, P., Journal Water Pollution Control Federation, Vol. 45, No. 2, February 1973, pp 262-268.

A co-precipitation method for enumerating bacteria in water samples is based on the fact that non-multiplying cells utilize phosphorus by rapidly turning over ribonucleic acid and phosphoproteins. Since these compounds are insoluble in cold trichloroacetic acid (TCA), they can be precipitated out and measured so that the incorporation of radioactive phosphorus can be followed. The method was tested by mixing buffered *E. coli*, P-32, and carrier phosphorus and incubating for various time periods. After incubation, a clear solution of eggwhite equilibrated with carrier phosphorus was added, the mixture stirred, and cold TCA added to cause precipitation. The precipitate was then centrifuged, washed in TCA, ethanol, ethanol-ether, and ether, suspended in acetone, and filtered through a Whatman No. 4 disk. The P-32 activity was read from the filters with a Geiger-Mueller counter as an estimate of the bacterial population. The method, which provided results in 4 hrs., showed a linear relationship between population and phosphorus uptake in exposures up to 14 hrs. Tests with *E. coli*, *Streptococcus faecalis*, *Aerobacter aerogenes*, and *Proteus vulgaris* showed that gram-positive and negative cells can be differentiated by appending 1 percent KOH and 2 percent bile salt, respectively, to test samples.

INDEX TERMS: *E. coli*, Radioactivity techniques, Absorption, Phosphorus, Pollutant identification, Separation techniques, Co-precipitation, *Streptococcus faecalis*, *Aerobacter aerogenes*, *Proteus vulgaris*.

AMIC-7394

"BIOLOGICAL OXIDATION OF THE HYDROCARBONS IN AQUEOUS PHASE", Liu, D. L., Dutka, B. J., Journal Water Pollution Control Federation, Vol. 45, No. 2, February 1973, pp 232-239.

Biological oxidation of hydrocarbons in aqueous phase by *Pseudomonas desmolytica* was studied by manometric and gas chromatographic techniques. The organisms were grown on media containing n-decane and Indulin C in a cyclone fermenter for 20 hours before the harvesting of the cells. Cell-free extracts were prepared by centrifugation and chemical treatment. Overall oxygen consumption as determined in a differential respirometer was taken as a measure of enzyme activity. Oxidation products were identified using a chromatograph equipped for flame ionization detection. Cell free extracts prepared from cells grown on n-decane plus the thiolignin Indulin-C were more active in oxidation of n-decane than were corresponding cells grown on n-decane alone. The hydrocarbon-oxidizing enzyme was most active at pH 7 and could be precipitated by 30 percent ammonium sulfate. Manometric and gas chromatographic studies indicated that the initial oxidate attack occurred at the terminal methyl carbon and required both oxygen and nicotinamide adenine dinucleotide. These studies suggest that Indulin-C or other nontoxic surfactant may be used to accelerate biological treatment of petroleum wastewater.

INDEX TERMS: Microbial degradation, Oil wastes, Oxidation, Gas chromatography, *Pseudomonas desmolytica*, n-Decane.

AMIC-7397

"ISOLATION OF SALMONELLAE FROM MODERATELY POLLUTED WATERS", Dutka, B. J., Bell, J. B., Journal Water Pollution Control Federation, Vol. 45, No. 2, February 1973, pp 316-324.

Qualitative sampling techniques and enrichment broth/selective agar combinations for the demonstration of *Salmonella* in receiving waters were compared. The sampling procedures used were: (1) placement of collecting pad(s) at a specific station; (2) collection of a 5-gal (18.9-l) grab sample; (3) field filtration of 50 gal (189 l) of water in 5-gal (18.9-l) units; (4) collection of approximately 400 ml of water for coliform, fecal coliform, and fecal streptococcus density determinations and for 20 and 35 C standard plate count tests. One to eight days later the collecting pads were retrieved, and Procedures 2, 3, and 4 were repeated. All water samples, collecting pads, and filters were put on test within 6 hr of collection. Strips of the collecting pad(s), and the various filters were aseptically placed in both prewarmed tetrathionate and selenite enrichment broths. After incubation at 41.5 C for 20 plus or minus 2 hr, colonies resembling salmonellae were screened using phenylalanine and MacConkey's agars and incubated overnight at 35 C. Cultures showing reactions typical of *Salmonella* with these media were slide tested with *Salmonella* polyvalent O antisera. Specific O and H antisera were used to identify fully all suspected salmonellae. The collecting pad and 50-gal (189-l), field-filtered samples were equally efficient in isolating *Salmonella* from waters containing low to moderate numbers of coliforms. The efficiency of the collecting pads did not increase with prolonged exposure (3 to 5 days). The use of the 50-gal (189-l) on-site filtering technique is recommended for routine stream surveys. Tetrathionate broth/brilliant green agar proved to be the most productive broth-agar combination, but in different geographical locations, other media combinations may prove to be more productive.

3. MICROBIOLOGICAL METHODS

AMIC-7397 (Continued)

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INDEX TERMS: Water sampling, Isolation, Water pollution, Salmonella, Methodology, Pollutant identification, On-site tests, Laboratory tests, Selective media, Culture media, Enrichment, Culturing techniques, Biochemical tests, Serotypes.

AMIC-7399

"OCCURRENCE OF SALMONELLA IN OXIDATION DITCHES", Kampelmacher, E. H., van Noorle Jansen, L. M., Journal Water Pollution Control Federation, Vol. 45, No. 2, February 1973, pp 348-352.

An investigation was undertaken to determine the capability of oxidation ditches of the type used in small municipalities for the treatment of wastewater. Two oxidation ditches that treat slaughterhouse wastes were studied in reference to their ability to remove Salmonella. Five 100-ml samples of circuit liquid, influent, and effluent were collected within 30 min, transferred together to a liter bottle, and thoroughly shaken. The mixed samples were tested for salmonellae within a 4-hr period using tetrathionate enrichment media prepared by the Muller-Kauffman method, and the most probable number (MPN) computed. Variable numbers of Salmonella species were present in the effluent of the plants studied. The number of salmonellae/100 ml was less than 20, with one exception (350/100 ml). The ability of the plants to remove Salmonella was comparable to that of conventional wastewater treatment plants. Exact measurements of Salmonella reduction in the plant effluents were not possible, but it was feasible to determine bacteria counts in the influent, circuit liquid, and effluent during specific periods. In one of the plants, Salmonella contamination could be traced to its source. Results of the investigation support a theory about the circulation of Salmonella bacteria in natural systems.

INDEX TERMS: Oxidation lagoons, Salmonella, Pollutant identification, Waste water (pollution), Waste water treatment, Effluents, Sampling, Slaughterhouse wastes, Tetrathionate broth, Enrichment, Most probable number test, Influent.

AMIC-7398

"WATER QUALITY MODELS FOR TOTAL COLIFORM", Canale, R. P., Patterson, R. L., Gannon, J. J., Powers, W. F., Journal Water Pollution Control Federation, Vol. 45, No. 2, February 1973, pp 325-335.

First-order kinetic formulations approximated the death curve of total coliform bacteria following an initial growth period in experiments where domestic wastewater was added to Lake Michigan water. Three separate studies using water collected during different seasons have demonstrated that the first-order rate coefficient is temperature dependent and relatively independent of illumination, prechlorination, and season of the year. The rate coefficient exhibits a linear variation with temperature. The seasonal changes in total coliform density in the bay, as measured at the Traverse City municipal water intake, can be approximated using weighted sine and cosine series, auto-regression, and multiple-regression statistical models. Although it is possible to obtain a satisfactory fit of the data with each of these approaches, such models cannot be reliably used for long-range predictions. Historical data collected in Grand Traverse Bay demonstrate regular seasonal variations as well as long-range trends for total coliform density and turbidity. Additional data convey a consistent spatial pattern of total coliform at beaches in near-shore regions of the bay. These data and data from more recent surveys along with circulation patterns predicted from modeling studies suggest that a deterministic approach based on continuity equations may be possible.

INDEX TERMS: Coliforms, Water quality, Model studies, Turbidity, Temporal distribution, Environmental effects, Seasonal, Water temperature, Kinetics, Grand Traverse Bay, Survival.

AMIC-7401

"MICROBIAL DECOMPOSITION OF PENTACHLOROPHENOL", Kirsch, E. J., Etzel, J. F., Journal Water Pollution Control Federation, Vol. 45, No. 2, February 1973, pp 359-363.

A soil sample was obtained from the grounds of a wood products manufacturer in Terre Haute, Indiana, who used pentachlorophenol (PCP) and added to nutrient broth in order to obtain definitive evidence of PCP biodegradation in heterogeneous cultures of microorganisms. The biodegradation of sodium pentachlorophenate was observed in both proliferating and nonproliferating mixed bacterial populations that had previously received lengthy acclimation to the biocide. Definite proof of dissimilation was obtained by measuring the release of C-1402 from radioactive sodium pentachlorophenate. The maximum yield of CO₂ in a 24-hr exposure period was 68 percent in nonproliferating cultures. The rate and extent of decomposition in proliferating cultures was significant but less than found in nonproliferating cultures. Spontaneous, nonbiological decomposition of sodium pentachlorophenate was observed but did not exceed 0.1 percent in a 48-hr reaction period.

INDEX TERMS: Microbial degradation, Wood preservatives (pesticides), Cultures, Microorganisms, Radioactivity techniques, Bioassay, Radiochemical analysis, Pentachlorophenol, Fate of pollutants, Sodium pentachlorophenate, Bacterial populations, Substrate utilization, Degradation products, Heterotrophy.

3. MICROBIOLOGICAL METHODS

AMIC-7402

"MICROBIAL COMMUNITY STRUCTURE IN CONTAMINATED ESTUARINE SEDIMENTS", Roach, A., Silvey, J. K. G., Guthrie, R. K., Journal Water Pollution Control Federation, Vol. 45, No. 2, February 1973, pp 365-368.

Punch cores were taken at 4-m intervals along transects in estuarine flats near Flour Bluff, Texas. One tenth ml of mud from a subcore drawn at 2 dm of each core and at each 0.5 dm of the cores was diluted 1:1,000 and placed on an extract medium. The extract medium was designed to give the broadest possible cross section of microbial population and was prepared by (1) adding 500 ml of deionized water to 500 g of mud; (2) cooking for 30 minutes at 90 C in a double boiler; (3) allowing mud to settle and decanting; (4) adding 2 g yeast extract, 15 g mannitol, 0.5 g each of calcium sulfate and magnesium sulfate, 20 g agar, and sufficient deionized water to make 1 liter. Frequencies were plotted for each organism encountered on five plates per subcore sample. A Raunkiaeran frequency spectral analysis showed that a structured community rather than a heterogeneous mixture existed laterally over the space of some 80 m in uniform bottom mud. Moreover, such structure resembled that of an undisturbed, climax surface community. A community coefficient analysis showed no significant stratification or vertical discontinuity to a depth of 8 dm.

INDEX TERMS: Biological communities, Estuarine environment, Sediments, Distribution patterns, Bacteria.

AMIC-7407

"EVALUATION OF COLIFORM TESTS FOR CHLORINATED SECONDARY EFFLUENTS", Lin, S., Journal Water Pollution Control Federation, Vol. 45, No. 3, March 1973, pp 498-506.

The purpose of this investigation was (1) to determine whether or not the LES two-step enrichment MF technique for total coliform assay on chlorinated effluents is comparable to the recommended MPN method and (2) to compare fecal coliform detection by M-FC MF technique on chlorinated secondary effluents with the MPN procedure. Grab samples of secondary effluent were collected from three Illinois treatment plants, chlorinated with up to 6 mg/l of chlorine, stirred, dechlorinated after various periods of contact by sodium thiosulfate, and assayed. The results showed that the LES two-step MF procedure is comparable to the completed MPN techniques for total coliform detection in chlorinated secondary effluents. Total coliform recovery in chlorinated effluent by the LES two-step MF technique was approximately 1.5 times that observed using the M-Endo, one-step MF procedure. Fecal coliform recovery using the M-FC MF technique on chlorinated effluent was less than that obtained using confirmed MPN in EC broth. Estimates of MPN densities in chlorinated secondary effluent might be useful from currently acceptable MF procedures by using a mathematical relationship similar to log MPN equals to 1.062 log MF minus 0.014.

INDEX TERMS: Cultures, Chlorination, Separation techniques, Sewage effluents, Fecal coliforms, Membrane filter, Most probable number test, Method evaluation.

AMIC-7410

"A ZOOGLOEA BACTERIUM WITH GELATINOUS MUCOPOLYSACCHARIDE MATRIX", Tezuka, Y., Journal Water Pollution Control Federation, Vol. 45, No. 3, March 1973, pp 531-536.

A zoogloea-forming bacterium was isolated from activated sludge and identified tentatively as belonging to the genus Zoogloea. The bacterium grew in liquid media with the formation of amorphous gelatinous colonies in which the bacterial cells were sparsely embedded. The gelatinous substance was isolated and purified partially: it was a mucopolysaccharide composed primarily of two amino sugars. One of these sugars was identified as N-acetylglucosamine, and the other was suggested to be N-acetylfucosamine. The molar ratio of the former to the latter was approximately 1:2. The polymer was quite resistant to the action of the microfloras from wastewater and soil.

INDEX TERMS: Pollutant identification, Cultures, Separation techniques, Activated sludge, Zoogloea.

AMIC-7413

"ENTERIC VIRUS SURVIVAL IN ALGAL-BACTERIAL WASTEWATER TREATMENT SYSTEMS-I. LABORATORY STUDIES", Sobsey, M. D., Cooper, R. C., Water Research, Vol. 7, No. 5, May 1973, pp 669-685.

The survival of a representative enteric virus, poliovirus type 1, in laboratory models of algal-bacterial sewage treatment systems and the interactions of poliovirus with stabilization pond water was studied. In laboratory reactors a fraction of the total poliovirus present rapidly adsorbed to stabilization pond water solids by a reversible process, conforming to a Freundlich adsorption isotherm. In laboratory cultures the growth of Scenedesmus quadricauda and Bacillus megaterium in sterile sewage had no detrimental effect on poliovirus survival, whereas the growth of heterogeneous populations of stabilization pond bacteria in the same medium resulted in substantial virus inactivation. Appreciable poliovirus inactivation occurred in laboratory cultures of mixed algal-bacterial populations obtained from stabilization ponds. Because the degree of antiviral activity in these cultures was greater than that in cultures of stabilization pond bacteria alone, additional microbial factors must contribute to this virus inactivating phenomenon. The results of this study suggest that in algal-bacterial treatment systems both virus adsorption to solids and virus inactivation due to microbial activity play a role in reducing the enteric virus concentration in wastewater.

INDEX TERMS: Waste water treatment, Oxidation lagoons, Biological treatment, Laboratory tests, Bioassay, Sewage effluents, Enterovirus, Survival, Scenedesmus quadricauda, Bacillus megaterium, Inactivation, Data interpretation, Heterotrophy.

3. MICROBIOLOGICAL METHODS

AMIC-7414

"SUR L'ISOLEMENT ET L'ACTIVITE BACTERIOLYTIQUE DE QUELQUES MYXOBACTERIES ISOLEES DE L'EAU", Raverdy, J., Water Research, Vol. 7, No. 5, May 1973, pp 687-693.

Four strains of Myxobacteria were isolated in samples of river water. Their bacteriolytic activity was studied in relation to 24 strains of Gram-negative bacilli and 10 strains of Gram-positive bacteria. Their morphology and cultural characteristics are described and their role in the phenomena of self-purification is discussed. (In French)

INDEX TERMS: Isolation, Cytological studies, Pollutant identification, Water sampling, Methodology, Myxobacteria, Fate of pollutants, Bacteriolytic activity, Gram-negative bacteria, Gram-positive bacteria, Biochemical characteristics.

AMIC-7423

"THE OCCURRENCE AND POSSIBLE SOURCE OF THE COLIFORM BACTERIA ON THE SHORELINE OF NORTHERN LAKE MICHIGAN", Mack, W. N., Dekker, C. L., Michigan State University, Department of Microbiology and Public Health, East Lansing, Michigan, Completion Report, Contract No. 14-31-0001-3598, November 1972, 25 pp. NTIS Report No. PB 213 503.

During studies on the presence of coliform bacteria in a marina used by pleasure watercraft in northern Lake Michigan, it was determined that there were more coliform organisms present in the water than could be accounted for by the presence of the watercraft. This resulted in a study to determine the source of these organisms. Samples of water were collected from thirteen rivers and creeks draining the 12-mile beach study area. The water was analyzed for coliforms by Standard Methods. All the streams were found to contain coliforms with larger numbers in the rivers. Two of the rivers drained watershed areas in which man and domesticated animals reside. Those streams draining remote areas contained more coliform bacteria than streams draining populated areas. Of the organisms identified 43-86 percent were of *Escherichia coli*, variety I; the other species were *Escherichia freundii* and *Aerobacter*. The organisms washed into Lake Michigan from the streams accumulated along the beach but very few organisms were recovered as little as 1000 feet out into the lake from the shoreline.

INDEX TERMS: Coliforms, Lake Michigan, Water pollution sources, Pollutant identification, *E. coli*, Rivers, Streams, Recreation, Bioindicators, *Escherichia freundii*, *Aerobacter*.

AMIC-7416

"TRAITEMENT EXPERIMENTAL D'EPURATION D'UNE EAU DE SURFACE PAR LAGUNAGE: ASPECTS CHIMIQUES ET MICROBIOLOGIQUES", Water Research, Vol. 7, No. 5, May 1973, pp 707-728.

Polluted river water was treated by lagooning in an experimental bed. The evolution of the most representative parameters of the organic and bacterial pollution has been studied in relation to the period of retention. The predominant bacterial populations have been identified and their qualitative and quantitative variations have been related to the degree of pollution. The analytical results are commented upon the advantages of the method are stressed. (In French)

INDEX TERMS: Methodology, Chemical properties, Lagoons, Water pollution, Isolation, Microbiology, Pollutant identification, Bioindicators, Chemical analysis, Dominant organisms, Water treatment, Rivers, Water analysis, Bacterial populations.

AMIC-7428

"PHAGE-TYPING OF STAPHYLOCOCCUS AUREUS", Parker, M. T., In: Methods in Microbiology, Vol. 7B, Academic Press, New York, 1972, pp 2-28.

This chapter of 'Methods in Microbiology' discusses the historical development and present technical methods of phage typing as a means of distinguishing *Staphylococcus aureus*, interpretation of results from phage typing, staphylococci from domestic animals, taxonomic significance of phage typing, and the future potential of the method. The section on technical methods thoroughly reviews the media and conditions of growth, propagation and testing of phages, typing, and reading and reporting of results. The section on interpretation discusses the range and causes of variability and long-term changes in typing patterns.

INDEX TERMS: Separation techniques, Pollutant identification, Phage typing, Data interpretation, Culture media, *Staphylococcus aureus*.

4. METHODS AND PERFORMANCE EVALUATION

AMIC-6972

"A METHOD FOR COMPUTING REGRESSION COEFFICIENTS UTILIZING INCOMPLETE OBSERVATIONS", Lynch, C. J., The American University, Washington, D.C., Dissertation Abstracts No. 73-1350, 1972, 78 p. (Complete report not available from AMIC)

A method is presented for estimating coefficients of linear regressions when some observation data are missing at random. The linear model is given by $Y_{sub t} = \beta_0 + \beta_1 X_{sub t 1} + \dots + \beta_P X_{sub t P} + e_{sub t}$, where the index t identifies the observation number and the $e_{sub t}$ are independent random disturbance terms with mean value 0 and (unknown) variance σ^2 . Coefficients are estimated for the conditional distribution of Y given fixed values of the X 's. Observation data consist of vectors drawn from some unspecified multivariate population. Some observation vectors have components missing at random, but it is assumed that N of these vectors have at least one X value available. These N vectors are used for computing estimators of the regression coefficients. In the process of deriving these estimators, denoted by $s_{sub ij}$, missing data are approximated as regressands in least squares equations whose parameters are computed over the subset of complete observations. The $s_{sub ij}$ are then inserted in classical least squares formulas and estimators (consistent (C) estimators) of the parameters $\beta_{sub k}$, $k = 0, 1, \dots, P$ are derived. The asymptotic variance-covariance matrix of the C estimators is derived for the case of no missing dependent variables. Monte Carlo experiments were conducted to compare the C estimators to classical least squares estimators based on the subset of complete observations and to Glasser's estimators, the only other published set of consistent estimators applicable to more than two non-random independent variables. The experiments were conducted for N equals 25 with P equals 3 and for N equals 40 with P equals 5. The sample mean-square-error

AMIC-7095

"OPTIMUM SAMPLE SIZES FOR THE COMPARISON OF THE CONTROL AND TREATMENT", Nam, J.-M., Biometrics, Vol. 29, No. 1, March 1973, pp 101-108.

The optimum sample sizes for the control and treatment groups for testing the difference between average survival times are investigated when the costs of testing the two groups differ. Situations are considered where the test cost per subject is constant and independent of its survival time as well as where it is proportional to its survival time. The optimum sample sizes are greatly preferred over equal sample sizes when the difference between the cost for the control and that for the treatment is large.

INDEX TERMS: Statistical methods, Sample size determination.

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and, separately, the absolute value of the sample bias were used as test criteria. The Monte Carlo experiments suggest that the C estimators retain their relative superiority over Glasser's estimators with respect to both mean-square-error and bias and over classical least squares with respect to mean-square-error for N equals 25 with P equals 3 and for N equals 40 with P equals 5. The Monte Carlo experiments also suggest that the C estimators retain their relative superiority over classical least squares with respect to bias for N equals 40 with P equals 5, but the reverse is true for N equals 25 with P equals 3.

INDEX TERMS: Statistical methods, Regression analysis, Least squares method, Model studies, Estimators, Regression coefficients, Incomplete observations, Monte Carlo method, Variance-covariance matrix, Mean square error, Variance, Bias, Data interpretation.

AMIC-7171

"ON THE STORAGE OF SEAWATER SAMPLES FOR AMMONIA DETERMINATION", Degobbs, D., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 146-150.

In order to clarify conflicting results concerning the effect of storage on ammonia concentration, a study was initiated to investigate the effects various storage parameters. Seawater samples were collected from Monterey Bay, California. Portions of the samples were analyzed immediately in shipboard laboratories. The remaining portions were stored in glass or polyethylene containers; filtered or unfiltered; slow frozen or quick frozen and with or without added preservatives. After various periods of time up to 20 days, samples were thawed, analyzed by the phenol-hypochlorite method, and the results compared with those from the unstored samples. The results showed significant changes in samples stored without treatment. Ammonia increased when stored in glass, but decreased when stored in polyethylene containers. Quick freezing and slow freezing stabilized ammonia concentrations, although variability was increased; quick freezing had no advantage over slow freezing. Preservation with phenol at the same concentration used in the analytical method (0.4 g 100 per ml) stabilized unfrozen samples for up to 2 weeks.

INDEX TERMS: Storage, Ammonia, Filtration, Freezing, Sample preservation, Sample containers.

4. METHODS AND PERFORMANCE EVALUATION

AMIC-7445

"A TEST OF EQUALITY OF MEANS OF CORRELATED VARIATES WITH MISSING DATA ON ONE RESPONSE", Morrison, D. F., *Biometrika*, Vol. 60, No. 1, April 1973, pp 101-105.

A statistic is proposed for testing the hypothesis of equality of the means of a bivariate normal distribution with unknown common variance and correlation coefficient when observations are missing at random on one of the variates. Expressions for the second and fourth moments of the statistic have been obtained, and normal, t and Cornish-Fisher approximations to the percentage points under the null hypothesis have been found from them. The expected squared lengths of the confidence intervals for the mean difference have been used to measure the additional sensitivity of the test over that of the conventional paired t .

INDEX TERMS: Statistical methods, Hypothesis testing, Missing data.

AMIC-7481

"REPORT OF ANALYSES OF WATER SAMPLES SUBMITTED TO SCRIPPS NOVEMBER 1971 FOR THE LAKE MICHIGAN INTERCALIBRATION/INTERCOMPARISON PROGRAM (EIIP)", Folsom, T. R., Hodge, V. F., Wong, K. M., Hansen, N., Scripps Institution of Oceanography, Soledad Environmental Radioactivity Laboratory, La Jolla, California, Report No. TID-26199, Contract Nos. AT (04-3)-34, N00014-69-A-0200-6011, April 6, 1972, 6 pp.

Water samples were collected at 45 m in Lake Michigan and from the surface near a Chicago water intake station. The latter sample was spiked with radionuclides, including Cs. The pH of both samples was adjusted to 1.0 with dilute NaOH and Cs-133 and Pu-236 spikes were added. The samples were agitated for 15 min, 10 g of pure AMP added to each, and the agitation continued for 15 min more. The AMP precipitates were combined for gamma assay after which they were analyzed for stable Cs, Pu recovery, and Cs-134 and Cs-137. The sample of Lake Michigan water contained 0.058 plus or minus 0.014 pCi (plus or minus 1 gamma)/kg Cs-137, 0.005 pCi/kg Cs-134, and 0.0007 plus or minus 0.0003 pCi/kg Pu-239 and Pu-240. In the spiked sample was found 3.66 plus or minus 0.10 pCi/kg Cs-137, 2.76 plus or minus 0.08 pCi/kg Cs-134, and 0.0373 plus or minus Pu-239 and Pu-240. It was concluded that although considerable care was used in these analyses, they should not be used for final evaluation of the relative capabilities of the several laboratories or of the general conditions in Lake Michigan because (a) not enough samples were supplied, (b) the low level reference standards have not been intercompared in all laboratories, and (c) absolute checks of radioactivity of several of these isotopes are still controversial at these very low concentration levels.

AMIC-7446

"A TWO-SAMPLE PROCEDURE FOR SELECTING THE POPULATION WITH THE LARGEST MEAN FROM SEVERAL NORMAL POPULATIONS WITH UNKNOWN VARIANCES", Ofose, J. B., *Biometrika*, Vol. 60, No. 1, April 1973, pp 117-124.

This paper gives a two-sample procedure for selecting the population with the largest mean from k normal populations with unknown variances. The method is based on a two-sample procedure proposed by Stein (1945). Tables necessary for the application of the procedure are given for selected values of k . Comparisons of the minimum values of the expected sample sizes using the proposed procedure are made with the corresponding single-sample sizes for known variances (Bechhofer, 1954). Comparisons are also made of the expected total sample sizes for the single-sample procedure, the two-sample procedure given in this paper and the two-sample procedure proposed by Bechhofer, Dunnett and Sobel (1954) which assumes that the populations have known variance ratios. It is shown that the expected total sample sizes are not much increased by ignorance of the variance ratios.

INDEX TERMS: Two-sample procedure, Mean values.

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INDEX TERMS: Water analysis, Methodology, Performance evaluation, Intercalibration programs, Method evaluation, Cesium radioisotopes, Plutonium radioisotopes, Chemical recovery, Interlaboratory tests.

5. INSTRUMENT DEVELOPMENT

AMIC-6824

"GUIDE TO SELECTING UNINTERRUPTIBLE POWER SYSTEMS", Instruments and Control Systems, Vol. 46, No. 3, March 1973, pp 84-86.

The general characteristics of uninterruptible power systems are described. There are basically two systems: rotating power systems which employ flywheels to filter the effects of transients, maintain rotation after power failure, and start the auxiliary prime mover; and static systems which employ batteries and DC-to-AC converters. The advantages and disadvantages of the systems are described, and manufacturers are listed.

INDEX TERMS: Electrical equipment, Uninterruptible power systems.

AMIC-7125

"MEASUREMENT OF CURRENT AND POTENTIAL DISTRIBUTION AT ROTATING-DISK ELECTRODES", Miller, B., Bellavance, M. I., Journal of the Electrochemical Society, Vol. 120, No. 1, January 1973, pp 42-53.

Current distribution at the rotating disk electrode has been experimentally evaluated by several techniques including single and double reference probe potential mapping, ring-disk electrode collection efficiency and resistive interaction, interrupter and steady-state resistance measurements, and automatic ohmic compensation methods. Mapping experiments are in quantitative agreement with the predictions of Newman's theory for this system and were further confirmed by resistance determinations and theoretically based correction methods. The implications of the data for various ring-disk and nonsteady-state experiments and also the utility of an approximate approach to estimating the degree of nonuniform current distribution are examined.

INDEX TERMS: Zeta potential, Electric currents, Measurement, Laboratory tests, Electrical resistance, Electrical properties, Instrumentation, Rotating disk electrode, Current distribution, Collection efficiency, Potentiometry, Sensors.

AMIC-6858

"DEVELOPMENT OF AN OIL/WATER POLLUTION MONITOR", McGrath, F. K., Naval Postgraduate School, Monterey, California, Master's Thesis, June 1972, 35 pp. NTIS Report No. AD 747 084.

Because of the simplicity, ruggedness, and state of the art, ultrasonic techniques were chosen for monitoring oil in bilge and ballast water from ships. Crystalline quartz was used to produce ultrasonic waves at 30 Mhz which were monitored for attenuation using another quartz crystal. The system was tested in the laboratory with a tank designed to circulate contaminated water past the monitor. Calibrations were made with distilled water before testing with water containing up to 500 ppm fuel oil. Results with contaminated tap water were inconclusive, but attenuation was found to vary linearly with oil concentration when the contaminant level was less than 500 ppm in distilled water. Turbulence disturbed the signals, but could probably be eliminated by filtering. Although results are preliminary, the method is potentially useful for monitoring relatively low levels of oil in water.

INDEX TERMS: Oily water, Monitoring, Electronic equipment, Ultrasonics, Fuel oil.

AMIC-7179

"AN INEXPENSIVE, RECORDING TIDE GAUGE", Tempel, N. R., Limnology and Oceanography, Vol. 18, No. 1, January 1973, pp 178-180.

An inexpensive, recording tide gauge that can operate a standard recorder remote from the sensing unit without line power has been constructed and tested in a small tidal pond on the north shore of Long Island. The unit consists of a 4-in. ID PVC tube about 4 m long and is similar in principle to the mechanical drum-float type instrument. Readout is accomplished electronically so that a 0-1 mA recorder can be incorporated for remote recording. This innovation reduces the cost of the instrument to less than 50 dollars if a recorder is already on hand.

INDEX TERMS: On-site data collections, Remote sensing, Instrumentation, Tidal waters, Tides, Calibrations, Measurement, Volume, Recording tide gages, Flax Pond.

5. INSTRUMENT DEVELOPMENT

AMIC-7242

"A TECHNIQUE USING POROUS CUPS FOR WATER SAMPLING AT ANY DEPTH IN THE UNSATURATED ZONE", Wood, W. W., Water Resources Research, Vol. 9, No. 2, April 1973, pp 486-488.

An improved design of the Parizek-Lane system is described which permits the collection of water samples at any specific depth, saturated or unsaturated. In general, the system operates by applying a vacuum greater than soil suction to a buried porous cup, and thereby water is induced to flow from the unsaturated material into the cup. Gas pressure is then applied to one tube of a two-tube system and the sample is forced to the surface. A check valve in the cup assembly prevents pressurization of the porous cup. This construction permits complete collection at any depth without the loss of samples. A detailed description of construction and operation illustrates the advancement over previous designs.

INDEX TERMS: Water sampling, Methodology, Equipment, Artificial recharge, Unsaturated flow, Design, Installation, Groundwater, Suction lysimeters, Porous cups, Zone of unsaturation.

AMIC-7351

"A NEW MODEL FOR THE RESPONSE OF A CYANIDE SELECTIVE SILVER IODIDE MEMBRANE ELECTRODE", Bound, G. P., Fleet, B., von Storp, H., Evans, D. H., Analytical Chemistry, Vol. 45, No. 4, April 1973, pp 788-789.

Selectivity data are presented for a pure AgI membrane in a mercury-mercuric chloride test cell. K values were calculated from results obtained with individual solutions and with solutions containing a constant level of iodide to which varying concentrations of cyanide were added. A model is included which describes the behavior of the electrodes and accounts for the differences in K values obtained with the two solutions.

INDEX TERMS: Electrodes, Ion selective electrodes, Cyanides, Selectivity, Membrane electrodes.

AMIC-7287

"SELECTIVE POTASSIUM-SENSITIVE ELECTRODES BASED ON POTASSIUM TETRA-P-CHLOROPHENYLBORATE-POLY(VINYL CHLORIDE) SENSOR MEMBRANES", Davies, J.E.W., Moody, G. J., Price, W. M., Thomas, J.D.R., Laboratory Practice, Vol. 22, No. 1, January 1973, pp 20-25.

The fabrication and performances of three different sensor membranes comprising varying quantities of potassium tetra-p-chlorophenylborate ion exchanger, but incorporating a fixed quantity of poly(vinyl chloride) matrix, are discussed with regard to potential behaviour in pure potassium solutions and in the presence of possible interferants. Response times, gamma radiation stabilities and operational life times are also discussed. Electrodes of comparable performance are obtained by coating platinum or silver with an ion exchanger/PVC mixture.

INDEX TERMS: Fabrication, Selectivity, Laboratory equipment, Physical properties, Performance evaluation, Potassium PVC electrodes, Ion selective electrodes, Sensors, Matrix membranes, Chemical interference, Ionic interference, Ion exchange electrodes, Selectivity coefficients.

AMIC-7352

"A PENICILLIN SELECTIVE ENZYME ELECTRODE", Papariello, G. J., Mukherji, A. K., Shearer, C. M., Analytical Chemistry, Vol. 45, No. 4, April 1973, pp 790-792.

An enzyme electrode has been developed which utilizes penicillin beta-lactamase (penicillinase) and is responsive to intact penicillin. The electrode is prepared by immobilizing the penicillinase in a thin membrane of polyacrylamide gel molded around and in intimate contact with a hydrogen ion glass electrode. When this electrode is exposed to an aqueous solution of penicillin adjusted to a pH of 6.4, the immobilized enzyme hydrolyzes the penicillin to produce the corresponding penicilloic acid. The increase in hydrogen ion concentration from the penicilloic acid is sensed by the glass electrode and a potentiometric response is recorded. This electrode is analytically useful in the penicillin concentration range of 0.0001-0.05 M. The response time is dependent upon the age of the electrode, with the typical response time being 15-30 sec. pH affects the solubility and stability of penicillin, and the reactivity of penicillinase. The authors found the electrode to be most sensitive and responsive at pH 6-7. If the electrode is prepared as recommended, (1) there is enough penicillinase to react with more than 0.5 mole of a penicillin; and (2) the electrode will function in an acceptable manner for up to 2 weeks making possible a hundred or more measurements.

INDEX TERMS: Fabrication, Physical properties, Aqueous solutions, Selectivity, Research equipment, Pollutant identification, Antibiotics (pesticides), Chemical reactions, Penicillinase, Enzyme electrodes, Penicillin, Penicillin enzyme electrode, Membrane electrodes, Substrate concentration, Detection limits, Response time, Specificity.

AMIC-7375

"A THERMAL WAVE FLOWMETER FOR MEASURING COMBINED SEWER FLOWS", Blase, R. A., Eshleman, P. W., Hydrospace-Challenger, Inc., Rockville, Maryland, Report No. EPA-R2-73-145, Contract No. EPA 14-12-911, March 1973, 100 pp.

A study of the application of thermal techniques to the measurement of flow rates in combined sewers has been conducted. The utilization of flush-mounted hot wire or hot film anemometers in a direct reading mode was extensively investigated. It was concluded that such a direct reading application was not feasible due to shifts in calibration caused by the build-up of contamination and the lack of commercially available units with sufficient ruggedness and reliability for application in a combined sewer pipe. A particular technique, which is based upon measuring the time-of-flight of thermal pulses generated at various positions around the periphery of the pipe, was investigated in depth. A full scale prototype unit using five thermal wave sensors distributed around one-half of the circumference of the pipe was fabricated and tested. These tests indicated that the present configuration does not provide signals which have adequate precision to enable this unit to measure the fluid flow with the desired accuracy.

INDEX TERMS: Flow rates, Flow measurement, Anemometers, Velocity, Combined sewers, Testing procedures, On-site tests, Waste water (pollution), Thermal wave flowmeter, Pollutant effects.

AMIC-7443

"EXISTING AUTOMATION, CONTROL AND INTELLIGENCE SYSTEMS FOR METROPOLITAN WATER FACILITIES", Poertner, H. G., Colorado State University, Department of Civil Engineering, Fort Collins, Colorado, Technical Report No. 1, Contract No. DI-14-31-0001-3410, January 1972, 149 pp. NTIS Report No. PB 214-266.

A survey was made of existing and planned applications of instrumentation in water and wastewater systems of selected urban and metropolitan areas of the United States. The basic goal was to make available information concerning instrumentation and automation that would be useful to decision-makers in providing and operating such systems. Summaries are included on specific applications of monitoring, data logging and analysis, data processing and reduction, conventional supervisory control, automation, and computer control of operations. The various systems reported upon are water supply, water treatment, wastewater and stormwater collection, wastewater treatment and disposal, water quality monitoring, and hydrologic data collection.

INDEX TERMS: Instrumentation, Automation, Electronic equipment, Hydrologic data, Control systems, Data collections, Data transmission, Methodology, Water quality, Monitoring, Distribution systems, Cities, Surveys.

AMIC-7438

"AERIAL SURVEILLANCE SPILL PREVENTION SYSTEM", Rudder, C. L., Reinheimer, C. J., Berrey, J. L., McDonnell Douglas Corporation, McDonnell Aircraft Company, Reconnaissance Laboratory, St. Louis, Missouri, Report No. EPA-R2-72-007, Contract No. EPA, ORM 68-01-0140, August 1972, 112 pp.

An aerial surveillance system, consisting of four Hasselblad cameras and a Zeiss RMK 1523 camera, was evaluated for the remote detection of both real and potential spills threatening inland waterways. Twenty-three multiband and baseline missions were flown over oil refineries and other industrial sites located adjacent to the Mississippi River. Baseline flights were effective in counting storage tanks, locating and identifying storage equipment and pipeline systems and determining dike conditions. Stereoscopic analysis of baseline imagery was used to estimate the height of tanks and dikes, drainage patterns and the area of openly stored waste products. The multiband imagery was obtained by combining each of nine filters with each of three different black-and-white films. Spectral contrast image enhancement was accomplished by either suppressing or transmitting the target reflected radiation through proper film/filter selections. Spills, effluents and waste areas were hence identified on the multiband imagery. Normal and false color imagery was evaluated with the multiband imagery to determine the best film/filter combinations for the areas of interest. Finally, the personnel, equipment and procedures required to implement an aerial surveillance spill prevention system were determined.

INDEX TERMS: Remote sensing, Industrial wastes, Oil wastes, Waste disposal, Thermal pollution, Powerplants, Steel mills, Refineries, Titanium plants, Asphalt, Gasoline, Fly ash, Process water, Lime sludge, Sulfuric acid, Coal, Cement plants.

AMIC-7456

"THROUGH THE MINI MAZE", Folts, J., Automation, Vol. 20, No. 2, February 1973, pp 44-48.

A discussion is presented which represents an effort to give those researchers interested in using minicomputers some idea of the real costs of mini systems and the hidden pitfalls of minicomputer application. The applications considered are those in which (1) no changes are made in the mini system without first taking it off-line; (2) multifunctional tasks are considered and the application programs are altered or replaced while the system is still on-line; and (3) multifunctional tasks involve incorporating on-line interaction with terminals and the ability to change application programs while simultaneously performing background computations. Extensive record-keeping and summary report generation is also involved. Three classes of machines that will provide the 'computer horsepower' to perform the above tasks are described and assessed on the basis of costs and performance. In addition, the pitfalls of system design are discussed.

INDEX TERMS: Data collections, Real costs, Monitoring, Data processing, Equipment, Water pollution, Automatic control, Design criteria, Industrial production, Minicomputers, Performance evaluation.

5. INSTRUMENT DEVELOPMENT

AMIC-7459

"DETECTORS FOR MEASUREMENT OF WATER POLLUTION", Process Biochemistry, Vol. 8, No. 3, March 1973, pp 31-33.

A symposium on this subject was held in January at the Electronics Division of the Institution of Electrical Engineers. Papers presented by representatives from instrument companies, the Water Resources Board, the Department of the Environment, the Water Research Association and River Authorities covered the following topics or areas of interest: (1) 'Improvements to the Organic Carbonic Monitor', (2) 'Recent Developments in Sensors and Systems for Monitoring Water Quality', (3) 'The Application of Gas Permeable and Selective Ion Electrodes to Continuous Water Quality Monitoring', (4) 'The Use of an Ammonia-Sensitive Membrane Electrode', (5) 'Application of Atmospheric Turbidity Monitoring Techniques to Water Turbidity Monitoring', (6) 'Automatic Monitoring of River Water Quality', (7) 'Some Operational Problems Associated with River Water Quality Monitors', (8) 'Practical Experiences in River Water Quality Monitoring'.

INDEX TERMS: Measurement, Water pollution, Monitoring, Instrumentation, Methodology, Automatic control, Pollutant identification, Detectors, Sensors, Ion selective electrodes, Membrane electrodes.

AMIC-7466

"DIGITAL-TO-ANALOG CONVERTER HAVING COMMON-MODE ISOLATION AND DIFFERENTIAL OUTPUT", Hellwarth, G. A., Boynodiris, S., IBM Journal of Research and Development, Vol. 17, No. 1, January 1973, pp 54-60.

A digital-to-analog converter (DAC) is described that has transformer-coupled isolation for both power and data inputs and provides a true differential output. The DAC provides a 10-bit, 10.23-V unipolar output of either polarity, depending on which of the two output lines is used as the load reference potential. The common mode potential may be as large as 250 V, and below 120 Hz the common-mode rejection typically exceeds 100 dB. The isolated, balanced circuit eliminates environmental noise problems and permits long cabling lengths without loss of dc accuracy. The DAC is an analog output feature available on the IBM System/7, a small computer designed for data acquisition and real-time automation applications.

INDEX TERMS: Automatic control, Data collections, Data processing, Instrumentation, Data storage and retrieval, Electrical properties, Electrical equipment, Digital-to-analog converters, Common-mode isolation, Differential output, Performance evaluation, Accuracy.

AMIC-7464

"FOCUS ON A/D AND D/A CONVERTERS", Kaye, D. N., Electronic Design, Vol. 21, No. 1, January 4, 1973, pp 56-65.

Analog-to-digital and digital-to-analog converters are discussed in reference to their circuitry, modes of operation, and other specifications. The vast majority of d/a converters on the market today use two basic circuits: the weight-resistor network and the R-2R configuration. These two types are most conveniently described for the case of a voltage-output d/a--that is, the case where a digital input yields a discrete voltage level at the output. As with d/a converters, the vast majority of a/d converters on the market comprise two basic types: the dual-slope integration a/d converter and the successive approximation a/d converter. Each takes a voltage input and puts out a digital code proportional to the input voltage. A/d specifications are similar to d/a specifications, a main difference being the output of a series of digital codes by an a/d converter. Manufacturers of converters of various specifications and costs are listed.

INDEX TERMS: Automatic control, Specifications, Design data, Data collections, Electrical equipment, Instrumentation, Design criteria, Analog-to-digital converters, Digital-to-analog converters, Accuracy.

AMIC-7480

"APPLICATIONS OF REMOTE SENSING TECHNIQUES TO BUOY-BASED ENVIRONMENTAL DATA GATHERING", Derr, V. E., Little, C. G., Emanuel, C. B., et al., National Oceanic and Atmospheric Administration, Wave Propagation Laboratory, Boulder, Colorado, NOAA Technical Memorandum ERL WPL-7, September 1972, 148 pp. NTIS Report No. COM-73-10134.

This report, written by the staff of the Wave Propagation Laboratory (WPL), is in response to a request by the National Data Buoy Project (NDBP) to evaluate the possible remote sensing techniques for the interrogation of both the marine atmosphere and the ocean from buoys. This abbreviated study is far from complete, but the principal optical, radio, and acoustic remote sensing concepts relevant to ocean buoys are identified and discussed. The main body of the report discusses existing remote sensing concepts (acoustic echo sounding, radar, lidar, radiometry, and line-of-sight methods) and makes a preliminary evaluation of their potential applicability to the needs and objectives of the National Data Buoy Project. The environmental difficulties which a system may be expected to experience on the buoy are not treated in depth at this time. A preliminary set of recommendations are presented which are directed toward the efficient exploration and realization of the potentials of the different remote sensing systems.

INDEX TERMS: Remote sensing, Buoys, Radar, Meteorological data, Oceans, Surface waters, On-site data collections, Air environment, Methodology, Lidar, Radiometry, Acoustic echo sounding, Marine environment, Method evaluation.