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Reviews of Current Literature on Analytical Methodology and Quality Control

No. 19

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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. 19

By

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OFFICE OF RESEARCH AND MONITORING
U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

NATIONAL ANALYTICAL METHODS DEVELOPMENT RESEARCH PROGRAM
ANALYTICAL QUALITY CONTROL LABORATORY

REVIEWS OF CURRENT LITERATURE ON ANALYTICAL METHODOLOGY AND QUALITY CONTROL

No. 19 August 1973

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.

CONTENTS

AMIC-3794
"A STUDY OF NUTRIENT VARIATIONS IN THE SURFACE AND MIXED LAYER OF MONTEREY BAY USING AUTOMATIC ANALYSIS TECHNIQUES", Paulson, G. O., Naval Postgraduate School, Monterey, California, Master's Thesis, September 1972, 151 pp. NTIS Report No. AD-757 700.

Concentrations of silicate, phosphate, nitrate, and nitrite were determined in Monterey Bay, California. Data were collected aboard ship during four cruises in April and May, 1972 using the Technicon (Trademark) AutoAnalyzer (Trademark) II System in dual channel operation. The sensitivity, reproducibility, and accuracy of this system were investigated and the results presented. Nutrient concentrations were presented as surface variations, depth variations, and vertical profiles. The large variability of nutrient concentrations in the ocean area studied was discussed. Upwelling areas were investigated for nutrient concentrations, circulation patterns, and variations in nutrient ratios. Planktonic bloom areas have been identified from the low nutrient levels, low nutrient ratio values, and high chlorophyll correlations. Results indicate that silicate was the limiting nutrient to biological activity in the waters studied. Assimilation ratios for biological activity were found to be 16.33 for NO3:PO4 and 1.14 for SiO4:PO4. Nutrient plateau regions were analyzed and sources discussed. The major cause of nutrient concentration changes in the area (except plankton blooms) as determined from nutrient ratio studies was found to be circulation of the water masses.

INDEX TERMS: Surface waters, Automation, Variability, Sea water, Mixolimnion, Nutrients, Essential nutrients, Water circulation, Chemical analysis, Water analysis, Methodology, Monterey Bay, Technicon Autoanalyzer II System, Shipboard measurements, On board analysis, Reproducibility, Sensitivity, Accuracy, Error sources, Data interpretation.

AMIC-7860
"WATER QUALITY STANDARDS CRITERIA DIGEST. A COMPILATION OF FEDERAL/STATE CRITERIA ON WATER QUALITY SAMPLING AND ANALYTICAL METHODS", Environmental Protection Agency, Washington, D. C., EPA Report, August 1972, 31 pp.

This digest, compiled in order to provide general information to the public as well as to Federal, State, and local officials, quotes those provisions of State/Federal water quality standards which relate to water quality sampling and analytical methods techniques and which stipulate the applicable stream flows.

INDEX TERMS: Water quality standards, Sampling, Analytical techniques, Bacteria, Radioactivity, Biological properties, Bioassay, Sample preservation.

AMIC-7876
"WATER QUALITY STANDARDS CRITERIA DIGEST. A COMPILATION OF FEDERAL/STATE CRITERIA ON MERCURY AND HEAVY METALS", Environmental Protection Agency, Washington, D. C., EPA Report, August 1972, 9 pp.

This digest, compiled in order to provide general information to the public as well as to Federal, State, and local officials, contains excerpts from the individual Federal-State water quality standards establishing mercury and heavy metals criteria for interstate waters. State adopted criteria are included.

INDEX TERMS: Water quality standards, Mercury, Heavy metals.

AMIC-7947
"CHEMICAL RESPONSE OF UTAH LAKE TO NUTRIENT INFLOW", Bradshaw, J. S., Sundrud, R. B., White, D. A., et al., Journal Water Pollution Control Federation, Vol. 45, No. 5, May 1973, pp 880-887.

Utah Lake, Provo, Utah, is a large shallow lake that receives the effluents from nine wastewater treatment plants. Provo Bay, an eastern extension of Utah Lake, receives much of the total volume of these effluents. A study was undertaken to determine the effect of the added nutrients on the chemistry and biota of Utah Lake. Established sites were sampled weekly during the summer months and periodically during the winter using either a boat or snowmobile. On-site measurements were made for DO, carbon dioxide, pH, turbidity. Laboratory tests included those for BOD, coliform density, phosphates, nitrates, ammonia, Ca, Mg, Na, K, chloride, bicarbonate, and sulfate. During the summer months, large chemical changes take place as the water that enters with high concentrations of nutrients moves through Provo Bay. These nutrients are effectively removed by the great algal bloom in the center of Provo Bay. Part of the carbon needed for algal growth is supplied by the great amount of bicarbonate in the Utah Lake water.

INDEX TERMS: Water analysis, Nutrients, Sewage effluents, Water pollution effects, Inflow, Chemical analysis, Water chemistry, Physical properties, Chemical properties, Laboratory tests, Waste water (pollution), On-site tests, Utah Lake, Provo Bay.

AMIC-7951
"DELAYED RECOVERY OF A MESOTROPHIC LAKE AFTER NUTRIENT DIVERSION", Emery, R. M., Moon, C. E., Welch, E. B., Journal Water Pollution Control Federation, Vol. 45, No. 5, May 1973, pp 913-925.

Limnologic conditions in Lake Sammamish (Washington) before an abrupt reduction of nutrient income (by way of wastewater diversion) are compared to those present in Lake Washington (Washington) before diversion. Lake Sammamish was relatively less enriched and eutrophied than was Lake Washington before diversion. The response of Lake Washington to nutrient diversion was shown by Edmondson to be prompt and complete and the estimated recovery time using the Vollenweider lake recovery model. Lake Sammamish, with about the same estimated time for recovery, has shown no significant amelioration since nutrients were diverted in September, 1968. This lack of response may be related to morphometric and hydrologic characteristics, but other undetermined aspects of the lake and its treatment application may be preventing Lake Sammamish from recovering as quickly as Lake Washington.

INDEX TERMS: Nutrients, Diversion, Waste water (pollution), Mesotrophy, Surface waters, Lake Sammamish, Recovery, Data interpretation.

AMIC-7967
"SELECTIVE ELECTRODE MEASUREMENT OF AMMONIA IN WATER AND WASTES", Thomas, R. F., Booth, R. L., Environmental Science and Technology, Vol. 7, No. 6, June 1973, pp 523-526.

The use of an ammonia selective electrode in the determination of ammonia in surface waters, sewage samples, and saline waters was investigated. The electrode exhibited Nernstian behavior at a minimum concentration of 0.02 mg NH_3-N/l in distilled water and 0.03 mg NH_3-N/l in actual samples. When the values obtained for river and sewage samples were compared to those from the indophenol blue method on a Technicon AutoAnalyzer, the results differed by an average of 1.2 percent and 4.6 percent, respectively. On river water samples, the known addition method was tested against direct measurement (use of a calibration curve) and found to be acceptable. In addition to being inexpensive, the ammonia electrode offered the advantages of minimal sample and reagent preparation prior to analysis, wide concentration range, precision and accuracy comparable to accepted methods, and speed (maximum of 5 min per sample).

INDEX TERMS: Ammonia, Water analysis, Pollutant identification, Surface waters, Sewage, Saline water, Methodology, Chemical analysis, Wastes, Waste water (pollution), Ammonia electrodes, Accuracy, Ion selective electrodes, Precision.

AMIC-8013
"SOLVENT CHARACTERIZATION BY GAS-LIQUID PARTITION COEFFICIENTS OF SELECTED SOLUTES", Rohrschneider, L., Analytical Chemistry, Vol. 45, No. 7, June 1973, pp 1241-1247.

A method is given for the determination of gas-liquid partition coefficients by gas chromatographic headspace analysis with two different columns. The partition coefficients of n-octane, toluene, ethanol, methyl ethyl ketone, dioxane, and nitromethane are specified for eighty solvents. The correlations of these data with solvent polarity, solubility parameter, and the molecular volume of the solvents are discussed. The measured data reference to the aromatics selectivity of extraction solvents and the solubility for polymers in diverse solvents. (Reprinted from Analytical Chemistry, Vol. 45, No. 7, June 1973, pp 1241-1247. Copyright 1973 by the American Chemical Society. Reprinted by permission of the copyright owner.)

INDEX TERMS: Gas chromatography, Solubility, Water, Partition coefficients, Organic solvents, Molecular volume, Solvent polarity, Toluene, Ethanol, Methyl ethyl ketone, Dioxane, Nitromethane.

AMIC-8049
"DETECTION OF NATURALLY FLUORESCENT PESTICIDES ON SILICA GEL LAYERS", Mallet, V., Surette, D., Brun, G. L., Journal of Chromatography, Vol. 79, May 16, 1973, pp 217-222.

A number of fluorescent pesticides, namely, benomyl, coumatetralyl, diphacinone, fuberidazole, propyl isome and quinomethionate, have been investigated on silica gel thin-layer chromatograms. The pesticides were prepared in solutions of methylene chloride. For determination of detection limits, dilution series of each pesticide were prepared in n-hexane from the original solutions. Fluorescence spectra were measured and visual detection limits estimated. In most cases, as little as a few nanograms could be detected. In addition, the effects of heat treatment of the fluorescence were observed. The most pronounced effect is a large bathochromic shift of the fluorescence excitation and emission maxima.

INDEX TERMS: Fluorescence, Pesticides, Pollutant identification, Detection limits, Thin layer chromatography, Benomyl, Coumatetralyl, Diphacin, Fuberidazole, Propylisome, Quinomethionate.

AMIC-8055
"ISOTACHOPHORESIS ON PAPER. PART II. THE SEPARATION OF Ag(I), Tl(I), Hg2(2 plus) AND Pb(II)", Taglia, V., Journal of Chromatography, Vol. 79, May 16, 1973, pp 380-382.

A Whatman No. 1 paper strip, sprayed with potassium chromate, was sandwiched between two glass plates and a potential of 400 V applied for isotachophoretic separation of silver, mercurous mercury, lead (II), and thallium (I). Nitric acid was used as the leading electrolyte, and lithium nitrate as the terminating electrolyte. This simple unbuffered system permits the concentration and separation of both Ag(I) and Tl(I) and a complete separation of all four members of the silver group.

INDEX TERMS: Separation techniques, Lead, Mercury, Silver, Thallium, Isotachophoresis.

AMIC-8110
"DISPOSAL OF DREDGE SPOIL, PROBLEM IDENTIFICATION AND ASSESSMENT AND RESEARCH PROGRAM DEVELOPMENT", Boyd, M. B., Saucier, R. T., Keeley, J. W., et al., U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report No. H-72-8, November 1972, 138 pp. NTIS Report No. AD-757 599.

Considerable concern has developed as to the environmental impact of dredging operations, with particular emphasis on open water disposal, especially that involving spoil materials containing pollutants. As a partial solution to the problem, the Corps of Engineers was authorized to conduct a four-phase comprehensive nationwide study of the environmental impact of current disposal operations, including research leading to new or improved spoil disposal practices. This report contains the results of the first two study phases, i,e., problem identification and assessment and research program development. As a result of the assessment, it is concluded that the nature and magnitude of effects of dredging and spoil disposal of water quality and aquatic organisms are quite poorly known and require extensive research. Since the consequences of confined land disposal are similarly poorly known, considerable research is needed to make this a viable disposal alternative. Research is needed to develop and implement pollution criteria for use in disposal alternative decision making, as existing criteria have major identifiable weaknesses in implementation procedures, scope, and application. A broad-based research program is outlined and recommended to develop a wide choice of technically satisfactory, environmentally comparable, and economically feasible disposal alternatives to cover the wide variety of dredging and disposal operations and environments. In addition to extensive research concerning the effects of dredging and open water disposal on water quality and aquatic organisms, ways would be sought to facilitate and improve the overall effectiveness and acceptability of land disposal.

AMIC-8110 (Continued) Card 2/2

Attention would also be devoted to modifying dredge plant equipment and operational procedures to reduce environmental impact, and to physical, chemical, and/or biological spoil improvement methods. Major attention would be given to considering spoil as a manageable resource, including utilization for marsh creation, wildlife habitat improvement or development, and beach nourishment. Completely new disposal concepts would be considered along with utilization of spoil for productive uses such as landfill and land enhancement. The recommended research program would cost about 30,000,000 dollars over a five-year period and would be accomplished by numerous groups and agencies under the direction of a multidisciplinary team.

INDEX TERMS: Disposal, Physical properties, Water pollution effects, Chemical analysis, Environmental effects, Biological communities, Water quality, Dredge spoils, Characterization.

AMIC-8118
"DETERMINATION OF ALUMINIUM BY ATOMIC ABSORPTION SPECTROPHOTOMETRY AFTER CHELATION WITH OXINE AND EXTRACTION WITH METHYL ISOBUTYL KETONE", Smith, B. H., Laboratory Practice, Vol. 22, No. 2, February 1973, pp 100-102.

Solutions of aluminum were prepared from Al2(SO4)3 (NH4)2 SO4.12H2O made up in HCl. Aliquots containing 0 to 100 micrograms of Al were prepared by dilution with distilled water to give concentrations of 2 to 20 ppm Al. The samples were prepared for AA analysis by chelation of the Al with oxine and extraction with methyl isobutyl ketone. The chelation step had the effect of concentrating the Al, thereby extending the range of usefulness of the method, and eliminating a number of interferences. A N2O/C2H2 flame was used in the AA analysis with absorption measured at 3092.7 angstroms. The sensitivity of the method was approximately 0.3 ppm Al per 1 percent absorption with a detection limit of approximately 0.2 ppm. Precision ranged from 3-20 percent depending on concentration of Al. Interferences and methods for eliminating them were studied by adding Fe(III), oxalate, fluoride, citrate, pyrophosphate, and orthophosphate.

INDEX TERMS: Aqueous solutions, Aluminum, Separation techniques, Chelation, Atomic absorption spectrophotometry, Sample preparation, Chemical interference, Sensitivity, Precision, Detection limits.

AMIC-8127
"A METHOD FOR THE IDENTIFICATION OF BRANCHED-CHAIN PARAFFINS BY CALCULATION OF THEIR RETENTION INDEX VALUES ON THE BASIS OF MOLECULAR STRUCTURE AND PHYSICAL PROPERTIES", Castello, G., Lunardelli, M., Berg, M., Journal of Chromatography, Vol. 76, February 7, 1973, pp 31-44.

The retention times of branched-chain paraffins were shown to depend on their physical properties, especially molecular volume, when non-polar phases were used for their separation. As the molecular volume depends strongly on structure, the calculation of additive terms, which are characteristic of every structural group in a molecule, can permit the theoretical calculation of the retention indices of any branched isomer. The additive terms can be calculated both by solving a system of equations and by comparison of the retention indices of selected compounds. The general application of the method to retention data taken from the literature is also possible.

INDEX TERMS: Separation techniques, Gas chromatography, Physical properties, Paraffins, Retention indices.

AMIC-8186
"SIMPLE ARRANGEMENT FOR THE DETECTION OF SULPHUR IN GAS-CHROMATOGRAPHIC ELUATES", Blasius, E., Lohde, H., Zeitschrift fur Analytische Chemie, Vol. 264, No. 4, May 7, 1973, pp 286-289.

The described apparatus for the detection of sulphur is gas-chromatographic eluates is based on the hydrogenation of compounds of sulphur to H2S and its detection with a thin-layer plate containing Pb (CH3COO)2. The PbS zones obtained can be evaluated optically, too, by measurement of the degree of remission. The limit of detection is 5 ng of sulphur (as CS2). Sixteen sulphur compounds can be detected in the pyrograms of a strong acid cation-exchanger. (In German)

INDEX TERMS: Gas chromatography, Sulfur, Detection limits.

AMIC-8216
"GROUNDWATER QUALITY IN THE CORTARO AREA NORTHWEST OF TUCSON, ARIZONA", Water Resources Bulletin, Vol. 9, No. 3, June 1973, pp 598-606.

The Cortaro Area is currently the depository for much of the liquid waste from the City of Tucson. In the past, more than one-half of the sewage effluent was used for crop irrigation. However, since 1970 virtually all of the sewage effluent has been percolated in the normally dry Santa Cruz River channel. Nitrate and chloride contents were monitored monthly in water samples from about 20 large-capacity irrigation wells. Contents and seasonal trends for these constituents were closely related to the disposal of sewage effluent. Water quality problems other than nitrate include total dissolved solids, boron, coliform, and lead. High lead contents in the area appear to be a natural phenomenon and the coliform contents are likely related to poor well construction. The other quality problems are primarily due to sewage effluent.

INDEX TERMS: Water quality, Waste disposal, Groundwater, Percolation, Nitrates, Chlorides, Dissolved solids, Coliforms, Lead, Boron.

AMIC-8226
"THE SPECTROPHOTOMETRIC DETERMINATION OF PALLADIUM WITH 4-((5-CHLORO-2-PYRIDYL)AZO)-1,3-DIAMINOBENZENE", Shibata, S., Ishiguro, Y., Nakashima, R., Analytica Chimica Acta, Vol. 64, No. 2, April 1973, pp 305-309.

Using 4-((5-chloro-2-pyridyl)azo)-1,3-diaminobenzene (5-Cl-PADAB) as the reagent, microgram amounts of palladium can be determined by spectrophotometry. The recommended procedure is as follows. To a 25-ml volumetric flask, transfer a suitable aliquot of acidic sample solution containing up to 25 micrograms of palladium, and add 0.5 ml of ethanolic 0.08 percent reagent solution. Then add 5 ml of (1 plus 1) hydrochloric acid solution, dilute to volume and mix well. Measure the absorbance of the palladium complex produced at 572 nm against a reagent blank. Obtain the concentration of palladium from a standard calibration curve obtained under identical condition. The calibration curve proved to be linear up to 1 ppm Pd. Interference tests showed that Al, Be, Bi, Cd, rare earths, Mg, Ca, Mn, Pb, Th, Ti, U, Zn, Zr in 5 mg amounts, V, W, Ni, Cr, in 1-2 mg amounts, and 0.5 mg of Co did not interfere. Five-fold amounts of iron(III) and two-fold amounts of copper did not interfere. Interference was caused only by chromium(VI). Common anions such as chloride, nitrate, acetate, sulfate and perchlorate did not interfere. Strong oxidizing agents interfered.

INDEX TERMS: Water analysis, Spectrophotometry, Aqueous solutions, Palladium, Sample preparation, Sensitivity, Chemical interference.

AMIC-8244
"ATOMIC ABSORPTION AND FLUORESCENCE SPECTROMETRY WITH A CARBON FILAMENT ATOM RESERVOIR. PART XIII. THE DETERMINATION OF CHROMIUM WITH A FULLY ENCLOSED ATOM RESERVOIR", Jackson, K. W., West, T. S., Balchin, L., Analytica Chimica Acta, Vol 64, No. 3, May 1973, pp 363-369.

The detection and measurement of chromium by atomic absorption spectrometry with a carbon filament atom reservoir is described. At a wavelength of 357.9 nm, a carbon filament atom reservoir is described. At a wavelength of 357.9 nm, a sensitivity (1 percent absorption) of 9.2 X 10 to the minus 12 power g was obtained. The detection limit was 10 to the minus 11 power g; in terms of concentration this is similar to that normally detectable in a flame. Tests were conducted to investigate the interferenceresulting from the presence of various levels of Sr, Fe(III), Co(II), Cu(II), Ca, Ba, Al, Sn(II), Sb, RB, Ti(IV), Pb, Mn(II), Zn, Hg(II), and V(V).

INDEX TERMS: Chromium, Chemical interference, Atomic absorption spectrophotometry, Sensitivity.

AMIC-8246
"THE FLUORIMETRIC DETERMINATION OF MERCURY", Holzbecher, J., Ryan, D. E., Analytica Chimica Acta, Vol 64, No. 3, May 1973, pp 333-336.

A description is given of the use of thiamine for the fluorometric determination of mercury. Stock solutions for analysis were prepared from mercury(II) chloride. The analytical procedure involved adding several milliliters of approximately neutral unknown solution (10-500 ng Hg per ml) and thiamine reagent to a borate buffer and making up to volume with twice-distilled water. It is important that the resulting solution contain less than 0.02 M foreign salts. The fluorescence intensity is measured at 440 nm after 1 hr or more; the excitation wavelength is 375 nm. Mercury must be present in the divalent state since Hg(I) gives a fluorescent intensity about half that of Hg(II). Organomercury compounds can only be analyzed after destruction of organic matter by acid digestion and conversion to inorganic Hg(II). Mercury(II) was successfully determined in the presence of a 10,000-fold (molar) amount of nickel(II), cobalt(II) or zinc(II); a 1000-fold amount of copper(II), cadmium(II), manganese(II) or aluminum(III); or a 100-fold amount of iron(II) or iron(III). Similarly, 100,000-fold amounts of the sodium or potassium salts of acetate, chloride, citrate, sulfate or tartrate did not interfere. A 10,000-fold amount of fluoride, nitrate, perchlorate or phosphate, and a 1000-fold amount of bromide and thiocyanate could be tolerated; the fluorescence was quenched by equivalent amounts of cyanide, iodide, sulphide or EDTA. Top water samples spiked with mercury(II) chloride were analyzed by this procedure with a relative error of determination of less than 5 percent.

INDEX TERMS: Water analysis, Mercury, Fluorometry, Sample preparation, Precision, Chemical interference, Detection limits.

AMIC-8267
"PHOTOLYSIS OF ETHYLENETHIOUREA", Ross, R. D., Crosby, D. G., Journal of Agricultural and Food Chemistry, Vol. 21, No. 3, May/June 1973, pp 335-337.

Ethylenethiourea (ETU) occurs as an impurity in and as an alteration product of technical ethylene bisdithiocarbamate fungicides. Its solubility in water suggests that it may occur as a contaminant in agricultural runoff. Therefore studies were conducted on the photodecomposition of ETU by preparing solutions with agricultural drainage or deionized water for exposure to sunlight or ultraviolet light. Decomposition products were isolated and identified by rotating vacuum evaporator and subjecting them to thin-layer chromatography. Separated compounds were detected by UV absorption. ETU was determined by evaporating samples, redissolving in methanol, and measuring absorbance at 239 nm. The results showed that ETU in aqueous solution (0.5-50 ppm) was stable to sunlight. However, in the presence of dissolved oxygen and sensitizers such as acetone or riboflavin, it was rapidly photooxidized via ethyleneurea and glycine sulfate. ETU decomposition also occurred in boiled samples of agricultural drainage waters in sunlight but not in the dark, indicating that natural photosensitizers may play an important part in the environmental transformations of xenobiotics.

INDEX TERMS: Absorption, Aqueous solutions, Water analysis, Solar radiation, Ultraviolet radiation, Ethylenethiourea, Photodecomposition, Sample preparation.

AMIC-8268
"DETERMINATION OF BENOMYL RESIDUES IN SOILS AND PLANT TISSUES BY HIGH-SPEED CATION EXCHANGE LIQUID CHROMATOGRAPHY", Kirkland, J. J., Holt, R. F., Pease, H. L., Journal of Agricultural and Food Chemistry, Vol. 21, No. 3, May/June 1973, pp 368-371.

Benomyl (methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate) residues in soils and plant tissues may be determined by procedures using high-speed cation exchange liquid chromatography (lc). The method for soils is based on an acidic methanol extraction of the residues, which converts residual benomyl to MBC (methyl 2-benzimidazolecarbamate). After a liquid-liquid partitioning cleanup, the total benomyl and/or MBC residues are measured as MBC by high-speed liquid chromatography. Any 2-AB (2-aminobenzimidazole) present in the original sample is also extracted and simultaneously dtermined as a separate lc peak. Recoveries of benomyl, MBC, and 2-AB from various types of soils average 92, 88, and 71 percent, respectively. The lower limit of sensitivity of the method is 0.05 ppm for each of these components. The method for plant tissues is based on ethyl acetate extraction of the residue followed by liquid-liquid partitioning cleanup and liquid chromatographic measurement. Recoveries and limit of sensitivity of this method for plant tissues were essentially that found for soils.

INDEX TERMS: Soil analysis, Plant tissues, Soils, Pesticide residues, Benomyl, Liquid chromatography, Sample preparation, Biological samples.

AMIC-8287
"A PROBE FOR SAMPLING MIRE WATERS FOR CHEMICAL AND GAS ANALYSIS", Summerfield, R. J., Plant and Soil, Vol. 38, No. 2, April 1973, pp 369-472.

In order to carry out accurate analysis of the oxygen dissolved in mire waters a method was devised for withdrawing water samples, relatively free from particulate matter, without contamination by atmospheric oxygen. A probe is introduced into the substrate, a few minutes are allowed for the collection chamber to become filled with mire water, and the sample is pumped out into a collecting bottle for analysis. The depth of insertion of the probe may be altered, samples may therefore be collected from different rooting zones for chemical or dissolved gas analysis. The construction and operation of the probe are described.

INDEX TERMS: Water sampling, Methodology, Mechanical equipment, Chemical analysis, Dissolved oxygen, Construction, Operation and Maintenance, On-site investigations, Water analysis, Gases, Mire waters, Reliability.

AMIC-8294
"ANTICATALYTIC MICRODETERMINATION OF MERCURY USING CERIUM-ARSENITE REACTION", Ke, P. J., Thibert, R. J., Mikrochimica Acta, No. 1, 1973, pp 15-24.

An anticatalytic kinetic method, based on the decreased rate of the reaction between Ce(IV) and As(III), was developed for the determination of mercury. The change in reaction rate due to inhibition by mercury was measured spectrophotometrically at 275 nm. The presence of the following ions in the reaction mixture (10 ml) did not interfere at a level of 0.1 mg: Na, K, ammonium, Ba, Mg, chloride, nitrate, sulfate, cyanide, and bicarbonate. Cu, Cr and bromide which catalyze the reaction between Ce and arsenite, yielded 10-15 percent negative error at 0.1-microgram level, and Ag gave serious interference. An increase of 10-15 percent recovery of Hg was observed with more than 50 micrograms of Ni(II), Co(II), Fe(III), and Zn(II). The As(III)/Ce(IV) reaction is extremely sensitive to iodide ions, and even with only 5 ng of iodide present in the reaction system, an error of 50 percent in the determination was observed for a sample containing 0.1 microgram of mercury. Amounts of mercury in the range 0.04 - 0.20 microgram were determined with an overall error of less than 5 percent at a reaction time of 25 minutes.

INDEX TERMS: Mercury, Pollutant identification, Chemical reactions, Aqueous solutions, Cerium-arsenite reaction, Anticatalytic kinetic method, Errors, Chemical recovery, Precision, Accuracy, Reliability, Reproducibility, Detection limits.

AMIC-8295
"APPLICATION OF OXINE IN THE POLAROGRAPHIC ANALYSIS OF ORGANOMETALLIC COMPOUNDS. MICRODETERMINATION OF CADMIUM, MAGNESIUM, ZINC, MANGANESE, AND COBALT", Bishara, S. W., Mikrochimica Acta, No. 1, 1973, pp 25-32.

A procedure for the microdetermination of Cd, Mg, Zn, Mn, and Co in organometallic compounds is presented. After closed-flask combustion, the metal-oxine complex is precipitated from an ammonia-ammonium chloride buffered medium of pH 10. At this pH value oxine gives a well-defined polarographic wave. The wave height of an excessive volume of oxine is measured before and after it has been used to precipitate a known weight of the organomentallic compound. The method is simple and rapid; one determination consumes 25 minutes. The average percent error amounts to plus or minus 0.53.

INDEX TERMS: Cadmium, Magnesium, Zinc, Manganese, Cobalt, Polarographic analysis, Heavy metals, Chemical analysis, Alkaline earth metals, Hydrogen ion concentration, Chemical reactions, Chemical precipitation, Organometallics, Oxine, Accuracy, Errors.

AMIC-8299
"MICROANALYSIS WITH THE AID OF ION EXCHANGE RESINS. XXVI. DETECTION OF SMALL QUANTITIES OF COPPER (II) WITH BATHOCUPROINE DISULFONATE", Takahashi, T., Imamura, T., Fujimoto, M., Mikrochimica Acta, No. 1, 1973, pp 69-76.

A new resin spot test with bathocuproine disulfonate for the specific detection of ng amounts of copper (II) is described. Using 1 grain of white strongly basic popcorn-resin, Diaion PA 3-series, the identification limit for copper is 10.4 ng in 10 microliters solution (1 : 1,000,000). (In German)

INDEX TERMS: Pollutant identification, Copper, Ion exchange, Iron, Cobalt, Nickel, Zinc, Molybdenum, Bromides, Nitrates, Chemical analysis, Ion exchange resins, Detection limits, Trace levels, Ionic interference, Tungsten, Bathocuproine disulfonate.

AMIC-8300
"SEPARATION OF MOLYBDENUM FROM TUNGSTEN, VANADIUM, IRON, URANIUM AND SEVERAL OTHER INTERFERING ELEMENTS BY EXTRACTION OF ITS THIOSULPHATO COMPLEX", Yatirajam, V., Ram, J., Mikrochimica Acta, No. 1, 1973, pp 77-86.

A sample solution containing 0.8 mg or less Mo/ml, 1.5 N HCl and 32 mg $Na_2S_2O_3.5H_2O$/ml, is shaken with methyl isobutyl ketone at about 10 degrees. Molybdenum is stripped off the solvent with ammonia-hydrogen peroxide solution and is determined after the filtration of any insoluble hydroxides and decomposition of hydrogen peroxide and any polythionates. The procedure separates microgram to mg of molybdenum from large amounts of Ti(IV), V(V), Cr(VI), Mn(II), Fe(III), Co(II), Ni(II), W(VI), Zr(IV), Ce(IV), U(VI), Bi(V), Sb(III) and Al(III) in a wide variety of samples.

INDEX TERMS: Separation techniques, Molybdenum, Solvent extractions, Methodology, Pollutant identification, Heavy metals, Iron, Titanium, Chromium, Manganese, Cobalt, Nickel, Aluminum, Chemical reactions, Color reactions, Metal complexes, Metal-thiosulphato complexes, Vanadium, Tungsten, Zirconium, Cerium, Uranium, Bismuth, Antimony, Chemical interference.

AMIC-8307
"MICRO AND SEMIMICRO DETERMINATION OF ARSENATE USING ION-SELECTIVE ELECTRODES", Selig, W., Mikrochimica Acta, No. 3, 1973, pp 349-359.

An indirect method for the microestimation of 0.75 to 15 ppm (0.01-0.2 mM) of As(V) has been described: Arsenate is precipitated with lanthanum nitrate at a pH of 8.65. The excess of lanthanum is titrated with standard fluoride, using a fluoride ion-selective electrode. Equivalence points are located on volume-corrected Gran's plot paper. This method can also be used to estimate the sum of arsenate and phosphate. For larger amounts of arsenate and for increased precision and accuracy, potentiometric titration with lead perchlorate, using a lead ion-selective electrode, is recommended. Other possibilities for determining arsenate and a method for estimating tungstate are suggested.

INDEX TERMS: Methodology, Pollutant identification, Ion selective electrodes, Arsenates.

AMIC-8309
"SPECTROPHOTOMETRIC DETERMINATION OF CALCIUM", Prokopov, T. S., Mikrochimica Acta, No. 3, 1973, pp 429-434.

A method was developed for determining calcium by a direct colorimetric method using sodium rhodizonate as a reagent. Standard solutions ranging from 2-200 ppm Ca(II) were prepared using calcium nitrate. The analytical procedure involved placing 1 ml of sample in a test tube, rendering it basic (pH 12) with sodium hydroxide, and adding 3 ml of 25 ppm rhodizonate solution. After shaking the samples were transferred to cuvets for measurement of absorbance at 570 nm. The procedure is not laborious, eliminates interfering ions, and is convenient to use.

INDEX TERMS: Chemical interference, Calcium, Aqueous solutions, Colorimetry.

AMIC-8317
"AN ELECTROCHEMICAL METHOD FOR THE DETERMINATION OF PHOSPHATE IN NATURAL WATER", Cox, J. A., Lundquist, G. L., Southern Illinois University, Department of Chemistry and Biochemistry, Carbondale, Illinois, WRC Research Report No. 61, Contract No. 14-31-0001-3013, November 1972, 55 pp. NTIS Report No. PB-214 486.

Cathodic Stripping Chronopotentiometry has been found to be analytically comparable to the spectrophotometric method for the determination of phosphate in natural water samples. Both methods have detection limits on the order of 10 ppb, and while the spectrophotometric method has greater reproducibility when laboratory standards are determined, the data scatter and average results observed on natural samples are nearly identical. The technique is based upon the reversible oxidation of a metallic indicator electrode to an insoluble phosphate salt film. When copper is used as the indicator electrode, the detection limit is 10 ppb. Control of the pH at 6.0 and removal of oxygen from the solution eliminates anticipated interferences in natural water samples. The major drawback of the method is that under the electrolysis conditions employed, salt of mixed stoichiometry is deposited which subsequently results in two separate stripping steps. When mercury is the indicator electrode, the system approaches true Nernstian behavior. An observed interference of chloride ion has, to the present, limited application of the electrode to solutions containing phosphate in excess of 50 ppb.

INDEX TERMS: Phosphates, Chemical analysis, Water analysis, Electrochemistry, Methodology, Pollutant identification, Chemical reactions, Ions, Chlorides, Nutrients, Natural waters, Cathodic stripping chronopotentiometry, Cyclic chronopotentiometry.

AMIC-8319
"TRACE METALS IN CORES FROM THE GREAT MARSH, LEWES, DELAWARE", Strom, R. N., Briggs, R. B., University of Delaware, College of Marine Studies, Newark, Delaware, Report Nos. CMS 2 GL-105, DEL-SG-12-72, and NOAA 73010803, December 1972, 35 pp. NTIS Report No. COM-73 10206.

The purpose of this study was to determine the areal and vertical changes in trace metal concentration in sediments deposited prior to the industrialization of the Delaware Bay watershed. Four 12-foot and one 18-foot core were taken by driving lengths of 2-1/2 inch plastic pipe into various locations of the Great Marsh near Lewes, Delaware. After extraction, the pipes were cut into 2-foot sections and a 6-inch sample extruded for analysis. Remaining portions were described by visual analysis (color, consistency). Extruded portions were tested for Eh and sieved to separate portions greater and less than 63 microns. These were decanted, dried, powdered, extracted with HCl, and analyzed for Zn, Cu, Cr, Fe, Pb, and Cd by atomic absorption spectrophotometry. The levels of Pb and Cd were below the detection limit of the method used, i.e., less than 1 ppm. Zn, Cu, and Cr contents ranged from 10-200 ppm; Fe ranged from 1-3 percent of dry sample weight. There was very little areal or vertical variation in the metals studied. There was little difference in concentration of metals between the smaller fraction (primarily inorganic) or the larger fraction (primarily organic). Zinc showed a slight increase with depth, and iron appeared to be more abundant in the inorganic fraction.

INDEX TERMS: Distribution patterns, Zinc, Copper, Chromium, Iron, Marshes, Sample preparation, Delaware Bay.

AMIC-8323
"1972 RESULTS OF THE CONTINUED INTERCOMPARISONS OF METHODS FOR ANALYSES OF CESIUM, COBALT, SILVER AND OTHER RADIONUCLIDES SPONSORED BY IAEA. PART II: ANALYSIS OF DRIED SEAWEED SAMPLES COLLECTED BY BRITISH FISHERIES RADIOBIOLOGICAL LABORATORY", Folsom, T. R., Hodge, V. F., Wong, K. M., University of California, San Diego, Soledad Environmental Radioactivity Laboratory, La Jolla, California, Report No. TID-26206, Contract No. AT (04-3)-34, May 31, 1972, 3 pp.

Seaweed samples were analyzed by two-dimensional gamma spectrometry and by one dimensional analyses for Cs-134, Cs-137, Co-60, and Ag-110 m. The results (in picocuries/gram dried seaweed) for three samples were 71.4-73.5 Cs-137; 10.2-10.8 Cs-134; 1.96-2.17 Co-60; and 0.1.17 Ag 110 m.

INDEX TERMS: Pollutant identification, Radioactivity techniques, Radioisotopes, Marine plants, Cs-134, Cs-137, Co-60, Ag-110m.

AMIC-8328
"LABORATORY EVALUATION OF RESIDUES MAINTAINED IN WATER TREATED WITH POLYETHYLENE FORMULATIONS OF CHLORPYRIFOS", Lawson, M. A., U.S. Army Environmental Hygiene Agency, Edgewood Arsenal, Maryland, Report No. USAEHA-44-013-72/73, December 1971-April 1972, 14 pp. NTIS Report No. AD-755 517.

Laboratory evaluations were conducted for 16 weeks to compare, under static conditions, residue levels maintained in water treated with three chlorinated polyethylene pellet formulations of chlorpyrifos (0,0-diethyl 0-(3,5,6-trichloro-2-pyridyl) phosphorothioate). All pellets were cylindrical in shape and had a specific gravity greater than 1.0. Each formulation was evaluated at dosages of 0.25, 0.5 and 1.0 ppm in one gallon glass jars containing three liters of distilled water. Treatments and controls were replicated three times. Water samples were removed from the jars weekly, partitioned with hexane, and subjected to electron capture gas chromatographic analysis to determine chlorpyrifos residues. Data were subjected to three way analysis of variance to determine effects of formulation, dosage, week after treatment, and the interactions thereof, on residues maintained in the water. Peak residue levels occurred within seven to ten weeks after treatment for all formulations at each dosage. A gradually decreasing trend in residues began after ten weeks for all formulations. Higher dosages resulted in significantly higher residue levels during each week of the study. There were no significant differences among the three formulations in the amount of residues maintained in the water during the 16 week test.

INDEX TERMS: Pesticide residues, Water analysis, Separation techniues, Chlorpyrifos, Electron capture gas chromatography, Persistence.

AMIC-8337
"CYCLING AND CONTROL OF METALS", Curry, M. G., Gigliotti, G. M., Breidenbach, A. W., et al., U.S. Environmental Protection Agency, National Environmental Research Center, Report No. NERC-C-CP-73-1, February 1973, 195 pp. NTIS Report No. PB-216 184.

This volume is based on a conference held October 31 through November 2, 1972, in Columbus, Ohio. Each of the five sessions of the conference was designed to bring together knowledge and thinking in areas bearing on the problem of metals and their relationship to the environment. The conference was sponsored by the U. S. Environmental Protection Agency's National Environmental Research Center, Cincinnati, National Science Foundation, and the Columbus Laboratories of Batelle Memorial Institute. Papers presented and their authors and facilities are as follows: 'Metals: Parts and the Whole', A. W. Breidenbach, U. S. Environmental Protection Agency; 'Natural Sources of Some Trace Elements in the Environment', M. Fleischer, U. S. Geological Survey; 'The Lead Industry as a Source of Trace Metals in the Environment', B. G. Wixson, E. Bolter, N. L. Gale, J. C. Jennett, and K. Purushothaman, University of Missouri; 'Sources of Trace Metals From Highly Urbanized Southern California to the Adjacent Marine Ecosystem', D. R. Young, C-S. Young, and G. E. Hlavka, Southern California Coastal Water Research Project; 'Overview of Effects of Trace Metals', H. A. Laitinen, University of Illinois; 'Physical Transport of Trace Metals in the Lake Washington Watershed', R. S. Barnes and W. R. Schell, University of Washington; 'Biological Uptake and Distribution of Lead in Animals', J. Abdelnour, University of Illinois; 'Effects and Development of Criteria and the Establishment of Standards', H. Wiser, U. S. Environmental Protection Agency; 'Effects and Establishment of Criteria', T. E. Larson, Illinois State Water Survey; 'Human Studies Laboratory', G. J. Love, U. S. Environmental Protection Agency; 'Significant Effect of Pollutants', J. F. Cole,

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International Lead Zinc Research Organization, Inc.; 'Statement on Establishment of Criteria for Metals in Foods', C. F. Jelinek, U. S. Department of Health, Education, and Welfare; 'Biomedical Research in Support of Criteria and Standards', D. H. K. Lee, U. S. Department of Health, Education, and Welfare; 'Trace Metals in Effluents From Metallurgical Operations', J. B. Hallowell, R. H. Cherry, Jr., and G. R. Smithson, Jr., Battelle's Columbus Laboratories; 'Pollution Abatement in the Metal Finishing Industry', J. Ciancia, U. S. Environmental Protection Agency; 'Control and Prevention of Mine Drainage', R. D. Hill, U. S. Environmental Protection Agency; 'Control of Particulate Lead Emissions From Automobiles', E. N. Cantwell, E. S. Jacobs, W. G. Kunz, Jr., and V. E. Liberi, E. I. duPont deNemours and Company; 'Trace Element Emissions From the Combustion of Fossil Fuels', J. R. Fancher, Commonwealth Edison Company; 'Monitoring for Trace Metals in the Atmospheric Environment: Problems and Needs', P. R. Harrison, Department of Environmental Control; 'Monitoring for Trace Metals-Water Environment', D. G. Ballinger, U. S. National Environmental Research Center; 'Monitoring of Solid Wastes', E. A. Glysson, University of Michigan; 'Monitoring for Trace Metals in Food', E. O. Haenni, U. S. Department of Health, Education, and Welfare; 'Dimensions of Monitoring', R. P. Ouellette and J. W. Overbey II, The MITRE Corporation; 'Economic and Legal Aspects', G. Strasser, Battelle's Columbus Laboratories; 'The Social Implication of Controls', P. Mickey, Concern, Inc.; 'How Much Recycling is Enough?', T. Page, Resources for the Future, Inc.; 'Law and Trace Metals', E. F. Murphy, Ohio State University.

INDEX TERMS: Heavy metals, Public health, Toxicity, Water pollution sources, Industrial wastes, Muncipal wastes, Cooling water, Brine disposal, Foods, Oil, Analytical techniques, Transport, Smelting, Metal finishing, Dredge spoil.

AMIC-8341

CHEMISTRY OF MARINE NATURAL PRODUCTS, Scheuer, P. J., Academic Press, New York, N.Y., 1973, 201 pp.

This publication is concerned with the naturally occurring organic compounds in the sea. Major emphasis has been placed on structural organic chemistry.

INDEX TERMS: Organic compounds, Chemistry, Nitrogen compounds, Marine algae, Marine animals, Marine bacteria, Sea water, Isoprenoids, Sterols, Benzenoids, Aliphatic hydrocarbons, Marine environment, Natural organics, Chemical structure.

AMIC-8343

"RECOMMENDED METHODS FOR WATER-DATA ACQUISITION", U. S. Geological Survey, Washington, D. C., Preliminary Report, December 1972, 417 pp.

This report documents results of Interagency efforts (Agriculture, Commerce, Defense, EPA, HUD, Interior, TVA, Transportation) during 1970-72 to designate recommended methods for acquisition of water data. The methods specified were identified as the most acceptable for acquisition of data on surface water; ground water; fluvial sediments; biologic, bacteriologic, chemical, and physical quality of water; and for automatic water-quality monitoring. Where available, details are given for sampling procedures, storage of samples, precision, interferences, and other appropriate data.

INDEX TERMS: Water analysis, Groundwater, Sediments, Suspended solids, Sediment transport, Bioassay, Fish, Aquatic plants, Phytoplankton, Periphyton, Phaeophyta, Gas chromatography, Chlorinated hydrocarbon pesticides, Organosphosphorus pesticides, Coliforms, Streptococcus, Phenols, Lignins, Surfactants, Sea water, Waste water (pollution), Radioactivity, Acidity, Alkalinity, Bicarbonates, Specific conductivity, Oxidation-reduction potential, Metals, Hardness (water), Monitoring, Brackish water, Tannins, Sample preservation.

AMIC-8345

"AN INVESTIGATION OF THE NITRATE PROBLEM IN RUNNELS COUNTY, TEXAS", Jones, D. C., Radian Corporation, Austin, Texas, Report No. EPA-R2-009, June 1973, 214 pp.

This report describes the results of an investigation of the nitrate contamination of the groundwater in Runnels County, Texas. The investigation had several goals: (1) to determine the extent and severity of the nitrate contamination of the groundwater, (2) to collect data regarding the geology, hydrology, soil and water chemistry, and land use practices in the contaminated areas, (3) to determine the source of the nitrate, (4) to develop a photographic technique to detect areas of nitrate contamination, (5) to recommend remedies for the contamination problem, (6) to recommend an ongoing monitoring program for the contaminated areas. These goals were achieved by collecting and analyzing water and soil samples, collecting data on land use, measuring the isotopic ratio of nitrogen in the nitrate to determine source, and studying infrared reflectance of vegetation to locate areas of nitrate contamination by aerial photography. Samples of soil and water were collected in plastic bottles and stored up to 2 months. Soil samples were collected to depths of ten feet with an air-rotary drilling rig, stored in plastic bags, and frozen. Details of sample preparation for analysis of isotopic ratios are included. Water samples were analyzed for nitrate, chloride, sulfate, fluoride, bicarbonate, sodium, calcium, silicate, magnesium, pH, and total dissolved solids. A few analyses were performed for nitrite, organic carbon and orthophosphate. It was found that most well water contamination was due to naturally occurring nitrate. However, all the very high nitrate contamination problems (greater than 1000 ppm) were principally due to nitrate from barnyards. The nitrate sources were confirmed utilizing the nitrogen isotope ratio technique. The nitrate contamination was caused by a rising water table which intersected and dissolved nitrate deposits from the soil.

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INDEX TERMS: Nitrates, Water quality, Water analysis, Water pollution sources, Radioactivity techniques, Aerial photography, Soil analysis, Texas, Groundwater, Isotopic ratios.

AMIC-8347
"PUBLIC HEALTH ASPECTS OF ORGANICS IN WATER", Ongerth, H. J., Spath, D. P., Crook, J., Greenberg, A. E., Journal American Water Works Association, Vol. 65, No. 7, July 1973, pp 495-498.

Interest in reuse of wastewaters for consumptive purposes necessitates that their components and potential effects be investigated. A literature survey for information regarding characterization of waters for residual organics has shown that very little is known about organic products in water. Even less is known about their effects, individually or in combination, on man. Review of studies that have been conducted revealed that organic compounds are often very complex and difficult to characterize. Toxic effects, especially long-term effects such as carcinogenicity, mutagenicity, and teratogenicity are likewise difficult to determine because of uncertainties in dosages which might occur under natural conditions and because of possible synergistic effects of contaminants. The authors conclude that much information will be needed before water can be reused for consumptive purposes.

INDEX TERMS: Water reuse, Public health, Toxicity, Organic matter, Reviews, Water analysis, Characterization.

AMIC-8359
"NITROGEN AND PHOSPHORUS IN A STRETCH OF THE GUADALUPE RIVER, TEXAS, WITH FIVE MAIN-STREAM IMPOUNDMENTS", Hannan, H. H., Young, W. C., Mayhew, J. J., Hydrobiologia, Vol. 43, No. 3, May 15, 1973, pp 419-441.

Nitrogen and phosphorus were studied in a 168-km stretch of the Guadalupe River that had five main-stream impoundments. Flow through the study area was controlled by releases from these five reservoirs and from Canyon Reservoir, a deep-storage reservoir, located 30 km upstream. Parameters measured monthly on a diel basis at 16 stations were nitrate nitrogen, nitrite nitrogen, ammonia nitrogen, Kjeldahl nitrogen, inorganic phosphate phosphorus, organic phosphate phosphorus, and total phosphate phosphorus. Inorganic nitrogen concentrations observed in this study were as high or higher than that previously reported for other bodies of water. Nitrate nitrogen, in general, reached seasonal minima in summer and maxima in winter. Nitrite nitrogen showed considerable variation with no meaningful pattern except that higher concentrations occurred in association with high chlorophyll a and high Kjeldahl nitrogen, regions and periods of low river flow, and large phytoplankton populations. There was no increase in concentration of any form of nitrogen in the vicinity of sewage outfalls and no downstream accrual. Phosphorus levels in the study area were as high or higher than those reported in studies of other bodies of water. Total phosphate phosphorus was determined to be the most critical phosphate parameter in assessing eutrophication. Seasonally, it ranged from a winter high to a summer low. Concentrations were highest immediately below sewage outfalls and decreased as water progressed downstream. Inorganic-phosphate-phosphorus concentrations showed no clear seasonal trend but were clearly associated with sewage outfalls. Total organic phosphate phosphorus varied seasonally, with high

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concentrations occurring during the spring and low concentrations in the fall, showed no correlation with sewage outfalls, but was correlated to a degree with total Kjeldahl nitrogen and chlorophyll a. No consistent pattern of diel fluctuations was evident for any phosphorus or nitrogen compounds analyzed.

INDEX TERMS: Nitrogen, Phosphorus, Pollutant identification, Reservoir storage, Nutrients, Water analysis, Water pollution sources, Water pollution effects, Sewage effluents, Water sampling, Chemical analysis, Industrial wastes, Pollutant identification, Fluctuations, Guadalupe River, Seasonal variation.

AMIC-8363
"SOME LIMNOLOGICAL CHARACTERISTICS OF THE NOZHA HYDRODROME, NEAR ALEXANDRIA, EGYPT", Saad, M. A. H., Hydrobiologia, Vol. 41, No. 4, May 30, 1973, pp 477-499.

Certain limnological characteristics of Nozha Hydrodome, an Egyptian artificial lake, have been studied and compared to the data obtained with those from the same lake prior to the erection of the high dam south of Aswan. Water samples were collected monthly during a 1-yr period for the determination of pH, chlorosity, dissolved oxygen and total residue of the lake water. Light penetration and water temperature were measured at each sampling site. Variations of water level, Secchi disc readings, pH, chlorosity, and total residue are correlated with the introduction of a large amount of fresh Nile water into the lake, to replace that lost mainly by evaporation. Comparison with previous data, obtained from the Hydrodrome prior to the construction of the high dam, gave considerable changes.

INDEX TERMS: Limnology, Water chemistry, Artificial lakes, Physicochemical properties, Water quality, Water sampling, Water analysis, Chemical analysis, Nozha Hydrodome, Seasonal variation, Egypt.

AMIC-8370
"PHYSICO-CHEMICAL ASPECTS OF LAKE McILWAINE (RHODESIA), A EUTROPHIC TROPICAL IMPOUNDMENT", Marshall, B. E., Falconer, A. C., Hydrobiologia, Vol. 42, No. 1, July 6, 1973, pp 45-62.

Lake McIlwaine is a tropical eutrophic impoundment in Rhodesia. The normal oxygen and temperature patterns are described, and the effect of flood water on these patterns is discussed. Several important chemical parameters are described, and the effects of lake-level fluctuations and stratification are outlined. There is a brief discussion on the effects of eutrophication in tropical lakes, and some indication is given of measures being taken to reduce nutrient input to Lake McIlwaine.

INDEX TERMS: Physiochemical properties, Impoundments, Eutrophication, Hydrology, Water quality, Water level fluctuations, Thermal stratification, Water chemistry, Lake McIlwaine, Seasonal variation.

AMIC-8389
"MAJOR ORGANICS", Carlton, T. L., Smith, I. L., Walters, J. V., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 979-982.

This portion of the Water Pollution Control Federation's annual literature review covers new developments in analytical methods for alkali metals, chlorides, sulfates, sulfides, nitrates, iron, manganese, fluorides, and cyanides.

INDEX TERMS: Water analysis, Chemical analysis, Reviews, Calcium, Magnesium, Bromides, Iodides, Nitrites, Sulfates, Sulfides, Nitrates, Iron, Manganese, Fluorides, Organomercury compounds, Cyanides.

AMIC-8390
"TRACE INORGANICS", Andelman, J. B., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 982-986.

Review of the 1972 literature on analytical techniques for trace inorganics reveals that work has been done on atomic absorption spectrophotometry, neutron activation analysis, anodic stripping voltammetry, polarography, flame and arc emission spectroscopy, spark source mass spectroscopy, photometry, gas chromatography, fluorometry, and in preparation of samples to improve results.

INDEX TERMS: Water analysis, Chemical analysis, Sea water, Reviews, Neutron activation analysis, Mass spectrometry, Polarographic analysis, Photometry, Gas chromatography, Fluorometry, Gold, Waste water (pollution), Groundwater, Estuaries Estuaries, Potable water, Atomic absorption spectrophotometry, Anodic stripping voltammetry, Sample preparation, Flame emission spectroscopy, Arc emission spectroscopy, Chemical interference, Detection limits.

AMIC-8391
"WATER CHARACTERISTICS", Ghosh, M. M., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 986-995.

The 1972 literature on methods for determining water characteristics is reviewed. Methods are considered for pH, acidity, alkalinity, color, odor, residue, turbidity, suspended solids, temperature, conductivity, particulate matter, ammonia, redox, radioactivity, and concentration of phytoplankton. Models and mathematical relationships for interpreting data are also reviewed.

INDEX TERMS: Water analysis, Water quality, Reviews, Hydrogen ion concentration, Acidity, Alkalinity, Color, Odor, Turbidity, Suspended solids, Water temperature, Conductivity, Ammonia, Oxidation-reduction potential, Radioactivity, Monitoring, Instrumentation.

AMIC-8392
"ORGANICS", Minear, R. A., Benko, J. J., Lambert, P. T., et al., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 995-1018.

Literature from 1972 is reviewed with respect to analytical methods for oxygen demand, organic carbon, detergents, oil, grease, and organochlorine, organophosphorus, and carbamate pesticides. Discussion is also included on toxic effects of the pollutants considered.

INDEX TERMS: Oxygen demand, Reviews, Water analysis, Surfactants, Toxicity, Oil, Polychlorinated biphenyls, Organophosphorus pesticides, Carbamate pesticides, Triazine pesticides, Bioassay, Chlorinated hydrocarbon pesticides, Vitamin B, Water quality, Biological samples.

AMIC-8393
"CONTINUOUS MONITORING, AUTOMATED ANALYSIS, AND SAMPLING PROCEDURES", Herbes, S. E., Allen, H. E., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1018-1026.

The 1972 literature is reviewed with respect to capabilities for monitoring, automatically analyzing, and sampling water for water quality parameters and the presence of organic and inorganic pollutants. The review includes a brief discussion of remote monitoring systems, automatic laboratory analysis, remote sensing, data handling, and sampling frequency.

INDEX TERMS: Monitoring, Chemical analysis, Reviews, Water quality, Sampling, Water analysis, Instrumentation.

AMIC-8394
"DETERGENTS", Banerji, S. K., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1059-1063.

This literature review on detergents is concerned with the (1) detergent builders - their toxicity, impact on water quality, and biodegradation; (2) anionic surfactant concentrations and biodegradation; and (3) the removal of surfactants from wastewater.

INDEX TERMS: Detergents, Waste water treatment, Reviews, Water pollution effects, Water pollution sources, Surfactants, Biodegradation, Nutrient removal, Environmental effects, Detergent-builders, Fate of pollutants.

AMIC-8421
"AQUATIC SEDIMENTS", Ku, W. C., Foess, G. W., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1301-1310.

A literature review is presented which covers the role of aquatic sediments in relation to water quality, nutrient cycling and interchange, and pollutant kinetics. Included also are (1) methods for sampling and analyzing such sediments, and (2) chemical characteristics and biological aspects of aquatic sediments.

INDEX TERMS: Reviews, Aquatic soils, Bottom sediments, Analytical techniques, Cycling nutrients, Sinks, Methodology, Bottom sampling, Water pollution sources, Heavy metals, Chemical analysis, Pesticide kinetics, Degradation (decomposition), Path of pollutants, Sediment transport, Separation techniques, Alkali metals, Alkaline earth metals, Pollutant identification, Eutrophication, Nutrient interchange, Mobilization, Chemical composition, Fate of pollutants.

AMIC-8422
"MARINE AND ESTUARINE POLLUTION", Reish, D. J., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1310-1319.

Discussed in this review concerned with marine and estuarine pollution are (1) bioindicators, (2) thermal pollution, (3) toxicity and pathology, (4) oil pollution, (5) biological and chemical effects (bioassays), (6) bioaccumulation, (7) pathogenic bacteria, (8) chemical analyses of organisms for pollutants, and (9) physical and chemical oceanography.

INDEX TERMS: Water pollution, Water pollution effects, Estuarine environment, Reviews, Oil pollution, Sea water, Invertebrates, Marine algae, Marine animals, Pathogenic bacteria, Bibliographies, Surveys, Bioindicators, Water quality, Waste water (pollution), Industrial wastes, Animal pathology, Thermal pollution, Path of pollutants, Water pollution sources, Marine environment, Macroinvertebrates.

AMIC-8423
"HEAVY METALS: A REVIEW OF LEAD", Shukla, S. S., Leland, H. V., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1319-1331.

This review on lead covers toxicity and sources of lead pollution along with the concentrations associated with each source.

INDEX TERMS: Lead, Toxicity, Path of pollutants, Water pollution effects, Water pollution sources, Animal pathology, Ecological distribution, Public health, Waste water (pollution), Soil contamination, Pollutant effects, Chemical concentration, Metal complexes, Biological magnification.

AMIC-8430
"SELECTED METALS IN SEDIMENTS, WATER, AND BIOTA IN THE ILLINOIS RIVER", Mathis, B. J., Cummings, T. F., Journal Water Pollution Control Federation, Vol. 45, No. 7, July 1973, pp 1573-1583.

This study was designed to assess the degree of metal contamination in a large midwestern river. The river is utilized both by industries for manufacturing and waste disposal purposes and by cities as a source of potable water and a means of wastewater disposal. Analyses were made for copper, nickel, lead, chromium, lithium, zinc, cobalt, and cadmium in bottom sediments, water, tubificid annelids, clams, and fishes. Metal concentrations were higher in sediments than in water and organisms. Clams and worms tt inhabit the mud or mud-water interface exhibited the highest metal concentrations of any of the organisms. Fishes that are primarily carnivorous in nature exhibited lower mean muscle concentrations of copper, nickel, lead, chromium, zinc, and cadmium than did omnivorous fishes.

INDEX TERMS: Heavy metals, Bottom sediments, Tubificids, Clams, Freshwater fish, Water pollution, Pollutant identification, Chemical analysis, Absorption, Benthic fauna, Illinois River, Sample preparation, Atomic absorption spectrophotometry, Bioaccumulation.

AMIC-8431
"PROTEINS IN WASTEWATER AND WASTEWATER SLUDGES", Sridhar, M. K. C., Pillai, S. C., Journal Water Pollution Control Federation, Vol. 45, No. 7, July 1973, pp 1595-1600.

The proteins found in raw wastewater, septic tank sludge, activated sludge, the mixed bacteria from activated sludge, the dominant protozoan Epistylis articulata in activated sludge, and the bacteria associated with the protozoan were identified on the basis of their solubilities in several solvents. On an equal dry-weight basis, these materials contained about 11, 17, 43, 73, 60, and 78 percent total proteins, respectively. Qualitatively, there were striking similarities between raw wastewater and septic tank sludge, between activated sludge and the protozoan, and between the two bacterial preparations in the distribution of the different protein fractions (albumins, globulins, glutelins, and prolamins). These observations seem to be of considerable significance in the study of the microbiology of wastewater and sludges and their protein contents.

INDEX TERMS: Waste water (pollution), Activated sludge, Septic tanks, Proteins, Sewage bacteria, Sewage sludge, Protozoa, Pollutant identification, Solubility, Organic solvents, Inorganic solvents.

AMIC-8450
"PRELIMINARY SURVEY OF MERCURY AND OTHER METALS CONTAINED IN ANIMALS FROM THE FRASER RIVER MUDFLATS", Parsons, T. R., Bawden, C. A., Heath, W. A., Journal of the Fisheries Research Board of Canada, Vol. 30, No. 7, July 1973, pp 1014-1016.

Additional research has been directed toward answering the question of the source of mercury contamination in the Fraser River estuary. The Fraser River mudflat community was divided into two areas from which crabs were collected for Hg analysis. Crabs and other marine organisms were also collected from other areas for comparative analyses. Soft tissue was freeze-dried, powdered, digested with concentrated HNO_3, evaporated to dryness, diluted with 1.5 M HCl, and analyzed by atomic absorption spectrophotometry for Ag, Cd, Co, Cu, Mn, Ni, and Zn. Pb analysis was done colorimetrically and Hg was analyzed by flameless AAS after sample digestion using sulfuric acid and hydrogen peroxide. Benthic animals from Sturgeon Bank contained larger amounts of mercury and other metals than animals from similar environments on the coast of British Columbia. These high levels of metals are believed to be associated with the Vancouver City sewer outfall.

INDEX TERMS: Heavy metals, Chemical analysis, Estuarine environment, Water pollution sources, Benthic fauna, Pollutant identification, Crabs, Fraser River, Animal tissues, Bioaccumulation.

AMIC-8451
"DISCHARGE OF NITRILOTRIACETATE (NTA) FROM TWO SEWAGE TREATMENT FACILITIES LOCATED IN A MIDCONTINENTAL CLIMATE", Rudd, J. W. M., Townsend, B. E., Hamilton, R. D., Journal of the Fisheries Research Board of Canada, Vol. 30, No. 7, July 1973, pp 1026-1030.

Concentrations of NTA entering the Red and Assiniboine rivers from two Winnipeg sewage treatment facilities were monitored. The activated sludge plant usually discharges less than 0.5 mg NTA/liter throughout the year. The aerated sewage lagon discharged less than 20 micrograms NTA/liter during summer. It was believed that the NTA passed through the lagon essentially unchanged during winter (1800 micrograms NTA/liter) when degradation rates must have been extremely low. No NTA was detected in river water downstream from either of these facilities. It was concluded that even under extreme environmental conditions NTA discharge did not present a hazard to either local aquifers or local biota.

INDEX TERMS: Nitrilotriacetic acid, Treatment facilities, Sewage effluents, Aerated lagoons, Activated sludge, Discharge measurement, Sewage treatment, Water pollution sources, Biochemical oxygen demand, Effluent streams, Influent streams, Dissolved oxygen, Pollutants, Pollutant identification, Degradation rates, Red River, Assiniboine River, Chemical concentration.

AMIC-8458
"DIRECT DETERMINATION OF PHOSPHORUS BY ATOMIC ABSORPTION FLAME SPECTROMETRY", Kirkbright, G. F., Marshall, M., Analytical Chemistry, Vol. 45, No. 9, August 1973, pp 1610-1613.

6 The direct determination of phosphorus by atomic absorption spectrometry at its 177.5-, 178.3-, and 178.8-nm resonance lines using a nitrogen-separated nitrous oxide-acetylene flame and a microwave-excited phosphorus electrodeless discharge lamp source is described. Phosphorus may be determined in aqueous solution as o-phosphate with a sensitivity of 4.8 and 5.4 micrograms/ml (for 1 percent absorption) at the 177.5- and 178.3-nm lines; the corresponding detection limits obtained at these wavelengths were 29 and 21 micrograms/ml, respectively. The high temperature and relatively transparent nature of the fuel-rich flame make it a convenient atom cell for the atomization of phosphorus; no significant chemical or physical interferences have been observed at the levels investigated. The results of a preliminary investigation of the application of the method to the direct determination of phosphorus in milk powder and yeast and beef extracts are described. (Reprinted from Analytical Chemistry, Vol. 45, No. 9, August 1973, pp 1610-1613. Copyright 1973 by the American Chemical Society. Reprinted by permission of the copyright owner.)

INDEX TERMS: Phosphorus, Pollutant identification, Aqueous solutions, Chemical analysis, Methodology, Nutrients, Atomic absorption spectrophotometry, Detection limits, Chemical interference, Yeast extract, Sensitivity, Accuracy, Molybdenum blue method, Beef extract, Biological samples, Milk products.

AMIC-8461
"RAPID, SELECTIVE METHOD FOR LEAD BY FORCED-FLOW LIQUID CHROMATOGRAPHY", Seymour, M. D., Fritz, J. S., Analytical Chemistry, Vol. 45, No. 9, August 1973, pp 1632-1636.

A forced-flow ion exchange method for the separation of lead from metal ions has been described. Lead is measured in manner similar to that described previously for iron. Lead(II) is retained on a small anion exchange column from 0.5 M hydrochloric acid and separated from many other metal ions. Then it is eluted with 8 M hydrochloric acid and the elution curve is recorded at 270 nm. The amount of lead is obtained from a plot of elution peak height vs. micrograms of lead. The entire separation sequence required only 8 min. There are two kinds of interference common to this type of analysis Column overloading can cause alteration of peak shape and retention time and, hence, a dependency of peak height on matrix composition. The other type of interference is due to ions that are retained in 0.5 M HCl, stripped in 8.0 M HCl and absorbed at 270 nm. Of the cations tested, only three were found to interfere. Rhodium(III), antimony(V), and molybdenum(VI) were found to cause a 1 percent error in the analysis with metal/lead ratios of 0.009, 0.181, and 5.30, respectively. Nitrate ion can also cause error and should be driven off by taking the sample to dryness in concentrated hydrochloric acid prior to analysis. Several standard samples have been successfully analyzed for lead.

INDEX TERMS: Lead, Separation techniques, Aqueous solutions, Pollutant identification, Heavy metals, Anion exchange, Chemical analysis, Methodology, Selectivity, Ions, Nitrates, Molybdenum, Forced-flow liquid chromatography, Environmental samples, Accuracy, Precision, Chemical interference, Ionic interference, Rhodium, Antimony, Sample preparation, Rare earth elements.

AMIC-8475
"DETERMINATION OF AMMONIA IN AQUARIA AND IN SEA WATER USING THE AMMONIA ELECTRODE", Gilbert, T. R., Clay, A. M., Analytical Chemistry, Vol. 45, No. 9, August 1973, pp 1757-1759.

An ammonia electrode that has been fabricated for the analysis of ammonia in aqueous solutions consists of a hydrophobic gas-permeable membrane which separates the alkaline test solution from an internal solution 0.1 M in ammonium chloride. When the electrode is immersed in an alkaline test solution, ammonia can diffuse across the membrane, alter the NH3 concentration in the filling solution, and so cause a pH change which is monitored by the glass electrode. Electrode reproducibility was evaluated using samples from different marine life display tanks at the New England Aquarium with varying ammonia levels. The results indicate that the relative precision of these analyses was fairly constant over a wide concentration range. To test the accuracy of the method and to evaluate the electrode/portable unit as a tool for on-site analysis, a series of 1-liter samples of Boston Harbor water was collected. A Dorchester Bay sample was analyzed on site using the standard procedure described above with a battery powered magnetic stirring motor. With the meter in a horizontal position to minimize needle oscillation due to rocking of the boat, six analyses of the sample gave a mean value of 92 ppb NH3-N with a standard deviation of 3 ppb. Other samples were acidified to pH 3-4 with 6 M HCl to stabilize the ammonia and analyzed the same day in the laboratory by the electrode and also by the phenol-hypochlorite method. The data indicate that the electrode provides an accurate means of analyzing ammonia in sea water and that is is usually more precise than the spectrophotometric method. Furthermore, the performance of the electrode in the field is comparable to that observed in the laboratory, showing the technique to be well suited for field analysis.

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INDEX TERMS: Ammonia, Water analysis, Sea water, Aquaria, Pollutant identification, Chemical analysis, Aqueous solutions, Pollutants, On-site tests, On-site investigations, Water quality, Water pollution, Ammonia electrodes, Ion selective electrodes, Precision, Reproducibility, Accuracy.

AMIC-8478
"ENVIRONMENTAL ANALYSIS PROBLEMS CREATED BY UNEXPECTED VOLATILE BERYLLIUM COMPOUNDS IN VARIOUS SAMPLES", Black, M. S., Sievers, R. E., Analytical Chemistry, Vol. 45, No. 9, August 1973, pp 1773-1775.

Analysis of orchard leaves samples for beryllium yielded inconsistent results when the samples were prepared by different methods suggesting that volatile beryllium contents may have been present. To investigate this possibility, samples of orchard leaves and air were obtained. The orchard leaves were prepared for analysis by wet digestion in an open container, by wet digestion in a flask with a reflux condenser, and by low temperature ashing in an oxygen plasma. Air samples, which were provided by EPA's Office of Air Programs, have been collected in a sampling train consisting of an EPA sampling probe, two Millipore AA filters backed by Whatman filters in series, two water impingers in series, a dry impinger to catch water condensation, and a cold trap. Samples from each section were analyzed. All analyses were by electron capture gas chromatography. These results were compared with those obtained by GC-mass spectrometry. The results of this study indicate the existence of naturally occurring volatile beryllium compounds. The various digestion and ashing procedures of orchard leaves have shown that beryllium is lost in the vapor phase at relatively low temperatures (less than 200 C). This suggests that a considerable amount (at least 90 percent) of the beryllium in the orchard leaves may be organically bound and that it is lost upon destruction of the organic matrix unless precautions are taken. Analyses of the impinger samples show that beryllium content was much higher in the cold traps than in the water impingers in spite of the fact that the cold traps came last in the flow train. This supports the contention that volatile beryllium compounds do exist and that they are present in the vapor state in facilities where beryllium is machined.

AMIC-8478 (Continued) Card 2/2

INDEX TERMS: Beryllium, Gas chromatography, Air pollution, Sample preparation, Chemical recovery, Orchard leaves, Volatilization.

AMIC-8483
"l-EPHEDRINE IN CHLOROFORM AS A SOLVENT FOR SILVER DIETHYLDITHIOCARBAMATE IN THE DETERMINATION OF ARSENIC", Kopp, J. F., Analytical Chemistry, Vol. 45, No. 9, August 1973, pp 1786-1787.

l-ephedrine in chloroform was substituted for pyridine as a solvent for silver diethyldithiocarbamate in the colorimetric determination of arsenic in water. This eliminates the objectionable odor associated with pyridine. Samples of river water, sewage effluent, and distilled water were analyzed by both procedures and the results compared. l-ephedrine in chloroform gave an accuracy within the acceptable range. Cr, Co, Cu, Hg, Mo, Ni, Pt, and Sb may interfere with the method. However, levels normally encountered do not cause significant interference. As with the pyridine method, organically bound arsenic cannot be determined without an acid digestion step.

INDEX TERMS: Colorimetry, Solvents, Water analysis, Rivers, Sewage effluents, Arsenic, Sample preparation, Chemical interference.

AMIC-8496
"DETERMINATION OF TRACE PHENOL IN AQUEOUS SOLUTION BY AQUEOUS LIQUID CHROMATOGRAPHY", Bhatia, K., Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1344-1347.

Liquid chromatographic methods capable of use both for identification of trace quantities of phenols in aqueous solution and for the quantitative analysis of mixtures whose components are known are described. An optical detector utilizing the 254-nm mercury resonance line was used. Phenol in the aqueous phase can be accurately determined down to 0.00001 M (less than mg/l). Further improvement in the sensitivity of the method for quantitative analysis of phenol can be achieved by using larger samples and a detector operating at about 270 nm. The presence of di- and trihydroxybenzenes, most other substituted phenols, naphthols, and phenolic bi- and terphenyls in the solutions does not interfere in the determination of phenol. The application of aqueous liquid chromatography to the determination of phenols in industrial waste waters is demonstrated. The methods can be easily extended to the determination of individual substituted phenols down to at least 0.00001 M. (Reprinted from Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1344-1347. Copyright 1973 by the American Chemical Society. Reprinted by permission of the copyright owner.)

INDEX TERMS: Phenols, Pollutant identification, Waste water (pollution), Water analysis, Liquid chromatography, Chemical interference, Detection limits.

AMIC-8506
"CORRELATION OF ENHANCEMENT OF ATOMIC ABSORPTION SENSITIVITY FOR SELECTED METAL IONS WITH PHYSICAL PROPERTIES OF ORGANIC SOLVENTS", Lemonds, A. J., McClellan, B. E., Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1455-1460.

Various alcohols, ketones, esters, and other organic compounds, as solvents for Ag, Cd, Co, Ni, and Zn ions, were studied to determine the enhancement of atomic absorption values for each metal-solvent system and to correlate the enhancement values with the physical properties of the solvents. Optimum instrumental conditions were determined for each metal-solvent system employing two different burner-aspirator systems. Absorbance values for the metal-organic solvent systems were measured and compared with the absorbance values for the aqueous system of the same concentration in order to calculate an enhancement value. Plots of enhancement vs. log viscosity and enhancement vs. log boiling point for each ion resulted in lines with negative slopes. Various plots involving density and surface tension showed little or no dependence of enhancement on either of the constants. However, a linear relationship existed between log (viscosity X boiling point) and enhancement. (Reprinted from Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1455-1460. Copyright 1973 by the American Chemical Society. Reprinted by permission of the copyright owner.)

INDEX TERMS: Atomic absorption spectrophotometry, Organic solvents, Signal enhancement, Silver, Heavy metals, Cadmium, Nickel, Cobalt, Zinc.

AMIC-8507
"INTERFERENCES IN NICKEL DETERMINATIONS BY ATOMIC ABSORPTION SPECTROMETRY", Sundbert, L. L., Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1460-1464.

This study was undertaken to evaluate interferences from Zn, Fe(III), Cu, Co, Mn(II), and Cr(III) in the atomic absorption spectrometry of nickel. Stock solutions of all but copper were prepared by dissolving the metals in HCl and diluting with water. Copper solutions were prepared by dissolving $CuCl_2.2H_2O$ in water. Interferences were studied with both oxidizing and reducing air-acetylene flames. Other variables were wavelength and burner elevation. Samples contained transition metal concentrations of 2000 ppm and 20 ppm Ni. The results show that interferences from Fe(III), Cu, Co, Mn(II), and Cr(III) are similar and are greatly influenced by observation height. Consequently, careful adjustment of this parameter can eliminate them. In a reducing flame, the Ni absorbance can be enhanced or depressed by the same concomitant, and the direction of the interferences is further dependent upon the concentration of interfering species.

INDEX TERMS: Nickel, Aqueous solutions, Atomic absorption spectrophotometry, Chemical interference.

AMIC-8508
"ATOMIC ABSORPTION ANALYSIS OF STRONG HEAVY METAL CHELATING AGENTS IN WATER AND WASTE WATER", Kunkel, R., Manahan, S. E., Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1465-1468.

A method for the analysis of total strong heavy metal chelating agents in water is described. The method is based upon the solubilization of copper by the chelating agents at pH 10 followed by filtration and atomic absorption analysis of soluble copper in the filtrate. The analysis gives total levels of strong chelating agents, a significant parameter insofar as the properties of natural waters and waste waters are concerned. The method is simple, sensitive, and relatively free of interferences. It can be applied to the analysis of individual chelating agents after separation.

INDEX TERMS: Heavy metals, Waste water (pollution), Pollutant identification, Chemical analysis, Methodology, Water analysis, Nitrilotriacetic acid, Chelating agents, Atomic absorption spectrophotometry, Natural waters, Chemical recovery, EDTA, Metal chelates, Ionic interference.

AMIC-8515
"RETENTION OF MERCURY WHEN FREEZE-DRYING BIOLOGICAL MATERIALS", LaFleur, P. D., Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1534-1536.

Guinea pigs and rats were fed foods containing Hg-203 labelled phenylmercuric acetate, methylmercury chloride, or inorganic mercury for use in tests to determine whether mercury losses occur during lyophilization (freeze drying) of biological samples. Upon sacrifice, the animals were dissected, and the liver, kidney, heart, brain, muscle, spleen and samples of blood taken for study. Feces were also collected during the feeding regimen. The samples were weighed, the relative mercury content determined radiometrically, and frozen. The samples were then lyophilized and the mercury content was again determined radiometrically. Net loss of mercury was calculated after making appropriate decay corrections. Of a total of over 30 tissue samples from animals fed methylmercury chloride, the mean mercury loss was less than 3 percent. Of the 10 organ samples from animals fed inorganic mercury and 11 tissue samples from those fed phenylmercuric acetate, the mean loss was less than 2 percent. Loss from blood was negligible, loss from feces was approximately 10 percent. Additional tests to determine the effects of pretreatment by freezing and time of lyophilization showed that neither affected loss of mercury. Freeze drying of aqueous solutions resulted in losses up to 90 percent for the organomercurials and 10 percent for inorganic mercury.

INDEX TERMS: Mercury, Radioactivity techniques, Aqueous solutions, Biological samples, Freeze drying, Feces.

AMIC-8518
"LIQUID CHROMATOGRAPHY-MASS SPECTROMETRY. COUPLING OF A LIQUID CHROMATOGRAPH TO A MASS SPECTROMETER", Lovins, R. E., Ellis, S. R., Tolbert, G. D., McKinney, C. R., Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1553-1556.

Because of the increasing utility of liquid chromatography in analytical and bio-analytical problems, the need for a reliable method of analyzing and identifying the effluent peaks generated by the liquid chromatograph has become apparent. For this purpose a system was designed to couple the liquid chromatograph to a mass spectrometer. The interface consisted of a motor driven probe to accept the effluent peaks from a liquid chromatograph, separate the solute from the solvent by flash evaporation in the probe tip, and automatically insert the isolated material into the ion source of the mass spectrometer for analysis. Results are given for the analysis of dieldrin, DDT, DDD, sulfathiazole, sulfanilamide, sulfamethazine, anthracene, pyrene, chrysene, and naphthalene.

INDEX TERMS: Chlorinated hydrocarbon pesticides, Laboratory equipment, Pollutant identification, DDT, DDD, Dieldrin, Liquid chromatography, LC-mass spectrometry, Sulfathiazole, Sulfanilamide, Sulfamethazine, Anthracene, Pyrene, Chrysene, Naphthalene.

AMIC-8534
"ASBESTOS FIBERS IN BEVERAGES, DRINKING WATER, AND TISSUES: THEIR PASSAGE THROUGH THE INTESTINAL WALL AND MOVEMENT THROUGH THE BODY", Cunningham, H. M., Pontefract, R. D., Journal of the Association of Analytical Chemists, Vol. 56, No. 4, July 1973, pp 976-981.

Methods were developed using an electron microscope to isolate and count asbestos fibers in liquids and tissues. Fibers were detected in beer, sherry, port, vermouth, soft drinks, and city drinking water at levels generally ranging from 1 to 11 million per liter. River water was higher in asbestos fibers than water passed through a city filtration system, and melted snow was considerably higher than river water. Asbestos fibers were also detected in parenteral solutions. Distribution studies on asbestos fibers administered to rats were performed with the electron microscope and were supplemented with studies using both tritiated and neutron-activated asbestos. Crysotile fibers were injected into the stomachs of rats and 2-4 days later fibers were isolated from the blood, spleen, liver, kidney, omentum, muscle, lung, and brain. Highest levels of orally administered fibers were found in the omentum; intravenously injected fibers resulted in highest levels in the liver and the lung.

INDEX TERMS: Asbestos, Electron microscopy, Foods, Rain, Potable water, Rivers, Neutron activation analysis, Biological samples.

AMIC-8536
"QUANTITATIVE PERCHLORINATION OF POLYCHLORINATED BIPHENYLS AS A METHOD FOR CONFIRMATORY RESIDUE MEASUREMENT AND IDENTIFICATION", Armour, J. A., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 4, July 1973, pp 987-993.

The perchlorination procedure for derivatization of PCBs described by Berg, Diosady, and Rees has been modified to achieve a micro-scale quantitative conversion (greater than 90 percent) of commercial PCB preparations (Aroclors) to decachlorobiphenyl. Cleaned up sample extracts containing PCB residues (1-20 micrograms) are allowed to react with antimony pentachloride in the presence of chloroform to form decachlorobiphenyl. This procedure converts a multicomponent mixture to a single derivative detectable by electron capture GLC, thus providing an easy method for quantitating and identifying PCB residues and at the same time increasing the sensitivity of detection. The usefulness of the perchlorination procedure is demonstrated by comparing results for environmentally contaminated samples quantitated by 2 methods: by measuring the total area of the electron capture response for the residue against the Aroclor it most closely resembles, and by measuring the single peak of the decachlorobiphenyl derivative and expressing the results in terms of the particular Aroclor.

INDEX TERMS: Polychlorinated biphenyls, Pollutant identification, Chemical analysis, Methodology, Chemical reactions, Poultry, Perchlorination method, Electron capture gas chromatography, Derivatives, Mixtures, Quantitative analysis, Sample preparation, Decachlorobiphenyl, Chemical recovery, Aroclor 1242, Aroclor 1016, Aroclor 1248, Aroclor 1254, Aroclor 1260, Aroclor 1262, Chubs, Sturgeon, Animal tissues, Eggs, Fat, Sensitivity, Gas liquid chromatography.

AMIC-8538
"POLYCHLORINATED TERPHENYLS AS POTENTIAL CONTAMINANTS OF ANIMAL PRODUCTS", Fries, G. F., Marrow, G. S., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 4, July 1973, pp 1002-1007.

Evidence is presented of the presence of polychlorinated terphenyl (PCT) residues in samples of wall scrapings, silage and milk from farms where the PCT, Aroclor 5460 has been used in a sealant for concrete stave silos. Milk and silage samples were extracted and cleaned up using FDA multipesticide residue methodology; wall scrapings and the sealant sample were extracted and diluted, respectively, with hexane and examined by electron capture GLC without further cleanup. The cleaned up samples were chlorinated with $SbCl_5$ to form the 3 tetradecachloroterphenyl derivatives which facilitates identification of PCT residues by electron capture GLC. This work demonstrates that milk produced on farms with contaminated silos will contain PCT residues. Since the PCB and PCT residues are from the same source, correction of the PCB problem will also eliminate the PCT residues. The silo situation does provide good opportunity to study the comparative behavior of the 2 classes of compounds under environmental conditions. If the behavior is similar, it may be possible to predict the distribution and levels of PCT residues from information available on PCBs.

INDEX TERMS: Milk, Silage, Pollutant identification, Chemical analysis, Polychlorinated terphenyls, Electron capture gas chromatography, Aroclor 5460, Sample preparation, Chemical recovery, Tetradecachloroterphenyls, Chemical interference.

AMIC-8539
"VERSATILE COMBUSTION-AMALGAMATION TECHNIQUE FOR THE PHOTOMETRIC DETERMINATION OF MERCURY IN FISH AND ENVIRONMENTAL SAMPLES", Willford, W. A., Hesselberg, R. J., Bergman, H. L., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 4, July 1973, pp 1008-1014.

Total mercury in a variety of substances is determined rapidly and precisely by direct sample combustion, collection of released mercury by amalgamation, and photometric measurement of mercury volatilized from the heated amalgam. Up to 0.2 g fish tissue is heated in a stream of O_2(1.2 l/min) for 3.5 min in 1 tube of a 2-tube induction furnace. The released mercury vapor and combustion products are carried by the stream of O_2 through a series of traps (6 percent NaOH scrubber, water condenser, and $Mg(ClO_4)_2$ drying tube) and the mercury is collected in a 10 mm diameter column of 24 gauge gold wire (8 g) cut into 3 mm lengths. The resulting amalgam is heated in the second tube of the induction furnace and the volatilized mercury is measured with a mercury vapor meter equipped with a recorder-integrator. Total analysis time is approximately 8 min/sample. The detection limit is less than 0.002 microgram and the system is easily converted for use with other biological materials, water, and sediments. Major advantages of the method over the normal acid-digestion, flameless atomic absorption techniques include: simplicity of operation; speed of complete analysis; high sensitivity, precision, and accuracy; small sample size required; freedom from rigorous and sometimes hazardous acid-digestion procedures; freedom from reagent and glassware contamination; and comparatively low cost of equipment. Disadvantages of the method as described include: somewhat limited usable range of sensitivity (0.02-5.0 ppm); a general inability to analyze highlycontaminated samples (greater than 5.0 ppm) without the use of a gas stream splitter or an extremely small sample; necessity for frequent changes in attenuation of mercury

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vapor meter, unless previous knowledge permits grouping of samples within ranges having less than a 5-fold difference in concentration; and increased emphasis on the need for well homogenized representative samples because of the small sample size used. It is expected that minor changes in the system or substitution of a less sensitive mercury vapor meter would overcome many of these disadvantages when they are restrictive for a particular use.

INDEX TERMS: Mercury, Chemical analysis, Fish, Methodology, Pollutant identification, Plant tissues, Sediments, Environmental samples, Biological samples, Chemical interference, Detection limits, Precision, Sensitivity, Accuracy, Sample size, Sample preparation, Chemical recovery, Accuracy.

AMIC-8540

"COLLABORATIVE STUDY OF THE RECOVERY AND GAS CHROMATOGRAPHIC QUANTITATION OF POLYCHLORINATED BIPHENYLS IN CHICKEN FAT AND POLYCHLORINATED BIPHENYL-DDT COMBINATIONS IN FISH", Sawyer, L. D., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 4, July 1973, pp 1015-1023.

Nine laboratories collaborated on the analyses of PCBs in chicken fat and DDT-PCB combinations in fish. Existing AOAC multipesticide methodology with GLC quantitation was employed. One solution containing a mixture of Aroclors 1254 and 1260 was analyzed by GLC only. The fish samples were subjected to a published silicic acid procedure for separating the DDT-PCB mixtures. The DDT analogs were quantitated before and after the separation. The PCB content was quantitated by total peak height and total area comparisons against appropriate Aroclor(s), using electron capture GLC, and additionally in 6 laboratories by total area comparisons, using halogen-specific detection. The electron capture GLC data demonstrated better accuracy and precision. The following PCB recoveries were obtained by using total peak height comparisons: 5 ppm mixed Aroclor solution, 100 plus or minus 4 percent; 8 ppm Aroclor 1242-fortified chicken fat, 101 plus 13 percent; 7.5 ppm Aroclor 1248-fortified chicken fat, 96 plus or minus 9 percent; incurred Aroclor 1242 chicken fat, 9.2 ppm plus or minus 8 percent; 6 ppm Aroclor 1254-fortified fish, 75 plus or minus 14 percent; 6 ppm Aroclor 1260-fortified fish, 75 plus or minus 15 percent; and an environmentally incurred residue in fish, 4.5 ppm plus or minus 20 percent. The 2 Aroclor-fortified fish samples were concurrently spiked with the p,p'-isomers of DDE, TDE, and DDT at levels of 4, 1, and 3 ppm, respectively. After silicic acid separation the combined recoveries for these 2 samples were: DDE, 86 plus or minus 13 percent; TDE, 89 plus or minus 20 percent; and DDT 84 plus or minus 17 percent. Environmentally incurred-DDT

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residues were recovered at 4.1 ppm plus or minus 14 percent for p,p'DDE, 0.7 ppm plus or minus 24 percent for o,p'-DDT and 2.7 ppm plus or minus 17 percent for p,p'-DDT. The DDT values calculated before the silicic acid separation compared favorably with those summarized. The multiresidue method for chlorinated pesticides, 29.001-29.027, has been adopted official first action to include polychlorinated biphenyls in poultry fat and fish.

INDEX TERMS: Polychlorinated biphenyls, Poultry, Fish, DDT, Chemical analysis, Animal tissues, Electron capture gas chromatography, Chemical recovery, Fat tissue, Quantitative analysis, Interlaboratory studies, Isomers, Aroclor 1260, Aroclor 1254, Aroclor 1242.

AMIC-8546

"IN SITU SAMPLER FOR MARINE SEDIMENTARY PORE WATERS: EVIDENCE FOR POTASSIUM DEPLETION AND CALCIUM ENRICHMENT", Sayles, F. L., Wilson, T. R. S., Hume, D. N., Mangelsdorf, P. C., Jr., Science, Vol. 181, No. 4095, July 13, 1973, pp 154-156.

A devide (probe) for sampling the interstitial waters of the deep-sea sediments in situ has been developed and tested. The probe is basically a 2-m length of heavy-wall stainless steel tubing, with a pointed tip for penetration and with five filter-covered sampling ports (each filter equals 6 sq cm) spaced 30 cm apart along the length. Above these is a broad base plate to halt penetration and above that one further port to sample overlying water. The suction required to draw the samples into the ports is provided by a compressed heavy-duty spring working the piston of a large master cylinder (120-cu cm displacement). The sampler collects a series of samples over a depth of 1.5 meters in the sediment and thus makes possible the accurate delineation of chemical gradients existing in the pore waters. Samples collected in the North Atlantic indicate that significant gradients of K(plus) and Ca(2 plus) exist in the sediments sampled. Interstitial solutions sampled between Ireland and Cape Cod, Massachusetts, are characterized by the depletion of K(plus) and the enrichment of Ca(2 plus).

INDEX TERMS: Pore water, Water sampling, Equipment, On-site data collections, Connate water, Deep water, Bottom sediments, Withdrawal, Sea water, Marine sediments, Characterization.

AMIC-8551
"COBALT INTERFERENCE IN THE NON-STEADY STATE CLEAN WATER TESTS", Kalinske, A. A., Lash, L. D., Shell, G. L., Water and Sewage Works, Vol. 120, No. 7, July 1973, pp 54-59.

The purpose of this study was to evaluate the non-steady state method for determining oxygen transfer by aeration. It was observed that when sodium sulfite was used to deoxygenate the test water more than 0.05 mg/l cobalt ion concentration caused a chemical interference in the Winkler dissolved oxygen determination. This chemical interference varied with the cobalt ion concentration, the number of sulfite additions, the aeration period between tests and C sub s (saturation value for oxygen under test conditions). Values of oxygen input efficiency reported for aerators tested with cobalt ion concentrations greater than 0.05 mg/l can be high by as much as 10 to 50 percent. The degree of error will depend on the amount of cobalt ion used and the number of sulfite additions. If higher cobalt ion concentration is used, then the dissolved oxygen must be measured using a fast response dissolved oxygen probe. A meter which achieves 99 percent of the true value in 15 seconds (after swinging full scale) should be satisfactory. Cobalt interference in the determination of dissolved oxygen (Winkler method) in the non-steady state reoxygenation method may be reduced to insignificant levels by use of no higher than 0.05 mg/l cobalt ion.

INDEX TERMS: Cobalt, Dissolved oxygen, Chemical analysis, Water analysis, Heavy metals, Aeration, Methodology, Water quality, Water pollution, Cations, Laboratory tests, Ionic interference, Chemical interference, Winkler method, Error sources, Non-steady state reoxygenation test, Oxygen diffusion coefficient, Errors.

AMIC-8556
"HERBICIDE CONTAMINATION OF SURFACE RUNOFF WATERS", Evans, J. O., Duseja, D. R., Utah State University, Department of Plant Science, Logan, Utah, Report No. EPA-R2-73-266, June 1973, 110 pp.

Field and laboratory studies of the movement of herbicides were conducted to determine their potential as contaminants in irrigation return flow. Special emphasis was given to the use of herbicides for vegetation control along ditches, canals and watersheds where high dosages are required to control the excessive growth of grasses and broadleaved weeds. The following herbicides have been studied: substituted urea (diuron), triazines (summitol and atrazine), phenoxyacetic acid (2,4-D and 2,4,5-T) and a substituted pyridine (picloram). The greatest tendency for transport of herbicides in water coming in contact with soils occurs during the initial storms following spray application. If the intensity of the initial precipitation is not sufficient to cause movement across the soil, the danger of herbicide movement is essentially eliminated. The highest concentrations (ppm) of herbicide observed in surface waters were 1.8, 0.5, 4.2, 1.2 and 2.7 for diuron, summitol, 2,4-D, 2,4,5-T and picloram, respectively. These levels were observed immediately below treated areas receiving the higher recommended dosages of the herbicides. All herbicide concentrations dropped below the limit of detection within a few hundred meters below the sprayed areas. Presumably, soil filtration, adsorption and dilution are primarily responsible for the loss of herbicides from water.

INDEX TERMS: Herbicides, Water pollution, On-site investigations, Laboratory tests, Pesticide kinetics, Surface runoff, 2 4-D, 2 4 5-T, Diuron, Summitol, Atrazine, Picloram.

AMIC-8557
"A RAPID, SENSITIVE METHOD FOR THE DETERMINATION OF THE CHEMICAL OXYGEN DEMAND OF POLLUTED WATERS", Pitt, W. W., Jr., Katz, S., Thacker, L. H., In: Water-1972, AIChE Symposium Series No. 129, Vol. 69, 1973, pp 1-5.

A rapid, sensitive cerate oxidation method for measuring the chemical oxygen demand (COD) of waters is described. The pollutants are oxidized with perchloratocerate reagent, and the resulting cerium (III) is determined fluorometrically. Analysis requires only a few minutes for determinations at levels as low as 100 micrograms oxygen demand per liter. Results of tests on solutions of known organic compounds, an industrial waste stream, a domestic sewage plant effluent, and a natural stream show that the method compares favorably with the dichromate reflux procedure recommended by APHA. However, the new method is considerably faster and easier to use, and is a hundred times more sensitive. An analytical system which is suitable for use as either a continuous COD monitor or as an analyzer for multiple samples in series is also described.

INDEX TERMS: Chemical oxygen demand, Water pollution, Methodology, Water analysis, Chemical analysis, Waste water (pollution), Cerate oxidation method.

AMIC-8558
"SOURCES AND SINKS OF NITROGEN AND PHOSPHORUS: WATER QUALITY MANAGEMENT OF LAKE GEORGE (N.Y.)", Aulenbach, D. B., Clesceri, N. L., In: Water-1972, AIChE Symposium Series No. 129, Vol. 69, 1973, pp 253-262.

Measurements were made of the nitrogen and phosphorus contents of the precipitation, stream runoff, and wastewater discharges tributary to Lake George; the lake water itself; and the equivalent of the outlet at Ticonderoga. The major source of nitrogen to the lake is the precipitation which falls directly on the lake. The major source of phosphorus is from wastewater discharges on the watershed. Apparently both the nitrogen and the phosphorus are precipitated and accumulated in the bottom sediments. The concentration of phosphorus in the lake is approaching the critical level of 10 micrograms/l. Removal of phosphorus from wastewater is recommended.

INDEX TERMS: Phosphorus, Nitrogen, Sinks, Water pollution sources, Precipitation (atmospheric), Waste water (pollution), Streamflow, Sewage effluents, Path of pollutants, Lake George, Nutrient sources.

AMIC-8564
"WATER QUALITY MONITORING ON THE MISSISSIPPI RIVER HAS ITS PITFALLS", Rains, B. A., Flick, R. S., In: Water-1972, AIChE Symposium Series No. 129, Vol. 69, 1973, pp 401-413.

A discussion is presented of the difficulties and problems associated with sampling a large stream such as the Mississippi River to determine biological and chemical quality. Included is information on sampling point selection, methods of sample collection, flow measurement technique, and pollution source location. Description of field equipment is given in addition to laboratory results obtained from sample analysis.

INDEX TERMS: Water quality, Monitoring, Natural streams, Water pollution sources, Water sampling, Equipment, Methodology, Environmental effects, Flow measurement, Biological samples.

AMIC-8567
"MEASUREMENT OF ORGANIC WASTEWATER PARAMETERS", Neher, M. B., In: Water-1972, AIChE Symposium Series No. 129, Vol. 69, 1973, pp 600-602.

Techniques are discussed for the measurement of organic wastewater parameters including BOD, total carbon, total organic carbon, total oxygen demand, and COD. The analytical instruments of concern are (1) continuous monitoring and (2) intermittent sampling instruments which include automated GLC, a mass spectrometer, digital computer programmed gas chromatograph-mass spectrometers, and infrared spectrometry. There are only a limited number of organic parameters, however, that can be measured on a continuous basis. There are also only a few instruments available for monitoring the organic content of water, and these give measurements only of total organic carbon content. As pointed out in the attached student review and critique, the 'drawback for control purposes would seem to be an inability to specify organic constituents and demonstrate a toxicity effect of a wastewater'.

INDEX TERMS: Monitoring, Waste water (pollution), Organic wastes, Measurement, Pollutant identification, Instrumentation, Properties, Process streams.

AMIC-8569
"FACTORS INFLUENCING THE FREQUENCY OF SAMPLING", Jutze, G., In: Water-1972, AIChE Symposium Series No. 129, Vol. 69, 1973, pp 610-611.

Sampling frequency is an indispensable consideration in determining how wastewater parameters are to be measured. The factors that must be considered in determining monitoring frequency are: (1) variability of incoming waste, its flow and characteristics; (2) characteristics of the process; and (3) the effect of process upset on receiving streams.

INDEX TERMS: Sampling, Waste water (pollution), Treatment facilities, Frequency, Monitoring, Sewage effluents, Waste assimilative capacity, Waste water treatment, Flow, Properties, Methodology, Toxicity.

AMIC-8570
"THE DEVELOPMENT OF AN INSTRUMENTAL COMBUSTION METHOD FOR THE RAPID DETERMINATION OF TOTAL PHOSPHORUS IN AQUEOUS SOLUTIONS", D'Itri, F. M., Michigan State University, Institute of Water Research, East Lansing, Michigan, Project Completion Report, Contract No. 14-31-01-0001-3022, January 1973, 67 pp. NTIS Report No. PB-216 803.

The objective of this research proposal was to design an instrument for the rapid determination of trace amounts of organic and inorganic phosphorus in aqueous solutions without interferences from other organic or inorganic components of the system. With this method, the phosphorus compounds are reduced in a quartz tube filled with hydrogen gas to phosphine (PH_3) at 900-1000 C. Any interferences such as hydrogen chloride and hydrogen sulfide are removed by adsorption chromatography. The phosphine gas thus produced is then passed through a chromatographic column and measured by a cesium thermionic detector with the signal transmitted to a potentiometric recorder. The intensity of the signal is proportional to the amount of phosphine produced. The method requires microliter samples and the minimum detectability of the system is in the range of 0.1 to 0.2 micrograms (approximately equivalent to 100 to 200 milligrams per liter) as phosphorus. The analysis time per sample is less than 100 minutes.

INDEX TERMS: Aqueous solutions, Gas chromatography, Phosphorus, Detection limits, Phosphine, Combustion.

See also: Category 2, AMIC-7914, 8270, 8326
Category 4, AMIC-8446
Category 5, AMIC-6895, 8198, 8335, 8466, 8543.

AMIC-6209
"POLYCHLOROBIPHENYLS (PCBS) AND RELATED CHLOROPHENYLS: EFFECTS ON HEALTH AND ENVIRONMENT. I. BIBLIOGRAPHY 1881-1971", Quinby, G. E., Oak Ridge National Laboratory, Toxicology Information Response Center, Oak Ridge, Tennessee, Report Nos. TIRC-1, ORNL-EIS-72-20, Contract No. NLM Interagency Agr. No. 40-274-71, April 1972, 140 pp. NTIS No. PB-209 944.

Medical and public health interest in polychlorobiphenyls (PCBs) in the United States was meager before 1970. The expanding literature since then has reflected the realization of the importance of these substances as environmental pollutants. The analytical confusion of PCB with DDT and other chlorinated hydrocarbon pesticides prior to 1969 is of special interest. The concern over PCBs was heightened in 1971 by the recongition of gross contamination of certain animal feeds and of trace contamination of some human foods. The 870 articles cited in this bibliography are believed to cover the majority of articles in all languages available through January, 1972. This bibliography is part I of a state-of-the-art review. Part II, the review, is scheduled for publication about June, 1972.

INDEX TERMS: Polychlorinated biphenyls, Bibliographies, Documentation, Reviews, Public health, Water pollution effects, Analytical techniques, Pollutant identification, Toxicity, Pollutant effects, Chlorophenyls, Animal tissues.

AMIC-6754
"ABNORMAL SHAPE CHANGE BY NITZSCHIA PALEA IN KULTUR", Cholnoky-Pfannkuche, von K., Nova Hedwigia, Vol. 21, Nos. 2-4, 1971, pp 883-886.

In cultures of Nitzschia palea cultivated for a number of years, the following abnormalities were observed: the length of the valvae diminished and finally measured only 6.5-10 microns, but the breadth did not change. The cell divisions were also disturbed. The daughter cells were at various places irregularly indented, but the genotypically determined characteristics of Nitzschia palea REMAINED UNCHANGED. A change in the nutrients did not influence the length of the cells, but an increase of the SiO2-concentration resulted in more normal shape of the valvae. (In German)

INDEX TERMS: Chrysophyta, Cultures, Essential nutrients, Plant morphology, Diatoms, Plant pathology, Environmental effects, Deficient elements, Aquatic algae, Nitzschia palea, Chemical concentration.

AMIC-7676
"EFFECT OF THE CHEMICAL COMPOSITION OF THE MEDIUM ON THE GROWTH OF CHLORELLA PYRENOIDOSA", Zarnowski, J., Acta Hydrobiologica. Cracov., Vol. 14, No. 3, 1972, pp 215-223.

A study was conducted in order to observe the intensity of growth of Chlorella pyrenoidosa on 16 media selected from the literature, and to investigate the effect of different EDTA concentrations in the medium on the algal culture growth rates measured by the number of cells/ml and the weight of dry matter. Pure cultures of Chlorella were used and the same concentration of microelements was used in all media. The culture was grown under non-sterile conditions with a temperature of 24 plus or minus 2 C for 14 days under an illumination of 7.500 lux for 16 hr/day. Simultaneously, the culture was aerated with air enriched with CO2 to prevent sedimentation of algae and to intensify the photosynthetic process. Before the beginning and end of culturing, amounts of N, P, and K in the media were determined. Four media (Kanazawa, Myers, Tamiya, and Warburg) were selected because of the intensive growth observed and each used in four combinations: without EDTA and with 7, 37, and 100 mg EDTA/l of culture. Cultural conditions were the same except the temperature range of 19-22 C. Of the investigated media those of Kanazawa and Tamiya ensured the most intensive growth of Chlorella. The best utilization of nutrients by the Chlorella cultures was observed on the Tamiya medium. Ethylenediaminetetraacetic acid (EDTA) stimulated the growth of the alga cultures.

INDEX TERMS: Growth rates, Chlorophyta, Aquatic algae, Cultures, Plant growth, Nutrients, Biomass, Essential nutrients, Culture media, Substrate utilization, Chlorella pyrenoidosa, Chemical composition, Culturing techniques, Ethylenediaminetetraacetic acid.

AMIC-7734
"ANNOTATED BIBLIOGRAPHY OF LAKE ONTARIO LIMNOLOGICAL AND RELATED STUDIES. VOL. II - BIOLOGY", Downing, E. P., Hassan, J. E., Sweeney, R. A., State University College at Buffalo, Great Lakes Laboratory, Buffalo, New York, Report No. EPA-R3-73-028b, March 1973, 236 pp.

Five hundred ninty-six (596) papers concerning biological aspects of Lake Ontario and influent tributaries were reviewed and abstracted. Each paper was cross-indexed by author, geographic area of lake and/or tributary in which study was performed, organism, habitat niche and techniques and instrumentation. In addition, a list of addresses for the authors and agencies was included along with other possibly pertinent references which the authors were not able to secure and review within the time limitations of the grant.

INDEX TERMS: Reviews, Abstracts, Bibliographies, Documentation, Lake Ontario, Limnology, Aquatic life, Ecology, Bioassay, Instrumentation, Sampling, Equipment.

AMIC-7914
"SUCCESSION: SIMILARITIES OF SPECIES TURNOVER RATES", Shugart, H. H., Hett, J. M., Science, Vol. 180, No. 4093, June 1973, pp 1379-1381.

Rate coefficients have been examined for species turnover in published studies on succession to associate community dynamics with succession. The rate coefficients for species turnover (the proportion of species lost per unit time) for successional communities decrease as the communities approach some equilibrium state. This observation makes it possible to determine the parameters of a two-parameter model which quantifies the time variation of successional changes in the second derivative. For all the communities examined the rate coefficient was found to decrease with the age of the community, which indicates a deceleration in the rate of species loss. This pattern applies to heterotrophic and autotrophic successions, aquatic and terrestrial successions, and successions in laboratory microcosms and large natural ecosystems.

INDEX TERMS: Succession, Biological communities, Turnovers, Ecosystems, Model studies, Aquatic environment, Terrestrial habitats, Turnover rates, Rate coefficients, Laboratory microcosms, Heterotrophy, Autotrophy.

AMIC-7944
"CHLORINE AND TEMPERATURE STRESS ON ESTUARINE INVERTEBRATES", McLean, R. I., Journal Water Pollution Control Federation, Vol. 45, No. 5, May 1973, pp 837-841.

Five species of estuarine invertebrates subject to entrainment in the cooling water system of a steam electric station were exposed experimentally to chlorine and temperature stresses simulating plant operations. Estuarine water was injected with chlorine gas to achieve a final concentration of 2.5 mg/l total chlorine residual. This concentration effected as high as 80 percent population mortality in the barnacle nauplii Balanus sp and 90 percent in the copepod Acartia tonsa during a 5-min exposure. Temperature elevations of 10 F (5.5 C) and 20 F (11 C) for 3 hr had no significant effect on population mortality. Two amphipods, Gammarus sp and Melita nitida, and one species of shrimp, Palaemonetes pugio, exhibited greater tolerance to the same stress conditions.

INDEX TERMS: Thermal stress, Chlorine, Water pollution effects, Laboratory tests, Estuaries, Chlorination, Animal populations, Crustaceans, Model studies, Macroinvertebrates, Synergistic effects, Chemical concentration.

AMIC-7959
"BEHAVIOR OF YOUNG ATLANTIC SALMON (SALMO SALAR) EXPOSED TO OR FORCE-FED FENITROTHION, AN ORGANOPHOSPHATE INSECTICIDE, Symons, P. E. K., Journal of the Fisheries Research Board of Canada, Vol. 30, No. 5, May 1973, pp 651-655.

Exposure of young Atlantic salmon (Salmo salar) to 1.0 ppm fenitrothion for 15-16 hr caused a 50 percent decrease in the number holding territories 6 days following teratment. Some severely affected fish also swam stiffly and ceased feeding, but these effects disappeared within 48 hr following return to clean water. Territories were not reclaimed for approximately 2-3 weeks. Esposure to 0.1 ppm fenitrothion for 15-16 hr caused a lesser (20 percent) reduction in numbers of fish holding territories. When mealworms (Tenebrio sp) injected with 2-5 microliters pure (100 percent) fenitrot fenitrothion were force-fed to young salmon, 50 percent were regurgitated 8-12 hr afterwards. Almost all mealworms containing 10-20 microliters fenitrothion were regurgitated. The proportion of worms regurgitated remained constant during a week of daily force-feedings but, 24 hr after the third or fourth feeding, all fish except contro controls could be made to flex tetanically by rapping on the aquarium, and they made little attempt to escape a dipnet.

INDEX TERMS: Atlantic salmon, Fish behavior, Phosphothioate pesticides, Water pollution effects, Juvenile fish, Organophosphorus pesticides, Insecticides, Fish physiology, Food habits, Bioassay, Fenitrothion, Parr, Locomotion, Salmo salar, Pollutant effects.

AMIC-7960
"TAXONOMY AND ECOLOGY OF THREE NEW SPECIES OF MONODIAMESA KIEFFER, WITH KEYS TO NEARCTIC AND PALAEARCTIC SPECIES OF THE GENUS (DIPTERA: CHIRONOMIDE)", Saether, O. A., Journal of the Fisheries Research Board of Canada, Vol. 30, No. 5, May 1973, pp 665-679.

Three Nearctic species of Monodiamesa are described: Monodiamesa depectinata sp.n. from imagines, pupae, and fourth- and third-instar larvae; and Monodiamesa prolilobata sp.n. from male imagines. A larva possibly belonging to M. prolilobata is described. These are the first records and descriptions of imagines, pupae, and larvae of the Nearctic and Palaearctic species of the genus. Monodiamesa depectinata occurs in the Laurentian Great Lakes area and in Lake Winnipeg, Manitoba. It was taken from sandy substrates in the lower littoral and the sublittoral zones of oligotrophic to mesotrophic lakes. Monodiamesa tuberculata occurs from the mainland of British Columbia through the prairie provinces and the Northwest Territories to the Laurentian Great Lakes. It was taken from the sublittoral and profundal zones of oligotrophic lakes and in some lakes is probably a glacial relict. Monodiamesa prolilobata, from west of the Rocky Mountains, probably covers the combined ecological niches of the two more easterly species.

INDEX TERMS: Systematics, Speciation, Midges, Ecology, Ecological distribution, Niches, Aquatic habitats, Growth stages, Aquatic insects, Lakes, Trophic level, Monodiamesa depectinata, Monodiamesa tuberculata, Monodiamesa prolilobata, Nearctic, Palaearctic, Insect morphology.

AMIC-7968
"STIMULATED BIODEGRADATION OF OIL SLICKS USING OLEOPHILIC FERTILIZERS", Atlas, R. M., Bartha, R., Environmental Science and Technology, Vol. 7, No. 6, June 1973, pp 538-541. 538-541.

Biodegradation of polluting oil at sea is seriously limited by the scarcity of nitrogen and phosphorus. Since water-soluble sources of these elements would be ineffective in the ocean, oleophilic compounds were screened to serve as fertilizers for oil slicks. A combination of paraffinized urea and octylphosphate promoted oil biodegradation, both in laboratory experiments and in field trials, to an extent that the practical application of this principle to oil cleanup appears feasible. The tested oleophilic fertilizer supplies nutrients to hydrocarbon-degrading microorganisms selectively and, in contrast to nitrate and phosphate salts, it does not trigger algal blooms.

INDEX TERMS: Oil spills, Biodegradation, Nitrogen, Phosphorus, Laboratory tests, Microbial degradation, Model studies, On-site tests, Sea water, Chemical analysis, Oleophilic fertilizers, Nutrient sources, Crude oil, Fate of pollutants.

AMIC-8041 (Continued) Card 2/2

INDEX TERMS: Animal populations, Seasonal, Dominant organisms, Crustaceans, Sampling, Separation techniques, Biological communities, Reproduction, Acroperus harpae, Graptoleberis testudinaria, Chydorus sphaericus, Camptocerus cf. rectirostris.

AMIC-8041
"A PROBABILISTIC APPROACH TO THE DYNAMICS OF NATURAL POPULATIONS OF THE CHYDORIDAE (CLADOCERA, CRUSTACEA)", Keen, R., Ecology, Vol. 54, No. 3, Late Spring, 1973, pp 524-534.

Populations of four chydorids in the littoral of Lawrence Lake, Michigan, were studied through an entire year. Samples were collected (at 2 to 7 day intervals) by lowering an inverted, 1-liter container to the proper depth and then letting it fill with water. Samples were transferred to beakers, allowed to settle, and gently heated to stimulate the chydorids to swim to the surface thereby separating themselves from debris. The water and animals were then decanted. Samples were concentrated with a net to about 10 ml and preserved with 95 percent ethanol. These were examined for counts of species and individual reproductive stages. Four species of chydorids dominated the samples: Acroperus harpae Baird, Graptoleberis testudinaria (Fischer), Chydorus sphaericus (O.F.M.), and Camptocerus cf. rectirostris Schodler. Through the entire year, these represented at least 75 percent, and usually more, of the chydorid numbers in each sample. Acroperus, Graptoleberis, and Camptocerus appeared in spring after a winter absence and reached maximum population in late summer or fall. Chydorus sphaericus peaked in spring and dropped to a low level in the summer, then rose through fall to a winter plateau. Predicted rates of birth were higher during summer when rates of observed change fluctuated considerably. A probabilistic method, based on reproductive potential, showed relatively large proabilities for changes observed from late fall to early spring in populations of Chydorus. Most population changes in the other three species, and in Chydorus during the summer, had zero probability. Most population loss appears to be predatory; emigration and 'natural' mortality are not important.

AMIC-8087
"A PHOTON COUNTING DEVICE FOR THE MEASUREMENT OF NANOSECOND AND MICROSECOND KINETICS OF LIGHT EMISSION FROM BIOLOGICAL SYSTEMS", Beall, H. C., Haug, A., Analytical Biochemistry, Vol. 53, No. 1, May 1973, pp 98-107.

This paper describes the instrumentation and operation of a photon counting system which was constructed to measure the delayed light emission from the alga Scenedesmus obliquus. The study of the kinetics of the delayed light emission, especially the fast kinetics of the nanosecond and microsecond regions, should produce evidence concerning the mechanism involved in the early photochemical and biochemical steps of photosynthesis. The functioning of the system was illustrated by a plot which compared data of the recorded delayed light emission with data of the system noise over the first 20-microsecond interval after extinction of a modulated laser beam. This paper shows the utility of photon counting as a satisfactory method of measuring biological light emission, especially a very rapid process such as the delayed light emission from photosynthetic organisms.

INDEX TERMS: Photosynthesis, Instrumentation, Biochemistry, Scenedesmus obliquus, Photon counting, Light emission.

AMIC-8209
"DETRITUS IN LAKE TAHOE: STRUCTURAL MODIFICATION BY ATTACHED MICROFLORA", Paerl, H. W., Science, Vol. 180, No. 4085, May 4, 1973, pp 496-498.

Water samples were collected from Lake Tahoe over a vertical profile of 0 to 440 m to investigate microbiological utilization of detritus. Subsamples were filtered through Metricel filters, fixed with glutaraldehye, dehydrated by stepwise immersion in increasing concentrations of ethyl alcohol, portions mounted and gold plated, and viewed by scanning electron microscopy (SEM). Subsamples were also monitored for microbial heterotrophic activity as a measure of mineralization rates by determining acetate uptake. Total particulate carbon, and acetate concentrations were determined in samples taken from all depths. In a separate study, detritus was collected from Ward Creek, a tributary of Lake Tahoe, homogenized, sterilized, and divided into dialysis bags which were impervious to detritus and microorganisms, but allowed passage of nutrients and metabolic waste products. Two sets of dialysis bags were used: one containing sterile detritus and one containing lake water and live microorganisms. Both sets were incubated in Lake Tahoe and periodically examined by light microscopy and SEM. The results of the investigations show that readily identifiable groups of microorganisms present on nonliving particulate organic matter (detritus) in the upper waters of Lake Tahoe are attached in specific ways and appear responsible for detrital aggregation. This microflora is associated with active heterotrophic metabolism, but deeper waters possess little detrital microflora and little heterotrophic activity.

INDEX TERMS: Detritus, Microorganisms, Biodegradation, Organic matter, Nutrients, Lake Tahoe, Ward Creek.

AMIC-8262
"EFFECTS OF ARTIFICIAL DESTRATIFICATION ON PRIMARY PRODUCTION AND ZOOBENTHOS OF EL CAPITAN RESERVOIR, CALIFORNIA", Fast, A. W., Water Resources Research, Vol. 9, No. 3, June 1973, pp 607-623.

El Capitan reservoir was artificially mixed using compressed air during the summers of 1965 and 1966 to investigate the effects of destratification on primary production and zoobenthos. Phytoplankton production was measured by the C-14 technique. Zoobenthos was sampled with an unscreened Ekman dredge, screened with a no. 30 sieve, and sorted by sugar flotation. Estimates of organisms not sorted by sugar flotation were made by subsampling sediments. Physical and chemical characteristics of the water were also determined. The zoobenthos was numerically dominated by oligochaete worms (Limnodrilus hoffmeisteri, Bathrioneurum vejdovskyanum, Evilyodrilus bavaricus, E. hammoniensis, and Tubifex tubifex) and chironomid larvae (Chironomus attenuatus, Procladius bellus, P. denticulatus, and Tanytarsus spp. The Asiatic clam (Corbicula manilensis) became well established during the study period. The results show that mixing and reservoir volume increases resulted in more uniform physical and chemical conditions, aerobic conditions throughout the lake, increased primary production, increased depth distributions of zoobenthos, and zoobenthos population increases. Increased primary production was related to a decrease in algal depth distribution. This decrease was caused by incomplete destratification, since thermal microstratification persisted near the lake surface. Zoobenthos were distributed throughout the lake during mixing, whereas they were confined to shallow depths during well-stratified times. Water volumes increased three-fold during the study and greatly confounded interpretation of the mixing effects.

AMIC-8262 (Continued) Card 2/2

INDEX TERMS: Benthic fauna, Primary productivity, Destratification, Mixing, Sampling, Oligochaetes, Midges, Clams, Sorting.

AMIC-8270
-effect of nutrient additions on the apparent cometabolism of ddt-, Pfaender, F. K., Alexander, M., Journal of Agricultural and Food Chemistry, Vol. 21, No. 3, May/June 1973, pp 397-399.

Raw sewage samples, half of which were autoclaved, were placed in Erlenmeyer flasks and treated with DDT and inorganic salts to obtain additional evidence on the significance of cometabolism in the microbial transformation of DDT. Sets of sterilized and unsterileized samples received additions of glucose or diphenylmethane. One set received no additions. All flasks were incubated at 30 C. At periodic intervals, samples were removed and frozen for later extraction and analysis. At the same time, plate counts were made of the bacteria. For analysis, the samples were thawed, acidified with H_3PO_3, and extracted for 6 hours with ethyl ether. Extracts were concentrated with a flask evaporator and esterified by boiling with BCl_3-methanol. The microbial cultures were extracted in a separatory funnel with n-hexane-ethyl ether. All extracts were dried, resuspended in acetone, and analyzed by gas chromatography. The products formed by microbiological degradation of DDT were the same as those identified in other studies, namely, DDD, DDE, and DBP (4,4'-dichlorobenzophenone). The addition of glucose enhanced the rate of DDD formation but slowed DBP biosynthesis, and additions of diphenylmethane reduced the rate of formation of both DDD and DBP. The numbers of microorganisms potentially able to cometabolize DDT were high in raw sewage, but their abundance rose markedly as a result of the addition of glucose and diphenylmethane. Many of these microorganisms produced DDD, DDE, and DBP.

INDEX TERMS: Sewage bacteria, Microbial degradation, DDT, DDD, DDE, Bioassay, Cometabolism, Fate of pollutants, DBP, Biotransformation.

AMIC-8293
"ESTIMTION OF ESTUARINE MARSH PRODUCTIVITY", De Michele, E., Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 99, No. EE3, June 1973, pp 397-404.

The adsorptive and absorptive capabilities of tidal marshlands, have, in the past, been estimated using various techniques. Thus far it has been difficult to measure the organic matter representative of marsh productivity. To eliminate some of the distortions associated with such measurements, a model based on the convective-diffusion equation was used to estimate 5-day BOD additions from a tidal marsh to a northern temperature zone estuary. Use of the model involves: (1) determination of river coefficients for conservative and nonconservative substances, based on measured concentration profiles, for periods of maximum and minimum marsh activity; and (2) calculation of river reaction rates. Organic removals for the wo periods of extreme marsh activity then may be compared to provide a means of estimating net marsh productivity. Data collected over a 6-yr period were used to demonstrate the previously described technique. The extensive marshy area fringing Delaware's Murderkill River estuary (drainage area of 107 sq miles) is found to contribute 1,050 lb per day 5-day biochemical oxygen demand during the summer months. No attempt was made to evaluate contribution per unit area of marsh.

INDEX TERMS: Aquatic productivity, Estimating, Estuarine environment, Tidal marshes, Measurement, Biochemical oxygen demand, Primary productivity, Model studies, Turbulent flow, Transportation, Dispersion, Organic matter, Adsorption, Equations, Murderkill River, Convective-diffusion equation.

AMIC-8326
"NUTRIENT CYCLING AND PRODUCTIVITY OF DYSTROPHIC LAKE-BOG SYSTEMS (PART A)", Hooper, F. F., University of Michigan, School of Natural Resources, Ann Arbor, Michigan, Technical Progress Report No. COO-1771-5, Contract No. AT(11-1)-1771, December 1972, 71 pp.

Three items concerned with nutrient cycling are covered in this report: (1) 'Organic Phosphorus Compounds of a Northern Michigan Bog, Bog-Lake System', (2) 'Preliminary Report of the Role of Sphagnum in the Cycling of Phosphorus in a Bog-Lake System', and (3) 'Ionic State and Coordination of Iron in Bog Lakes'. The organophosphorus compounds produced in the bog mat were identified as hydrolytic products of ribonucleic acids as well as free mono-, di-, and triphosphate nucleotides. The inorganic P of the epilimnion and the mat waters were chiefly orthophosphate; that of the hypolimnion consisted of ortho- and polyphosphate P. The direct application of P-32 to the surface of Sphagnum produced a leachate consisting entirely of soluble unreactive P which was flushed into the lake (surface water and hypolimnion) when rains created a hydrologic gradient of flow within the mat. P-32 injected directly into the interstitial water of the mat produced a leachate of entirely particulate unreactive phosphorus. This was also flushed into the lake by the action of the rain and persisted in the surface water with little or no loss or transformation for a period in excess of 3 weeks. The presence of ionic Fe(II) without complexation was confirmed as the predominant form of Fe in the deoxygenated waters of the bog according to the sampling methods and reaction scheme used. However, the chemical state of iron present in the lake varied considerably in form and amount with depth.

INDEX TERMS: Iron, Cycling nutrients, Phosphorus, Aquatic productivity, Dystrophy, Lake-bog systems.

AMIC-8327
"UPTAKE OF TOXIC WATER POLLUTANTS (PCB) BY LAKE TROUT", Parejki, R., Johnston, R., Northern Michigan University, Biology Department, Marquette, Michigan, Project Termination Report, Contract No. 14-01-0001-3522, January 1973, 16 pp. NTIS Report No. PB-214 768.

Lake trout were netted from Lake Superior for analysis of polychlorinated biphenyls (aroclors) to determine whether biological magnification of PCBs occurs. The fish were frozen until analysis, at which time skin, muscle, and lipoid tissue from the area between the pectoral and pelvic fins was dissected and prepared for analysis. The samples were ground with anhydrous sodium sulfate to dehydrate the tissue centrifuged several times with petroleum ether, and the solvent evaporated leaving an oil which was cleaned up by partitioning and column chromatography. The oil was analyzed by gas-liquid chromatography for PCBs and chlorinated pesticides. Concentrations of PCBs determined were as follows: Aroclor 1242, 14-3.4 ppm; Aroclor 1248, 0-4.1 ppm; Aroclor 1254, 0-7.2 ppm; Aroclor 1262, 0-1.8 ppm. PCB concentrations were low, and it appeared that biphenyls containing lower percent concentrations of chlorine predominated. Concentrations of pesticides were as follows: Heptachlor, 0-0.029 ppm; Heptachlor epoxide, 0-0.167 ppm; o,p DDE, 0-0.81 ppm, p,p DDE, 0-15.3 ppm; o,p DDD, 0-0.67 ppm; p,p DDD, 0-1.17 ppm; o,p DDT, 0-1.88 ppm; p,p DDT, 0-1.88 ppm. Statistical determinations made between mean PCB concentration and fish age, sex and geographical location of removal from Lake Superior indicated that no correlation could be found.

INDEX TERMS: Lake trout, Absorption, DDT, DDD, DDE, Heptachlor, Biological samples, Sample preparation, Acoclor, 1242, Aroclor 1248, Aroclor 1254, Aroclor 1262, Gas liquid chromatography, Tissues.

AMIC-8329
"ECOLOGICAL CONCEPT OF THE COASTAL ZONE IN THE GREAT LAKES", Schelske, C. L., University of Michigan, Great Lakes Research Division, Ann Arbor, Michigan, Report No. COO-2003-10, May 26-28, 1971, 16 pp.

This concept paper contends that the coastal zone of the Great Lakes may be similar to the marine coastal zone in many respects, but in terms of ecological processes it must be viewed as part of the lake ecosystem and cannot be treated separately. Some of those differences between the coastal zones include salinity, residence times of water, circulation period, biological productivity, limiting nutrients, and the direction of the flow of water. In order to study the coastal zone adequately, the entire lake ecosystem must be studied. For some types of problems, such as chloride pollution, the five Great Lakes must be considered as a system.

INDEX TERMS: Ecosystems, Great Lakes, Ecology, Aquatic environment, Coasts, Salinity, Flow, Water circulation, Path of pollutants, Nutrients, Water temperature, Thermal stratification, Waste assimilative capacity, Lake Michigan, Lake Erie, Lake Ontario, Lake Superior, Lake morphometry, Lake Huron, Discharge (water), Chlorides, Upwelling, Aquatic productivity, Coastal zones, Marine environment, Thermal bar, Fate of pollutants.

AMIC-8346
"IDENTIFICATION AND CONTROL OF PETROCHEMICAL POLLUTANTS INHIBITORY TO ANAEROBIC PROCESSES", Hovious, J. C., Waggy, G. T., Conway, R. A., Union Carbide Corporation, Chemicals and Plastics Division, South Charleston, West Virginia, Report No. EPA-R2-73-194, April 1973, 103 pp.

Identification studies were made on potentially inhibitory materials using a Warburg respirometer procedure and an unacclimated anaerobic biomass. Identified inhibitory materials and concentrations for a 50 percent decrease in activity were acrolein (20-50 mg/l), formaldehyde (50-100 mg/l), 2-ethyl-1-hexanol (500-1000 mg/l), methyl isobutyl ketone (100-300 mg/l), diethylamine (300-1000 mg/l), acrylonitrile (100 mg/l), 2-methyl-5-ethylpyridine (100 mg/l), ethylene dichloride (150-500 mg/l), ethyl acrylate (300-600 mg/l), and phenol (300-1000 mg/l). Inhibitory effects were more severe at high volatile acid concentrations. Acclimation of anaerobic biomass to crotonaldehyde, phenol, ethyl acrylate, and sodium acrylate was studied in mixed digesters. An acclimated culture was developed for crotonaldehyde, phenol, and to some degree to ethyl acrylate. No acclimation was observed for sodium acrylate. Cultures acclimated to crotonaldehyde and ethyl acrylate were able to degrade the material while phenol was not degraded with acclimation but was no longer inhibitory. Additional acclimation studies were made in continuously fed anaerobic filters. A filter was acclimated to a crotonaldehyde concentration of 600 mg/l as compared to the 50-100 mg/l inhibitory in Warburg studies. Treatment of formaldehyde, ethyl acrylate, phenol, and acrylonitrile indicated synergistic inhibitory effects. These mixed inhibitors were treated satisfactorily at low concentrations in two series anaerobic filters, however, increasing inhibitor concentrations resulted in failure of both filters. Actual waste streams treated in an anaerobic filter indicated that inhibition from crotonaldehyde

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could be avoided in a chemical manufacturing waste by dilution. Successful treatment of 'hard' surfactant containing wastes was also noted. Other means of overcoming inhibition were discussed.

INDEX TERMS: Pollutant identification, Sewage sludge, Industrial wastes, Chemical wastes, Anaerobic digestion, Inhibitors, Biomass, Chemical analysis, Petrochemicals, Warburg technique, Synergistic effects.

AMIC-8350
"NEW AND RARE SPECIES OF SOME GREEN ALGAE FROM BANGLADESH", Islam, A. K. M. N., Nova Hedwegia, Vol. 23, No. 4, 1972, pp 655-677.

The following new species, varieties and formae have been described from Bangladesh together with Mougeotia pawhuskae Taft, and M. transeaui Collins, namely, Stigeoclonium geraldii, sp. nov.; Stigeoclonium penicillatum, sp. nov.; Temnogametum subtropicum, sp. nov.; Mougeotia longiarticulata, sp. nov.; M. longiarticulata fa. brevis, fa. nov.; M. longiarticulata fa. nayaharense, fa. nov.; Mougeotia oedogonoides var. dacchense, var. nov.; Mougeotia subellipsoidea, sp. nov.; Onychonema laeve var. cremulata var. nov.

INDEX TERMS: Chlorophyta, Aquatic algae, Speciation, Classification, Systematics, Bangladesh, India.

AMIC-8351
"EXAMINATION OF ULTRASTRUCTURE AND GROWTH OF THE CELL WALL OF SPYRIDIA FILAMENTOSA (WULF.) HARV.", Tsekos, V. I., Haritonidis, S., Nova Hedwigia, Vol. 23, No. 4, 1972, pp 785-793.

The structure and the course of development in cell walls of the red alga Spyridia filamentosa (Wulf.) Harv. were analyzed by cytochemistry and polarization microscopy. (1) The cell wall is composed of two layers; the inner one consisting of cellulose, the outer of acid carbohydrates. Contrary to other Rhodophycea analyzed hitherto, the outer layer of Spyridia filamentosa exhibits birefringence; under the polarization microscope and after staining with methylene blue it appears distinctly stratified. (2) The cell wall proper of the youngest central cells in the thallus tip is uniform, and it encloses the whole protoplast without any gap. As it is the case with Ceramium species, adult central cells show three distinct regions: two cap-like parts (each of which at the basal and apical pole of the cell) and a conic part encircling the remainder of the cell. The origin of the wall structure of adult central cells is discussed. (3)the inner layer of the cell wall is composed of lamellae. (4) The intensity of the cellulose reaction and of birefringence increases with the age of the cells. In young cells it is rather poor. (5) Nearly all parts of the thallus that border directly to the surrounding water have more or less thickened external walls. (6) Beside the axial pit connections of the central cells, which show an intense light refraction, there are another eighteen pits arranged in a ring at the apical pole. (In German)

INDEX TERMS: Rhodophyta, Marine algae, Cytological studies, Plant growth, Marine plants, Electron microscopy, Plant tissues, Cellulose, Spyridia filamentosa, Cell wall, Ultrastructure, Polarization microscopy.

AMIC-8352
"THE EPIPHYTIC DIATOM FLORA OF THE BENTHIC MACROPHYTE COMMUNITIES ON ROCKY SHORES IN THE SOUTHWESTERN ARCHIPELAGO OF FINLAND, SEILI ISLANDS", Rautiainen, H., Ravanko, O., Nova Hedwigia, Vol. 23, No. 4, 1972, pp 827-842.

An analysis of the epiphytic diatom flora was carried out in connection with a study of the benthic macrophyte communities in the SW archipelago of Finland, Seili Islands (Ravanko, 1972). Samples were taken from macrophytes collected from quadrats (1 sq m) on 13 lines. Preparations were made by pulverizing and homogenizing the macrophyte material to which was then added strong hydrogen peroxide. This mixture was allowed to stand 2-3 days at room temperature or 2 days at 40-50 C to allow the digestion of organic matter. Test tubes containing the mixture were then centrifuged and the material transferred to a cover glass, dried, and mounted in Clearax for microscopic observations. The diatoms were determined and counted; results relating to the same macrophyte belt were combined. The percentages of each diatom species in the different belts were calculated. The occurrence in the macrophyte belts of diatoms with percentages of five or more is presented in diagrams. No clear zonation of diatoms was distinguished corresponding to the macrophyte belts, but statistical analysis showed that on most lines the macrophyte belts differed from each other in regard to their epiphytic diatom flora. The species composition of the epiphytic diatom flora is discussed and compared with that of other areas.

INDEX TERMS: Diatoms, Marine algae, Marine plants, Biological communities, Speciation, Systematics, Pondweeds, Chlorophyta, Chrysophyta, Phaeophyta, Rhodophyta, Intertidal areas, Benthic flora, Cyanophyta, Epiphytes, Macrophytes, Sample preparation, Finland.

AMIC-8354
"THE KINETICS OF NH_4 UPTAKE BY CERATOPHYLLUM", Toetz, D. W., Hydrobiologia, Vol. 41, No. 3, May 15, 1973, pp 275-290.

The relationship between growth of aquatic plants and their nutrient supply is poorly understood, because of the lack of suitable models which could be tested in the field. The purpose of this research was to learn if the Michaelis-Menten expression describes the relationship between the uptake of NH_4 by Ceratophyllum and the concentration of NH_4 in solution. Both field and laboratory observations showed that the rate of uptake of NH_4 by nitrogen deficient Ceratophyllum describes a hyperbola when plotted against concentrations of NH_4. The uptake can be predicted by the rate Michaelis-Menten expression, where the half saturation constant is 613.4 to 4425.7 mg NH_4-N/cu m. The rate of uptake of NH_4 by Ceratophyllum at 2 degrees C is 50 to 73 percent the rate at 20 degrees C, suggesting that uptake of NH_4 is not likely to be due to metabolic processes alone and that the Michaelis-Menten expression may only model uptake approximately. The rate of turnover of NH_4 in pond water was calculated using this approximate model. At a concentration of 100 mg NH_4-N/cu m, the turnover time for NH_4 in one liter of pond water containing 1 g dry wt of Ceratophyllum was 0.6 to 4.5 h. The ecological usefulness of the Michaelis-Menten constants derived for Ceratophyllum is discussed.

INDEX TERMS: Kinetics, Absorption, Aquatic plants, Essential nutrients, Laboratory tests, On-site tests, Mathematical studies, Ammonium, Ceratophyllum.

AMIC-8357
"SUMMER ALGAL COMMUNITIES AND PRIMARY PRODUCTIVITY IN FISH PONDS", Boyd, C. P., Hydrobiologia, Vol. 41, No. 3, May 15, 1973, pp 357-390.

The paper presents data on primary productivity and phytoplankton communities in new experimental ponds which received the following treatments; ammonium nitrate and triplesuperphosphate, triplesuperphosphate, cracked corn (10 percent crude protein) and Auburn No. 3 fish feed (36 percent crude protein). Comparative data on algal communities were also obtained from production ponds which received feeds or fertilizers. Basic ecological data on macro-algae are also presented. All nutrient additions to experimental ponds resulted in higher levels of gross photosynthesis and greater concentrations of chlorophyll a than were found in the control treatments. Fertilization with both nitrogen and phosphorus gave the highest values. Chlorophyll a and gross photosynthesis were higher in ponds receiving high protein content feed (Auburn No. 3) than in ponds to which low protein content feed (corn) was applied. Persistent blooms of blue-green algae occurred in ponds receiving nitrogen and phosphorus fertilization. Phosphorus only fertilization produced blooms of blue-greens, but these blooms did not persist as in the ponds to which nitrogen was also added. Control ponds were dominated by green algae. Blue-green algae were seldom abundant in feed treatments. Production ponds had high level of gross photosynthesis and large concentrations of chlorophyll a. Many of the production ponds which received feed applications developed heavy blooms of blue-green algae. The major species of blue-green algae observed in the present study were Oscillatoria sp., Raphidiopsis curvata, Anacystis nidulans, A. aeruginosa, Spirulina sp., and Anabaena circinalis. Heterocyst bearing forms, which can presumably fix nitrogen, were seldom noted in ponds that received continuous

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additions of nitrogen from fish feeds. Macro-algae are abundant in many fish ponds. Data illustrating the competition of macro-algae with phytoplankton are presented.

INDEX TERMS: Primary productivity, Biological communities, Aquatic algae, Phosphorus, Nitrogen, Water pollution effects, Ecology, Phytoplankton, Eutrophication, Cyanophyta, Fertilization, Nutrients, Standing crops, Chrysophyta, Chlorophyta, Euglenophyta, Pyrrophyta, Systematics, Dominant organisms, Protozoa, Ecological distribution, Fish ponds.

AMIC-8361
"SOME ROTIFERS FROM CAMBODIA", Berzins, B., Hydrobiologia, Vol. 41, No. 4, May 30, 1973, pp 453-459.

Some species of rotifers from Cambodia are described.

INDEX TERMS: Rotifers, Aquatic animals, Speciation, Invertebrates, Classification, Systematics, Cambodia, Filina camasecla cambodgensis, Lecane blachei, Anchitestudinella mekogensis, Branchionus donneri, Animal morphology.

AMIC-8364
"THE TESTACEA IN THE AREA OF BUSCHELBACH STATION (BIEBER/SPESSART, GERMANY)", Luminger, H., Hydrobiologia, Vol. 41, No. 4, May 30, 1973, pp 501-513.

Taxonomy and ecology of Testacea in samples from Sphagnum and from sediments of a pool, some springs and small waters collected near Buschelbach (Bieber/Spessart, Germany) were studied. Eighty-nine species were found. The Euglyphidae, one of the 9 investigated families, dominated with Trinema (T. lineare, T. enchelys), Corythion (C. dubium), Assulina (A. muscorum), Euglypha (E. rotunda, E. laevis, E. cristata) and Sphenoderia (S. minuta). The Nebelidae, another of the 9 families, were also relatively frequent, especially Nebela (N. collaris-bohemica-tincta-group), Lesquereusia (L. spiralis) and Quadrulella (Qu. symmetrica). Specimens of the families Arcellidae, Centropyxidae and Difflugiidae were generally more rare. (In German)

INDEX TERMS: Ecology, Systematics, Protozoa, Dominant organisms, Sediments, Springs, Mosses, Water.

AMIC-8366
"ECOLOGICAL STUDIES IN THE PLANKTON OF CERTAIN FRESHWATER PONDS OF HYDERABAD-INDIA. III. ZOOPLANKTON AND BACTERIA", Seenayya, G., Hydrobiologia, Vol. 41, No. 4, May 30, 1973, pp 529-540.

The ecological behavior of zoplankton and bacteria were studied in freshwater ponds in India. Populations of the organisms were determined and related to rainfall and several chemical parameters (oxidizable and nitrogenous organic matter, phosphates, and dissolved solids). Cladocerans were more abundant than copepods, rotifers or ostracods in all the ponds investigated. The pond harboring Chara and Nitella had a dense population of Chydorus. Thermocyclops grew abundantly in oxygen-rich water. The pulses of zooplankton preceded those of phytoplankton and the grazing effect was very well marked in one of the ponds. Ponds smaller in dimension harbored denser populations of bacteria. Higher concentrations of phosphate, dissolved solids, and oxidizable and nitrogenous organic matter favored their multiplication. Bacterial pulses almost coincided with those of phytoplankton - more precisely with chlorophyll-a. Possibly microbes fed on the freshly liberated materials from the phytoplankters.

INDEX TERMS: Ecology, Biological communities, Zooplankton, Phytoplankton, Bacteria, Animal populations, Chlorophyll a.

AMIC-8367
"UPTAKE OF RADIONUCLIDES BY SOME AQUATIC MACROPHYTES OF ISMAILIA CANAL, EGYPT", Abdelmalik, W. E. Y., El-Shinawy, R. M. K., Ishak, M. M., Mahmoud, K. A., Hydrobiologia, Vol. 42, No. 1, July 6, 1973, pp 3-12.

The uptake and accumulation of Cs-134, Co-60, Sr-90, and P-32 were studied with four aquatic macrophytes: Elodea densa, Ceratophyllum demersum, Potamogeton pectinatus, and Chara sp. Tests were conducted with plants in large aquaria containing canal water labelled with the radionuclides. Periodically, portions of the plants were removed, dipped in running distilled water, blotted on filter paper, weighed, dried, ashed, and radioassayed. Statistical evaluations of the correlation between radionuclide concentration and uptake by the plants led to the following conclusions. (1) Uptake of the radionuclides was found to increase at increasing initial concentrations of the radionuclides in the water. (2) Maximum uptake was reached by most of the aquatic plants after different periods of contamination, ranging from 1 to 4 days. (3) Ceratophyllum was found to be the most favourable biological indicator for strontium radioisotopes in concentrations ranging from 0.5 to 10 microcuries/l and for contamination periods up to 16 days. (4) Elodea was found to serve as a biological indicator for either strontium or phosphorus radioisotopes for limited contamination periods of 2 to 16 days for Sr and to 2 days for P isotopes. (5) Potamogeton was also found to serve as a biological indicator for limited contamination periods for strontium, phosphorus and cesium radioiostopes: 0 to 2 days for Sr, 2 to 16 days for P, and 0 to 2 days for Cs isotopes.

INDEX TERMS: Bioassay, Radioactive wastes, Bioindicators, Aquatic plants, Bioaccumulati Bioaccumulation, Cs-134, Co-60, Sr-90, P-32, Elodea densa, Ceratophyllum demersum, Potamogeton pectinatus.

AMIC-8368
"THE MAYFLY (EPHEMEROPTERA) IN TROUT STREAMS OF THE BESKIDS. II. PRODUCTION", Zelinka, M., Hydrobiologia, Vol. 42, No. 1, July 6, 1973, pp 13-19.

The first part of this study (1969) dealt with the abundance and biomass of mayflies (Ephemeroptera). On the basis of the measurement of length of all mayflies and of the determination of the respective weight (according to the curve expressing the relation length:weight) the production for each month was calculated. The annual average for Baetis rhodani amounted to 5,317 g/sq m, for Rhithrogena semicolorata 12,478 and for the species belonging to the genus Ecdyonurus 8.47 g/sq m. The relation between the annual production and average annual biomass was nearly the same in all three species equals to 1:8.37. These three taxa formed 76 percent of the biomass. After addition of the remaining taxa of mayflies the production of Ephemeroptera in the two brooks under investigation totalled 27,152 g/sq m equals to 271,52 kg/ha per year. Water quality characteristics are tabulated for the streams. (In German)

INDEX TERMS: Mayflies, Secondary productivity, Water quality, Biomass, Animal populations, Streams, Baetis rhodani, Rhithrogena semicolorata, Ecdyonurus, Czechoslovakia.

AMIC-8369
"ON THE VARIABILITY OF STEPHANODISCUS HANTZSCHII GRUN.", Kalbe, L., Hydrobiologia, Vol. 42, No. 1, July 6, 1973, pp 21-29.

A new variety, striatior, of the diatom Stephanodiscus hantzschii GRUN. (S.h.) with denser striae was described (KALBE 1971). The legality of S.h. var. pusillus is confirmed by specimens from freshwaters of the north of Mecklenburg. The species S.h. probably consists in this region of several races with different peaks of valve diameter variation. The planktonic mass changing of S.h. and its forms in the three rivers Warnow, Malchiner Peene and Neukalener Peene and in the Lake Kummerow is represented. The differences of the average valve sizes in these waters are remarkable. Var. pusillus GRUN. appears to be a benthic mass form, too. High cell numbers and high cell volume sums are not developing ever simultaneously. Var. pusillus is not a suitable form for evaluating the saprobiological status, for it is adaptable to different ecological conditions. The species S.h. itself is a beta- to alphamesosaprobic organism, being able to produce high cell numbers within this range of saprobity. (In German)

INDEX TERMS: Systematics, Diatoms, Ecology, Stephanodisucs hantzschii var. pusillus, Stephanodiscus hantzschii var. striatior.

AMIC-8372
"THE ENVIRONMENTAL TOXICITY OF CRASSIN ACETATE USING TETRAHYMENA PYRIFORMIS AS A MODEL", Perkins, D. L., Ciereszko, L. S., Hydrobiologia, Vol. 42, No. 2, July 6, 1973, pp 77-84.

Crassin acetate, a macrocyclic diterpene lactone, may constitute as much as 1.5 percent of the dry weight of the cortex of the gorgonian Pseudoplexaura porosa (HOOUTIUYN). An amicromucleate strain of Tetrahymena pyriformis was cultured and subjected to various concentrations of the compound to investigate its effect on motility and growth. The effects of the compound were essentially concentration dependent and for concentrations of 0.027 to 0.133 millimoles, they may be summarized as follows: increased generation time from 0 to 14 hours after subculture; decreased population density; decreased motility; and death. The conclusions of this investigation have been extended to include a possiible role of the macrocyclic diterpenes in their natural environment, i. e., crassin acetate and related compounds function in the marine ecosystem by decreasing the viability of ciliated larvae of organisms which compete with the gorgonians for space.

INDEX TERMS: Bioassay, Toxicity, Protozoa, Reproduction, Growth rates, Crassin acetate, Tetrahymena pyriformis.

AMIC-8373
"RELATIONSHIP BETWEEN EXTRACELLULAR AND CELLULAR PRODUCTION IN THE SULPHURIC GREEN BACTERIUM CHLOROBIUM LIMICOLA NADS. (CHLOROBACTERIACEAE) AS COMPARED TO PRIMARY PRODUCTION OF PHYTOPLANKTON", Czeczuga, B., Gradzki, F., Hydrobiologia, Vol. 42, No. 1, July 6, 1973, pp 85-95.

Dark and double light bottles containing Chlorobium limicola and phytoplankton from two stands were immersed in Wadolek Lake at depths of 0 to 7 m to study the quantities of substances formed during photosynthesis both inside and outside the cells. Each bottle was spiked with C-14 labelled $NaCO_3$. Assimilation of carbon and quantities of substances filtering outside the cells were also determined in the dark bottles. After one day at any depth, formalin was added to each bottle and the contents filtered to separate algal cells from Chlorobium bacteria. After drying of the filters, the residue was measured with a Geiger-Mueller counter. To measure extracellular matter, a portion of the contents of each bottle was put on an aluminum plate, evaporated and the activity measured. Mean values of extracellular production of phytoplankton were 58.4 percent (stand II) and 65.2 percent (stand I) of cellular production, and for extracellular production of Chlorobium limicola the values were respectively 44.7 percent (stand II) and 70.7 percent (stand I). On the average 70.8 percent of carbon assimilated in the dark filtered outside the cell in case of phytoplankton, and 31.0 percent in the case of Chlorobium limicola. Extracellular and cellular production in case of phytoplankton and Chlorobium limicola was calculated for 1 square meter of the water column.

INDEX TERMS: Primary productivity, Organic matter, Bacteria, Phytoplankton, Photosynthesis, Chlorobium limicola.

AMIC-8374
"CONCERNING THE INFLUENCE OF HERBICIDES ON SEVERAL FRESHWATER ANIMALS", Pravada, O., Hydrobiologia, Vol. 42, No. 1, July 1973, pp 97-142.

Toxicity of fourteen herbicides has been determined for thirteen animal species: Planaria gonocephala, Tubifex sp, Lymnaea stagnalis, Daphnia pulex, Gammarus pulex, Asellus aquaticus, Micronecta minutissima, Esox lucius, Cyprinus carpio, Phoxinus phoxinus, Leucapius delineatus, Perca fluviatilis, Rana temporaria, in 510 laboratory experiments. It was followed in three concentrations and expressed both in tables, by the value LT50 or by the various degree of damage of the organisms, and in graphs. The organisms were divided into four groups according to their sensitivity to herbicides: (1) organisms with high sensitivity; (2) sensitive; (3) medium sensitive; (4) little sensitive. From the point of view of the toxicity the herbicides were divided into three groups: (1) powerfully toxic, (2) medium toxic; (3) little toxic. A relationship between the intensity of toxicity and the chemical structure of herbicides was found. The first group includes herbicides on the basis of carbamates and phenols, the second group includes the derivatives of phenoxyacetic acid, and the third group includes inorganic herbicides and those pertaining to the group of the chlorated organic substances. The menchanism of the toxic action was followed from the point of view of the mutual relationship of herbicide toxicity and the sensitivity of organisms. Eight basic types of this action were found. Special attention was paid to those types where significant reparation phases appeared during the experiments. Only inorganic herbicides and those from the group of the chlorated organic substances or eventually those on the basis of phenoxyacetic acid may be used for mass application in water economy. In all cases further complex investigations must be made concerning the influence on water

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biocenoses, as the recent data on the toxicity of herbicides with respect to several species of fish only are not sufficient. The use of herbicides from the group of phenols and carbamates should be prohibited in the neighbourhood of water bodies. (In German)

INDEX TERMS: Herbicides, Aquatic animals, Bioassay, Pesticide toxicity, Water pollution effects, Invertebrates, Freshwater fish, Carbamate pesticides, Phenolic pesticides, Lethal limit, Laboratory tests, Chlorinated hydrocarbon pesticides, Frogs, Median tolerance limit, Sensitivity, Macroinvertebrates.

AMIC-8379
"KINETICS OF AMINO ACID INFLUX INTO NITELLA FLEXILIS", Wallen, D. G., Journal of Phycology, Vol. 9, No. 2, June 1973, pp 148-152.

The uptake of amino acids by Nitella flexilis has been investigated. Separated internodal cells of the alga were placed in artificial pond water to which had been added C-14-labeled L-amino acids(glycine, alanine, valine, arginine, and aspartic acid) to give concentrations up to 30 mM. The experiments were conducted at 20 C. At the end of the experiments, the labeled cells were harvested and the radioactivity measured. In some cases, the nature of the C-14-labeled organic compounds determined. Influx of glycine, alanine, and valine appears to be a diffusive process. Influx ranged from 0.14 to 0.06 and 0.04 pmoles/(cm)(sec), respectively. Aspartic acid uptake is an active transport mechanism. The V sub max is 2.8 pmoles/(cm)(sec); the transport constant (Michaelis constant) K sub m, 0.0078 M. The uptake of arginine is apparently due to 2 transport systems, one with a V sub max and K sub m of 3.1 pmoles/(cm)(sec) and 0.0032 M, respectively. The second system has a V sub max of 1.4 pmoles/(cm)(sec) and a K sub m of 0.00021 M. The possibility that the second system is diffusive has been considered.

INDEX TERMS: Kinetics, Absorption, Amino acids, Inflow, Aquatic algae, Nitella flexilis.

AMIC-8382
"OBSERVATIONS ON THE STRUCTURE OF SOME FORMS OF GOMPHONEMA PARVULUM KUTZ. II. THE INTERNAL ORGANIZATION", Dawson, P. A., Journal of Phycology, Vol. 9, No. 2, June 1973, pp 165-175.

The diatom species Gomphonema parvulum Kutz. was isolated, grown in culture, and the details of the internal organization studied by light and electron microscopy. The organism is usually identified from its frustular morphology, but members of the genus Gomphonema can be separated from other naviculoid forms by the H-shaped chromatophore, whose lobes are connected on 3 sides across the center of the cell, and also from the position of the pyrenoid. This is situated on the inner side of the chromatophore and is not embedded in the center of the chromatophore. New observations of this pennate diatom include details of the periplastidial network, of the Golgi vesicular activity, and of the storage products.

INDEX TERMS: Diatoms, Plant morphology, Aquatic algae, Electron microscopy, Cytological studies, Chrysophyta, Cultures, Gomphonema parvulum, Light microscopy, Ultrastructure, Frustules, Sample preparation, Cell wall, Characterization.

AMIC-8383
"CONTINUOUS CULTURE OF MARINE DIATOMS UNDER SILICATE LIMITATION. I. SYNCHRONIZED LIFE CYCLE OF SKELETONEMA COSTATUM, Davis, C. O., Harrison, P. J., Dugdale, R. C., Journal of Phycology, Vol. 9, No. 2, June 1973, pp 175-180.

Skeletonema costatum was grown in silicate-limited continuous culture. Culture conditions resulted in synchronization of sexual reproduction. A detailed description of the life cycle is presented. During the life cycle growth rates varied from 0 to 0.12/hr. Sexual reproduction in diatoms has often been observed in batch cultures and some stages have been reported in nature. However, this is apparently the first report of its occurrence in continuous culture. Other experiments that demonstrate the importance of sexual reproduction in continuous culture work are discussed.

INDEX TERMS: Diatoms, Deficient elements, Silicates, Life cycles, Synchronization, Skeletonema costatum.

AMIC-8412
"EFFECTS OF COPPER ON THE LOCOMOTOR ORIENTATION OF FISH", Kleerekoper, H., Texas A&M University, Department of Biology, College Station, Texas, Report No. EPA-R3-73-045, Contract No. R800995 (18050DWQ), June 1973, 106 pp.

The effects of copper ions at subacute concentrations on the locomotor orientation of goldfish (Carassius auratus), channel catfish (Ictalurus punctatus), largemouth bass (Micropterus salmoides), white sucker (Catostomus commersoni commersoni) and green sunfish (Lepomis cyanellus) were investigated in detail. In regions of water containing 11-17 micrograms/l Cu(2 plus) (as $CuCl_2$) in a shallow gradient goldfish oriented toward the copper source ('attraction'). This response is reduced in a somewhat steeper gradient. In steep gradients significant but no absolute avoidance behavior occurred. Whether the response will be 'avoidance' or 'attraction' seems to depend on the slope of the gradient to which the fish is exposed. Even in steep gradients, the 'avoidance' behavior is reversed to 'attraction' when the copper ions interact with a temperature slightly higher (0.4C) than that of the surrounding copper free water. The interaction creates a new stimulus configuration which is different from those formed by the two variables separately. The orientation of the largemouth bass is not affected by copper ions at the concentrations tested. Channel catfish are weakly attracted by the copper-containing water and green sunfish significantly increase time spent there. Suckers significantly but not absolutely 'avoid' such water through changes in turning behavior.

INDEX TERMS: Copper, Water pollution effects, Fish behavior, Water temperature, Freshwater fish, Cations, Bioassay, Lethal limit, Laboratory tests, Locomotor activity, Avoidance, Pollutant effects.

AMIC-8413
"FRESHWATER MACROINVERTEBRATES", Warner, R. W., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1231-1237.

This literature review stresses the effects on freshwater macroinvertebrates of various kinds of pollutants: inorganic wastes, organic wastes, pesticides, and radiation. Analyses of biotic communities, secondary productivity, periodicity and drift, distribution and habital requirements, sampling techniques, and the effects of altering the physical environment are also reviewed.

INDEX TERMS: Aquatic animals, Secondary productivity, Biological communities, Water pollution effects, Reviews, Ecological distribution, Biorhythms, Environmental effects, Aquatic drift, Aquatic habitats, Growth stages, Niche, Waste water (pollution), Biomass, Animal metabolism, Animal growth, Animal physiology, Predation, Spatial distribution, Temporal distribution, Sampling, Methodology, Equipment, Macroinvertebrates, Data interpretation, Bioaccumulation, Species diversity, Survival, Substrate utilization.

AMIC-8414
"EUTROPHICATION", Foehrendbach, J., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1237-1244.

The eutrophication process is reviewed in terms of sources, control, ecological factors, and nutrient removal.

INDEX TERMS: Eutrophication, Nutrient removal, Water pollution sources, Nutrients, Nitrogen compounds, Reviews, Water pollution control, Phosphorus compounds, Trophic level, Aquatic environment, Algae, Waste water treatment, Path of pollutants, Water pollution, Sinks, Environmental effects, Aquatic populations, Methodology, Nutrient sources, Mobilization, Fate of pollutants.

AMIC-8424
"THERMAL EFFECTS", Coutant, C. C., Pfuderer, H. A., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1331-1369.

A thorough review is given of the effects of water temperature and/or thermal pollution on aquatic life.

INDEX TERMS: Water pollution effects, Water temperature, Thermal pollution, Aquatic life, Reviews, Heat resistance, Heated water, Thermal stress, Laboratory tests, Bioassay, Powerplants, Effluents, Animal physiology, Aquatic populations, Aquatic productivity, Plant physiology, Animal morphology, Plant morphology, Ecological distribution, Marine microorganisms, Aquatic microorganisms, Speciediversity.

AMIC-8425
"EFFECTS OF POLLUTION ON FRESHWATER FISH", McKim, J. M., Cristensen, G. M., Tucker, J. H., Lewis, M. J., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1370-1407.

An extensive literature review is presented which is concerned with the effects of pollutants (metals, pesticides, detergents, industrial wastes) on freshwater fish; chemical and biological methods for identifying and determining the effects of such pollutants; and the effects of the water quality parameters salinity, oxygen, and pH on freshwater fish.

INDEX TERMS: Water pollution effects, Freshwater fish, Reviews, Analytical techniques, Methodology, Chemical analysis, Heavy metals, Aquatic environment, Ecosystems, Fish physiology, Fish behavior, Stress, Pesticide toxicity, Animal metabolism, Fish reproduction, Water pollution, Fish diseases, Bioassay, Lethal limit, Fish populations, Mortality, Organic wastes, Industrial wastes, Oil spills, Alkaline earth metals, Mine wastes, Cooling towers, Pulp wastes, Wood wastes, Domestic wastes, Waste water (pollution), Nuclear wastes, Radioactivity effects, Radioactive wastes, Laboratory tests, On-site tests, Animal tissues, Bioaccumulation, Mobilization, Biological magnification, Biomonitoring, Sample preparation, Fate of pollutants, Biotransformation.

AMIC-8429
"TOXICITY ASSESSMENT OF TREATED MUNICIPAL WASTEWATERS", Esvelt, L. A., Kaufman, W. J., Selleck, R. E., Journal Water Pollution Control Federation, Vol. 45, No. 7, July 1973, pp 1558-1572.

Bioassay studies of the toxicity of municipal wastewaters and its removal by conventional and advanced waste treatment processes were conducted with effluents from full-scale and pilot-plant treatment facilities. Wastewater toxicities were determined before and after each treatment process with continuous-flow, on-line bioassays using golden shiners and three-spined sticklebacks. Primary effluent 96-hr TL50 values from four communities averaged about 45 percent. Good correlations were observed between the toxicity and methylene blue active substance and NH3-N concentrations in primary and treated effluents. Biological treatment with activated sludge at conventional loadings removed most toxicity from primary effluents, and chemical precipitation with lime at pH 11, followed by recarbonation, reduced the toxicity to an average 96-hr TL50 of 75 percent. Further ion exchange and sorption treatments resulted in even less toxic effluents. Chlorination of all effluents resulted in increased toxicity, and dechlorination with sodium bisulfate resulted in the removal of all chlorine-induced toxicity.

INDEX TERMS: Bioassay, Waste water (pollution), Waste water treatment, Toxicity, Sewage effluents, Water pollution effects, Laboratory tests, Freshwater fish, Lethal limit, Mortality, Pilot plants, Golden shiner, Three-spined stickleback, Median tolerance limit, Continuous flow technique, Notemigonus crysoleucas, Gasterosteus aculeatus, Chemical composition.

AMIC-8433
"REDUCTION AND EVALUATION OF BIOLOGICAL DATA", Harkins, R. D., Austin, R. E., Journal Water Pollution Control Federation, Vol. 45, No. 7, July 1973, pp 1606-1611.

Aquatic organisms were collected from the area surrounding the confluence of Anacoco Bayou and the Sabine River, Louisiana, in an attempt to develop a single biological index useful in evaluating water quality. A secondary objective was to compare artificial substrate samplers: rock-filled baskets and multiplate samplers. Samplers were retrieved after 4 weeks, and the organisms harvested by scrubbing, identified, and counted. An equation based on information theory was developed to process the data. Computer programs were written to do the calculations as well as the analysis of variance. It is concluded that the method can objectively reduce several biological indexes to a single meaningful value. Resulting sets of standardized distance values can be compared subjectively or can be subjected to statistical evaluation and probability levels of differences assessed. There was no indication of differences between samplers or interaction between samplers and site.

INDEX TERMS: Sampling, Mathematical studies, Water pollution effects, Equations, Biological communities, Data interpretation, Artificial substrates, Species diversity.

AMIC-8439
"MOLYBDENUM CONCENTRATIONS IN TISSUES OF RAINBOW TROUT (SALMO GAIRDNERI) AND KOKANEE SALMON (ONCORHYNCHUS NERKA) FROM WATERS DIFFERING WIDELY IN MOLYBDENUM CONTENT", Ward, J. V., Journal of the Fisheries Research Board of Canada, Vol. 30, No. 6, June 1973, pp 841-842.

Salmo gairdneri and Oncorhynchus nerka were obtained from Dillon and Eleven Mile Reservoirs and a hatchery in Colorado for analysis of molybdenum content. Liver, kidney, testes, ovaries, spleen, bone, muscle, intestine, stomach, brain, fat, and gill samples were analyzed by x-ray fluorescence. Water samples were analyzed spectrophotometrically. Concentrations of molybdenum in tissues of rainbow trout increased only slightly with increase in molybdenum concentration of the water. Fish from high (300 ppb) molybdenum water had mean concentrations of 13-332 ppb on a wet-weight basis; those from low (6 ppb) molybdenum water, 10-146 ppb; and those from trace molybdenum water, 5-118 ppb. Rainbow trout exhibited generally higher molybdenum concentrations than did kokanee salmon in high molybdenum water. A possible plateau mechanism concerning molybdenum accumulation by salmonids is discussed.

INDEX TERMS: Water analysis, Molybdenum, Rainbow trout, X-ray fluorescence, Spectrophotometry, Biological samples, Bioaccumulation, Kokanee salmon.

AMIC-8441
"CADMIUM UPTAKE BY FIDDLER CRABS EXPOSED TO TEMPERATURE AND SALINITY STRESS", O'Hara, J., Journal of the Fisheries Research Board of Canada, Vol. 30, No. 6, June 1973, pp 846-848.

Fiddler crabs (Uca pugilator) were collected from an unpolluted estuary near Georgetown, South Carolina and, after acclimation, subjected to 1 microcurie of Cd-109 and 10 ppm Cd (2 plus) as cadmium chloride in filtered seawater at temperature and salinity combinations of 33, 25, and 10 C and 3.0 and 1.0 percent salinity. After 24, 48, and 72 hr, samples were sacrificed and the gill and hepatopancreas weighed and digested for 24 hr. Scintillation fluid was added to the digested sample and Cd determined by scintillation counting. At each temperature crabs accumulated more Cd in low salinity water than in high salinity water. This effect is probably due to osmotic stress caused by the different salt concentrations. Maximum accumulations occurred at high temperature and low salinity with totals for gill and hepatopancreas of 4.98 micrograms at 24 hr, 10.10 micrograms at 48 hr, and 17.44 micrograms at 72 hr.

INDEX TERMS: Bioassay, Cadmium, Salinity, Water temperature, Fiddler Crabs, Bioaccumulation.

AMIC-8442
"EFFECTS OF REDUCED OXYGEN CONCENTRATIONS ON NORTHERN PIKE (ESOX LUCIUS) EMBRYOS AND LARVAE", Siefert, R. E., Spoor, W. A., Syrett, R. F., Journal of the Fisheries Research Board of Canada, Vol. 30, No. 6, June 1973, pp 849-852.

The objective of this study was to determine the effects of continuous dissolved oxygen concentrations in the range 50-12.5 percent saturation on the survival and development of northern pike (Esox lucius) embryos and larvae from egg fertilization until all surviving larvae fed. Eggs were mixed with milt for fertilization and placed in acrylic plastic experimental chambers containing three compartments. One compartment where the water and gas mixture entered, one containing the embryos, and one containing larvae. Tests were conducted at combinations of temperatures, flow rate, and oxygen concentration. At 15 and 19 C, and at flows of 60 and 30 ml/min (velocities about 3.3 and 1.6 cm/min), 50 percent oxygen saturation was sufficient for survival and development of northern pike from fertilization until all surviving larvae fed. Oxygen tensions of about 33 percent saturation appeared inadequate for proper survival.

INDEX TERMS: Bioassay, Reproduction, Dissolved oxygen, Water temperature, Flow rates, Pikes, Larvae, Embryonic growth stage, Survival.

AMIC-8560
"BIOLOGICAL EFFECTS OF COOLING TOWER BLOWDOWN", Garton, R. B., In: Water-1972, AIChE Symposium Series No. 129, Vol. 69, 1973, pp 284-292.

The purpose of this study was to determine the toxicity of a 'typical' cooling tower blowdown and of its individual components. Since blowdown composition is variable, a simulated blowdown was made using chemicals and concentrations listed in waste discharge permit applications. The mixture contained varying amounts of chromate, zinc, phosphate, sulfate, boron, sodium, ammonia, morpholine, cyclohexylamine, and hydrazine and simulated blowdown from the Trojan Nuclear Plant. Separate tests were also conducted with sodium chromate, zinc phosphate, and with blowdown without chromate. Fish (Salmo gairdneri) and an alga (Selenastrum capricornutum) were used in bioassays of the mixtures. Algal assays were conducted according to the 'Algal Assay Procedure, Bottle Test'. Fish bioassays were conducted in accordance with procedures given in 'Standard Methods'. Algal growth was reduced by blowdown at full strength and at dilutions of 0.1. Fish were killed at dilutions of 0.1; no effect was observed at 0.032 dilution. The LC50 value was 0.068 dilution. With sodium chromate, algal growth was reduced at 0.139 ppm, and fish survived 96 hours at 31 ppm. Zinc phosphate had no significant effect on algal growth at 0.016 ppm. The LC50 for fish was 0.09 ppm zinc phosphate. Based on all the tests, zinc and chromium were identified as the toxic components in the blowdown. It is noted that synergistic effects may occur in other mixtures containing different compounds. Furthermore, the organisms used in the bioassays must be specified since toxicities may differ for different ones.

INDEX TERMS: Toxicity, Rainbow trout, Bioassay, Cooling towers, Chromates, Zinc, Phosphates, Sulfates, Sodium, Ammonia, Boron, Blowdown, Selenastrum capricornutum, Morpholine, Cyclohexylamine, Hydrazine.

AMIC-8573
"THERMAL EFFECTS ON EGGS, LARVAE AND JUVENILES OF BLUEGILL SUNFISH", Banner, A., Van Arman, J. A., Aquatic Sciences, Incorporated, Boca Raton, Florida, Report No. EPA-R3-73-041, Contract No. 14-12-913, May 1973, 111 pp.

Bioassay experiments were conducted to determine thermal tolerance of early life history stages of bluegill sunfish. Bluegill eggs hatched at temperatures from 18 to 36 C during two incubation tests. Maximal hatch occurred at 22.2 and 23.9 C. Lower TL50 temperature for hatch of normal fry was 21.9 C and upper TL50 temperature was 33.8 C. Juvenile bluegills acclimated to 12.1 C had a lower 96-hour TL50 of 3.2 C and an upper 96-hour TL50 of 27.5 C. Juveniles acclimated to 32.9 C had a lower 96-hour TL50 of 15.3 C and an upper 96-hour TL50 of 37.3 C. TL50 increased with increasing temperature of acclimation. For juveniles acclimated to a given temperature, upper TL50 decreased with longer exposure. A preliminary test determined ranges of thermal tolerance for sac-fry and swim-up fry. In another preliminary test, juvenile bluegills were acclimated to 12.1, 19.0, 26.0 or 32.9 C, and reared at a series of test temperatures for three to six weeks to define optimal temperature ranges for growth and survival. Additional research determined conditions for the culture of Lepomis macrochirus, including spawning induction, hatching, and growth of larvae and juveniles.

INDEX TERMS: Heat resistance, Thermal stress, Water pollution effects, Growth stages, Fish physiology, Fish behavior, Larvae, Juvenile fish, Fish eggs, Bluegills, Median tolerance limit.

AMIC-8574
"INTERACTION BETWEEN MARINE ORGANISMS AND OIL POLLUTION", Blumer, M., Hunt, J. M., Atema, J., Stein, L., Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, Report No. EPA-R3-73-042, May 1973, 97 pp.

Results from a two-part study are presented. Part I, 'Interaction Between Marine Organisms and Oil Pollution', produced the following results. Hydrocarbons in uncontaminated living plants and animals differ in structure and molecular weight distribution from the hydrocarbons in fossil fuels. Criteria and methods were established that permit the detection of hydrocarbons from fossil fuels in the presence of biogenic hydrocarbons and vice versa. Hydrocarbons are remarkably stable in marine sediments and in the lipids of marine organisms. Even chemically reactive hydrocarbons can move unaltered through several trophic levels in the marine food web. Degradation and dispersal eventually proceeds by physical (evaporation, dissolution), by chemical (oxidation, polymerization) and by biochemical (metabolism) processes. There is now ample evidence for the importance of chemical communication between marine organisms, both with inter- and intraspecific message systems. Only very low concentrations of organic stimuli are required for communication. Consequently, such processes appear especially prone to interference by pollutants at low concentration levels. Results from Part II, 'Sublethal Effects of Crude Oil on Lobster, (Homarus americanus) Behavior', are as follows. Small quantities of crude oil (0.9 milliliters in 100 liters of seawater) interfere with some specific, possibly chemosensory, behavior of the lobster, Homarus americanus. Timing of their feeding behavior showed that the delay period between noticing food and going after it doubled when oil was added. The water soluble fraction of this crude oil alone (in the 50 ppb range) does not have a noticeable effect on behavior and feeding times. Morphological changes in odor

AMIC-8574 (Continued) Card 2/2

receptors after oil exposure were not detected by light and electron microscopy. The results indicate that small quantities of oil mixed into seawater constitute a noxious, bad smell in the lobsters' environment, depressing his appetite and chemical excitability. Chemical analyses showed that before the addition of oil a great quantity of lipids was present in the test aquaria. When the water was brought in contact with an oil slick, the lipid concentration dropped considerably. The same effect was seen in the alkane and the alkene-aromatic hydrocarbon fractions. The fate of oil in seawater followed the usual degradation pattern.

INDEX TERMS: Oil, Water pollution effects, Sea water, Pollutant identification, Toxicity, Bioassay, Degradation (decomposition), Behavior, Metabolism, Phytoplankton, Benthic flora, Crabs, Oil characterization, Fate of pollutants, Chemotaxonomy.

AMIC-8575
"THE ECOLOGIC IMPACT OF THE INTERACTIONS AMONG MICROORGANISMS AND AQUATIC CONTAMINANTS IN LAKE ERIE, PHASE III, PARTS 5, 6, AND 7, Pfister, R. M., Dugan, P. R., Frea, J. I., Randles, C. I., Ohio State University, Water Resources Center, Columbus, Ohio, Project Completion Report No. 373X, Contract No. DI-14-31-0001-3320, 1973, 171 pp. NTIS Report No. PB-216 897.

In part 5 of this report, 'Interaction among Microbial Cells, Enzymes, Substrates and Clay Minerals', laboratory strains of Streptomyces fradiae and Micromonospora chalcea were used to make preliminary tests of (1) substrate utilization; (2) adherence of mineral particulates to mycelium; (3) adherence of proteins in general, and enzymes in particular to mineral particulates, and (4) degradation of dye-conjugated collagen substrates by cell-free enzyme preparations. The preliminary tests indicated that (1) actinomycetes were suitable organisms for studying enzymatic degradation of complex organic materials; (2) mineral particulates adhered to mycelia and protein substrates; (3) active enzyme was adsorbed to kaolinite and bentonite, and (4) the collagen preparations, Azocoll and HPA, used in conjunction with mineral particulates, permitted qualitatively sensitive assays of enzymatic activity. Part 6 is entitled 'Suspended Particles from Lake Erie: Amino Acid Composition and the Effect of Detergents on Their Interactions with Bacteria'. The effect of particulates larger and smaller than 0.45 millimicron from Lake Erie was investigated with Pseudomonas, Micrococcus, Bacillus, and Flavobacterium. It can be concluded that the particulate material can serve as a source of carbon and nitrogen. An attempt was made to determine the amount of carbohydrate material in the particulates by paper chromatography. The results suggest that the carbohydrate concentration in the particulates is less than 10 micrograms/liter. Another series of experiments

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investigated the interactions of detergent compounds and the particulate material from Lake Erie on the growth of the Pseudomonas organism. The 30 micrograms/ml quantity was chosen as the optimal concentration. The Pseudomonas organism was able to utilize all three of the detergents. The effect of the detergent on the clumping of the cells was very striking, as was the production of a green water soluble pigment. The organisms incubated with the LAS and the particulates did not appear to grow at all. There was some growth in the Sears and Tide but not so much as was achieved with the particles alone. Part 7 is entitled 'Response of a Pure Culture of Anacystis nidulans and a Unialgal Culture of Microcystis aeruginosa to Aldrin and Dieldrin'. The results showed that both pesticides inhibited growth, but the organisms were able to recover. Dieldrin inhibited production of oxygen and suppressed photosynthesis, and aldrin inhibited chlorophyll synthesis. Both organisms concentrated the pesticides then released and reabsorbed them.

INDEX TERMS: Bioassay, Toxicity, Growth rates, Clays, Organic matter, Adsorption, Degradation (decomposition), Lake Erie, Amino acids, Pseudomonas, Particle size, Surfactants, Aldrin, Dieldrin, Absorption, Photosynthesis, Chlorophyll, Streptomyces fradiae, Micromonospora chalcea, Substrate utilization, Micrococcus, Flavobacterium, Bacillus, Bioaccumulation, Microcystis aeruginosa, Anacystis nidulans.

AMIC-8576
"CONCENTRATION FACTORS OF CHEMICAL ELEMENTS IN EDIBLE AQUATIC ORGANISMS", Thompson, S. E., Burton, C. A., Quinn, D. J., Ng, Y. C., University of California, Lawrence Livermore Laboratory, Livermore, California, Report Nos. TID-4500 and UC-48, Contract No. W-7405-ENG-48, October 10, 1972, 77 pp. NTIS Report No. UCRL-50564 (Rev.1).

This revised report presents tables of concentration factors derived for edible plants, invertebrates, and fish from both freshwater and marine environments. The values are based on an extensive literature review of elemental concentrations in aquatic organisms and water and on experimentally determined concentration factors. The document also summarizes concentration factors for edible plants, molluscs, crustaceans, and fish derived from studies on radioactivity in the environment. The Appendix gives the basic data used to derive the concentration factors and the special procedures employed to estimate concentrations or concentration factors where the required data were inadequate or nonexistent.

INDEX TERMS: Reviews, Crustaceans, Marine plants, Aquatic plants, Crustaceans, Marine fish, Mollusks, Freshwater fish, Radioisotopes, Heavy metals, Bioaccumulation, Biological magnification.

AMIC-8577
"AQUATIC-BIOTIC COMMUNITY STURCTURE AS AN INDICATOR OF POLLUTION", Dills, G. G., Rogers, D. T., Jr., Geological Survey of Alabama, Division of Water Resources, University, Alabama, , Circular 80, Contract No. DI-14-31-0001-3201, 1972, 25 pp. NTIS Report No. PB-216 801.

Physicochemical conditions and community structure of benthic macroinvertebrates were investigated in a drainage system polluted with acid mine drainage. Biweekly water samples were collected at ten sites on Crane Creek (Alabama) and analyzed for turbidity, phosphate, nitrate, silica, alkalinity, hardness, Cr, and chloride. On-site measurements included DO, water temperature, conductivity, pH, Fe and Mn. Biweekly benthic samples were taken from similar stream substrates with no repeated sampling at a given spot in less than 2 months. The samples were preserved, sorted and place in groups, identified, and enumerated. A statistical interpretation was performed to show a possible correlation between the water quality parameters and species diversity. Tributaries exposed to acid effluents were characterized by lack of a natural buffering capacity, a reduction in turbidity, a decrease in pH, and an increase in mineral content. Strong positive correlation existed between hardness, iron, manganese, pH, conductance, and sulfur, while dissolved-oxygen content and temperature values were strongly negatively correlated. A step-wise regression analysis showed pH, phosphate, and turbidity to be highly correlated (P less than .01) with species diversity. Significant differences (P less than .01) in species diversity existed between acidic and nonpolluted tributaries. Stations located near areas of acid production were consistently lowest in diversity. Species diversity values for the unpolluted stations showed temporal variations with highest values occurring during late March and December. The polluted stations showed random fluctuations in diversity

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values. A regression line, calculated to show the relationship between pH and species diversity, could be used to predict species diversity on the basis of periodic measurement of stream pH. Varying degrees of acid mine pollution were reflected by changes in the macroinvertebrate community structure.

INDEX TERMS: Biological communities, Mine drainage, Water pollution effects, Physicochemical properties, Benthic fauna, Bioindicators, Regression analysis, Aquatic environment, Water properties, Species diversity, Macroinvertebrates, Species diversity index, Cane Creek.

See also: Category 1, AMIC-3794, 7947, 7951, 8110, 8337, 8370, 8394, 8422
Category 3, AMIC-7427, 8065, 8156, 8596.

AMIC-7209
"AN IMPROVED BACTERIAL TEST SYSTEM FOR THE DETECTION AND CLASSIFICATION OF MUTAGENS AND CARCINOGENS", Ames, B. N., Lee, F. D., Durston, W. E., Proceedings of the National Academy of Sciences, Vol. 70, No. 3, March 1973, pp 782-786.

A set of four strains of Salmonella typhimurium designed for detecting the various types of mutagens was described, and showed their utility in detecting a wide variety of carcinogens as mutagens. The lipopolysaccharide that normally coats these bacteria is a barrier to penetration of mutagens to the cell membrane. The set of tester strains has been improved by adding a mutation (rfa: deep rough) that results in a deficient lipopolysaccharide. The techniques for using these strains for detecting mutagens are presented and the tests are shown to be extremely sensitive and convenient. The specificity of frameshift mutagenesis is clairfied. As adjuncts to the test with the four strains, a test is described that compares mutagenic killing in deep rough strains with and without DNA excision repair, and a test using forward mutagenesis in a deep rough strain lacking excision repair.

INDEX TERMS: Toxicity, Bioassay, Salmonella typhimurium, Mutagens, Carcinogens.

AMIC-7290
"THE FATTY ACIDS OF PSEUDOMONAS MULTIVORANS (PSEUDOMONAS CEPACIA) AND PSEUDOMONAS KINGII", Samuels, S. B., Moss, C. W., Weaver, R. E., Journal of General Microbiology, Vol. 74, No. 2, February 1973, pp 275-279.

The fatty acid compositions of three strains of Pseudomonas multivorans and three of P. kingii were determined by gas-liquid chromatography. The major fatty acids identified were 16:0, 16:1, 18:1, 3-OH 14:0, 3-OH 16:0 and cyclopropane acids 17 delta and 19 delta. The fatty acid compositions of these strains were similar to the acids identified in sixteen clinical isolates of the 'P. multivorans (P. cepacia)/P. kingii group'. These data support the current view that P. multivorans and P. kingii are identical species.

INDEX TERMS: Pollutant identification, Gas liquid chromatography, Pseudomonas multivorans, Pseudomonas kingii, Fatty acids.

AMIC-7283
"VOLATILIZATION OF MERCURIC CHLORIDE BY MERCURY-RESISTANT PLASMID-BEARING STRAINS OF ESCHERICHIA COLI, STAPHYLOCOCCUS AUREUS, AND PSEUDOMONAS AERUGINOSA", Summers, A. O., Lewis, E., Journal of Bacteriology, Vol. 113, No. 2, February 1973, pp 1071-1072.

It is reported that Escherichia coli, Staphylococcus aureus, and Pseudomonas aeruginosa strains carrying independently isolated plasmids with genes determining resistance to mercury will convert mercuric chloride to a volatile form of mercury which is soluble in organic solvents. Strains of the 3 bacteria species above were examined for their ability to volatilize Hg-203 added as HgCl2 and for their ability to convert added Hg-203 Cl2 to a chloroform-soluble form. All experiments were done with cells growing aerobically at 37 C in tryptone broth. Resistant strains were induced by pregrowth in tryptone broth containing 0.00001 M HgCl2 for not less than 3 hr. The results showed that those resistant strains can convert 0.00001 M Hg(2 plus) chloride to a volatile form of Hg which is soluble in organic solvents. The volatilization activity is induced by exposure to HgCl2.

INDEX TERMS: E. coli, Mercury, Resistance, Radioactivity techniques, Aerobic bacteria, Heavy metals, Genetics, Microbial degradation, Solvent extractions, Volatilization, Mercuric chloride, Pseudomonas aeruginosa, Staphylococcus aureus, Fate of pollutants, Organic solvents, Bacterial physiology, Chloroform, Degradation products, Hg-203, Substrate utilization.

AMIC-7427
"INOCULATION TECHNIQUES - EFFECTS DUE TO QUALITY AND QUANTITY OF INOCULUM", Meyrath, J., Suchanek, G., In: Methods in Microbiology, Volume 7B, Academic Press, New York, N.Y., 1972, pp 159-209.

This chapter of 'Methods in Microbiology' contains discussions on selection and standardization of inocula according to type of microorganism (bacteria, yeasts, filamentous fungi, microscopic algae), recovery and preparation of inocula, and effects of inoculum size and history of inoculum.

INDEX TERMS: Bacteria, Cultures, Fungi, Yeasts, Algae, Growth rates, Inocula, Sample preparation.

AMIC-7829
"FERMENTATION OF GLUCOSE, FRUCTOSE, AND XYLOSE BY CLOSTRIDIUM THERMOACETICUM: EFFECT OF METALS ON GROWTH YIELD, ENZYMES, AND THE SYNTHESIS OF ACETATE FROM CO2", Andreesen, J. R., Schnupp, A., Neurauter, C., et al., Journal of Bacteriology, Vol. 114, No. 2, May 1973, pp 743-751.

Clostridium thermoaceticum ferments xylose, fructose, and glucose with acetate as the only product. In fermentations with mixtures of the sugars, xylose was first fermented, then fructose, and last, glucose. Fructose inhibits the fermentation of glucose, and this inhibition appears to be due to a repression of the synthesis of an enzyme needed for glucose utilization. Addition of metals to the culture medium increased the cell yield drastically from about 7 to 18 g per liter, and Y(glucose) values between 40 and 50 were obtained. According to the postulated pathways of the fermentation of glucose and synthesis of acetate from CO2 by C. thermoaceticum, 3 mol of ATP are available as energy for growth. Thus a Y(adenosine 5'-triphosphate) of 13 to 16 is obtained. Because the normal Y(ATP) value is 10.5, this could mean that an additional source of ATP is available by an unknown mechanism. The addition of metals also increases the nicotinamide adenine dinucleotide phosphate-dependent formate dehydrogenase activity, the overall reaction (C-14-labelled CO2 to acetate), and the incorporation of the methyl group of 5-methyltetrahydrofolate into acetate. These reactions are catalyzed very efficiently by cells harvested in early growth, whereas cells obtained at the end of a fermentation have very low formate dehydrogenase activity and capacity to incorporate CO2 into acetate. Enzymes present were not or were very little affected by the addition of metals to the growth medium. The amount of corrinoids in cells from early growth is low, whereas it was high in delta-aminolevulinate dehydratase, which is high at the beginning of growth and low at the end.

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INDEX TERMS: Heavy metals, Growth rates, Enzymes, Fermentation, Clostridium thermoaceticum, Xylose, Fructose, Glucose, Culture media.

AMIC-7984
"LAND DISPOSAL AND SEWAGE EFFLUENT: APPRAISAL OF HEALTH EFFECTS OF PATHOGENIC ORGANISMS", Benarde, M. A., Journal American Water Works Association, Vol. 65, No. 6, June 1973, pp 432-440.

Concern about pollution of surface waters, especially by human and animal fecal wastes has evoked interest in alternate methods of disposal of these waters as well as in the reuse of waters. The author reviews the literature concerning possible health hazards and the advantages of disposing fecal wastes on land. Although many questions remain to be answered, reuse of water and land disposal of treated fecal wastes should pose no health threats if proper regulations are established and followed. The author further conjectures that wastewaters may in the future be used as a source of drinking water.

INDEX TERMS: Water reuse, Sewage disposal, Public health, Potable water, Reviews, Human diseases, Pathogenic bacteria.

AMIC-8033
"CALCULATION OF TURBIDIMETRIC MICROBIOLOGICAL VITAMIN ASSAY RESULTS, USING AN APL/360 COMPUTER PROGRAM", Brolund, G. V., Haskins, E. W., Hudson, G. A., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 3, May 1973, pp 754-757.

An APL-360 computer program is described for the calculation of results from microbiological vitamin assays. The results are compared to manual calculations specified in official AOAC methods. This comparison shows the validity of the computer program for these calculations.

INDEX TERMS: Computer programs, Cultures, Bioassay, Vitamins, Turbidity.

AMIC-8056
"NITRITE REDUCTASE-DEFICIENT MUTANTS OF ESCHERICHIA COLI K12", Cole, J. A., Ward, F. B., Journal of General Microbiology, Vol. 76, No. 1, May 1973, pp 21-29.

Mutants of Escherichia coli K12 have been isolated which reduce nitrite 3 to 30 percent as rapidly as the wild-type. Activities of reduced nicotinamide adenine dinucleotide (NADH)-nitrite oxidoreductase were lower in cell-free extracts of these mutants than in the wild-type. The mutants grew on minimal agar, and their sulphite reductase activity was the same as in the wild-type. Double mutants deficient in both nitrite and sulfite reductases were constructed, as well as recombinants which had regained one or both activities. The inability to reduce sulfite was due to a genetic alteration.

INDEX TERMS: E. coli, Separation techniques, Reduction (chemical), Cultures, Nitrites, Nitrates, Sulfites, Isolation.

AMIC-8057
"THE SELECTIVE TOXICITY OF ANTIMICROBIAL NITROHETEROCYCLIC DRUGS", Edwards, D. I., Dye, M., Carne, H., Journal of General Microbiology, Vol. 76, No. 1, May 1973, pp 135-145.

Three antimicrobial nitroimidazole drugs (metronidazole, dimetridazole, and tinidazole) inhibit a range of clostridia (C. welchii, C. tertium, C. bifermentans, C. pasteurianum, C. sporogenes, C. histolyticum, C. tetanomorphum, C. butyricum) and the protozoan Trichomonas vaginalis; they have an identical site and mode of action as specific electron acceptors from the pyruvate phosphoroclastic reaction. Analogues of the drugs are compared and the structural requirements for activity explained. The nitrofuran (nitrofurazone) probably has a different mechanism of action.

INDEX TERMS: Inhibition, Growth rates, Clostridium, Protozoa, Cultures, Metronidazole, Dimetridazole, Tinidazole, Nitrofuran, Gas evolution.

AMIC-8059
"UTILIZATION OF HYDROCARBONS BY CLADOSPORIUM RESINAE", Cofone, L., Jr., Walker, J. D., Cooney, J. J., Journal of General Microbiology, Vol. 76, No. 1, May 1973, pp 243-246.

Cladosporium resinae occurs in air, soil, and water and is capable of growing on hydrocarbons. Two strains were cultured with various hydrocarbons and with aldrin, dieldrin, diazonin, rotenone, malathion, and DDT to study their ability to degrade hydrocarbons. Fungal cells were harvested after 34 days from cultures showing growth. Cultures showing no growth were incubated for an additional 23 days. The fungus grew at various rates on the following hydrocarbons as the sole source of carbon: glucose, hexane, heptane, octane, nonane, decane, undecane, dodecane, tridecane, tetradecane, pentadecane, hexadecane, nonadecane, octene-1, decene-1, dodecene-1, tetradecene-7, 2-methyl undecane, cyclohexane, cyclohexene, benzene, toluene, o-xylene, m-xylene, and isopropylbenzene. Paraffin oil, hexene-1, 2, 6, 11-trimethyl dodecane, m-toluic acid, p-toluic acid, benzoic acid, catechol, salicyclic acid, DL-mandelic acid, p-xylene, phenol, naphthalene, anthracene, and phenanthrene did not support growth. C. resinae did not grow with the pesticides as sole carbon source. Growth on glucose or hexadecane was not inhibited by any of the pesticides, and several stimulated growth. Oxygen uptake also was not affected by pesticides. The ability to use a variety of hydrocarbons in the absence of organic nitrogen indicated by the present work, coupled with ability to grow on substrates which are recalcitrant to attack by many other organisms and in the presence of pesticides, in consistent with the view of C. resinae can proliferate in ecological niches which cannot be occupied by other organisms.

INDEX TERMS: Cultures, Microbial degradation, Organic compounds, Pesticides, Fungi, Growth rates, Aldrin, Dieldrin, DDT, Cladosporium resinae, Rotenone, Malathion.

AMIC-8060
"EXTRACTABLE LIPIDS OF GRAM-NEGATIVE MARINE BACTERIA: PHOSPHOLIPID COMPOSITION", Oliver, J. D., Colwell, R. R., Journal of Bacteriology, Vol. 114, No. 3, June 1973, pp 897-908.

Phospholipid compositions of 20 marine and estuarine bacteria were determined by thin-layer chromatography. Results showed that phospholipids of marine bacteria differed very little from those of nonmarine organisms with phosphatidylethanolamine, phosphatidylglycerol, and diphosphatidylglycerol being the predominant phospholipids in all strains examined. Lyso-phosphatidylethanolamine occurred in significant quantities among a number of the marine bacteria, and two of the isolates contained significant quantities of poly-beta-hydroxybutyrate. Effects of age and growth temperature on the phospholipid composition were also investigated. It is suggested that phylogenetic relationships among bacteria may be correlated with phospholipid composition.

INDEX TERMS: Marine bacteria, Environmental effects, Varieties, Chemical analysis, Aging (biological), Temperature, Gram-negative bacteria, Phospholipids, Chemical composition, Chemotaxonomy, Marine environment, Sample preparation, Natural organics, Biochemical characteristics, Substrate utilization, Vibrio algosus, Vibrio marinofulvus, Vibrio alginolyticus, Vibrio parahaemolyticus, Vibrio marinus, Vibrio cholerae, Agrobacterium stellulatum, Achromobacter aquamarinus, Spirillum linum, Pseudomonas perfectomarinus, Pseudomonas aeruginosa, Photobacterium fischeri, Arthrobacter marinus.

AMIC-8061
"POLYNUCLEOTIDE SEQUENCE RELATIONSHIPS AMONG JAPANESE AND AMERICAN STRAINS OF VIBRIO PARAHAEMOLYTICUS", Staley, T. E., Colwell, R. R., Journal of Bacteriology, Vol. 114, No. 3, June 1973, pp 916-927.

Polynucleotide sequence relationships between two reference Vibrio parahaemolyticus strains isolated from Japanese and American gastroenteritis patients were investigated by use of P-32-labeled-DNA/DNA reassociation in free solution. In addition, these strains were similarly compared with 22 other strains of estuarine and marine vibrios, including 11 strains previously identified as V. parahaemolyticus (2 Japanese, 1 of unknown location, and 8 American strains obtained from diverse geographical locations and sources in North America), 3 strains of V. alginolyticus, and 8 of Vibrio spp. Deoxyribonucleic acid (DNA) from the Japanese and American gastroenteritis isolates showed high relative levels of intraspecific duplex formation (92 to 93%) when reassociated, reciprocally, at 60 C. Heterologous DNA duplexes exhibited thermal elution midpoint (Tm(e)) values comparable to those obtained from homologous duplexes (88.0) when thermally eluted from hydroxyapatite, thus indicating high base-pair complementarity. Other V. parahaemolyticus strains showed DNA homologies of 85 percent or greater, with correspondingly high Tm(e) values (86.0 to 88.0) for the heteroduplexes formed. DNA of two of three V. alginolyticus strains (ATCC 17749 and 166-70) was 55 to 60 percent homologous to reference V. parahaemolyticus DNA preparations; Vibrio sp strain 5144 (originally classified as V. parahaemolyticus biotype 2 and subsequently as V. alginolyticus strain 5144) showed only 24 to 26 percent DNA homology to the same reference DNA. These data provide evidence that Vibrio sp strain 5144 is genetically distinct from the other V. alginolyticus strains used in this study. Three bioluminescent strains thought to be

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closely related to V. parahaemolyticus demonstrated only 24 to 31 percent DNA homology to the reference V. parahaemolyticus DNA. These data firmly establish the existence in some Atlantic and Gulf Coast estuaries of organisms genetically very similar to V. parahaemolyticus, the causative agent of 'shirasu' food poisoning in Japan.

INDEX TERMS: Marine bacteria, Pathogenic bacteria, Public health, Radioactivity techniques, Varieties, Vibrio parahaemolyticus, Polynucleotides, DNA, Chemotaxonomy, Chemical composition, Sample preparation.

AMIC-8062
"AMMONIUM REGULATION IN ASPERGILLUS NIDULANS", Pateman, J. A., Kinghorn, J. R., Dunn, E., Forbes, E., Journal of Bacteriology, Vol. 114, No. 3, June 1973, pp 943-950.

L-Glutamate uptake, thiourea uptake, and methylammonium uptake and the intracellular ammonium concentration were measured in wild-type and mutant cells of Aspergillus nidulans held in various concentrations of ammonium and urea. Mycelia for uptake and enzyme assays were grown in shaken cultures at 25 C for 18-20 h, harvested, and, for enzyme assays, extracted according to Cove (1966). The levels of L-glutamate uptake, thiourea uptake, nitrate reductase, and hypoxanthine dehydrogenase activity are determined by the extracellular ammonium concentration. The level of methylammonium uptake is determined by the intracellular ammonium concentration. The uptake and enzyme characteristics of the ammonium-derepressed mutants, meaA8, meaB6, DER3, amrA1, xprD1, and gdhA1, are described. The gdhA mutants lack normal nicotinamide adenine dinucleotide phosphate-glutamate dehydrogenase (NADP-GDH) activity and are derepressed with respect to both external and internal ammonium. The other mutant classes are derepressed only with respect to external ammonium. The mutants meaA8, DER3, amrA1, and xprD1 have low levels of one or more of the L-glutamate, thiourea, and methylammonium uptake systems. A model for ammonium regulation in A. nidulans is put forward which suggests: (i) NADP-GHD located in the cell membrane complexes with extracellular ammonium. This first regulatory complex determines the level of L-glutamate uptake, thiourea uptake, Nitrate reductase, and xanthine dehydrogenase by repression or inhibition, or both. (ii) NADP-GDH also complexes with intracellular ammonium. This second and different form of regulatory complex determines the level of methylammonium uptake by repression or inhibition, or both.

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INDEX TERMS: Absorption, Pathogenic fungi, Model studies, Path of pollutants, Ammonium, Mutants, Aspergillus nidulans, Regulation (chemical), NADP-glutamate dehydrogenase.

AMIC-8063
"OXYGEN TOXICITY AND THE SUPEROXIDE DISMUTASE", Gregory, E. M., Fridovich, I., Journal of Bacteriology, Vol. 114, No. 3, June 1973, pp 1193-1197.

Oxygen caused an increase in the amount of superoxide dismutase in Escherichia coli B but not in Bacillus subtilis. E. coli B cells, induced by growth under 100 percent 02, were much more resistant to the lethal effects of 20 atm of 02 than were cells which contained the low uninduced level of this enzyme. In contrast, B. subtilis, which could not respond to 02 by increasing its content of superoxide dismutase, remained equally sensitive to hyperbaric 02 whether grown under 100 percent 02 or aerobically. The catalase in these organisms exhibited a reciprocal response to oxygen. Thus, the catalase of E. coli B was not induced by 02, whereas that of B. subtilis was so induced. These results are consistent with the view that superoxide dismutase is an important component of the defenses of these organisms against the toxicity of oxygen, whereas their catalases are of secondary importance in this respect. The ability of streptonigrin to generate 02 (minus) by a cycle of reduction followed by spontaneous reoxidation, has been verified in vitro. It is further observed that E. coli B which contain the high induced level of superoxide dismutase were more resistant to the lethality of this antibiotic, in the presence of oxygen, than were E. coli B which contained the low uninduced level of this enzyme. This difference between induced and uninduced cells were eliminated by the removal of 02. These results are consistent with the proposal that the enhanced lethality of streptonigrin under aerobic conditions may relate to its in vivo generation of 02 (minus) by a cycle of reduction and spontaneous reoxidation. In toto, these observations lend support to the hypothesis that 02 (minus) is an important agent of oxygen toxicity and that superoxide dismutase functions to blunt the threat posed by this reactive radical.

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INDEX TERMS: Toxicity, Oxygen, E. coli, Resistance, Superoxide dismutase, Sensitivity, Bacillus subtilis.

AMIC-8064
"NITRATE REDUCTION AND THE GROWTH OF VEILLONELLA ALCALESCENS", Inderlied, C. B., Delwiche, E. A., Journal of Bacteriology, Vol. 114, No. 3, June 1973, pp 1206-1212.

Veillonella alcalescens, a strict anaerobe, was found to possess a nitrate reductase system which has characteristics of both assimilatory and respiratory nitrate reduction. The nitrate reductase has been identified tentatively as a particulate enzyme which utilizes a variety of electron donors for the reduction of nitrate. By use of N-15-labeled nitrite, it was shown that under appropriate conditions nitrate nitrogen is incorporated into cell material. V. alcalescens grown on pyruvate and nitrate has a greater growth rate than cells grown on pyruvate alone. Growth can occur in a medium with hydrogen and nitrate as the sole energy source. Ammonium chloride decreases the rate of nitrate reduction but does not completely inhibit reduction or incorporation. The results suggest that nitrate assimilation and respiration are not as distinct as in some other organisms.

INDEX TERMS: Anaerobic bacteria, Pathogenic bacteria, Reduction (chemical), Nitrates, Essential nutrients, Absorption, Growth rates, Veillonella alcalescens, Bacterial physiology, Nitrate reductase, Substrate utilization, Assimilation, Pyruvate.

AMIC-8065
"MICROFLORA OF SOIL AS VIEWED BY FREEZE-ETCHING", Balkwill, D. L., Casida, L. E., Jr., Journal of Bacteriology, Vol. 114, No. 3, June 1973, pp 1319-1327.

A study was conducted to determine whether the soil microbial population could be viewed and evaluated by transmission electron microscopy of replicas of frozen-etched cells physically removed from the soil. In addition simpler methods of cell separation were investigated as an alternative to those required for thin-section studies. Three samples of Hagerstown silty clay loam were obtained; the indigenous microflora of soil were released from the soil materials and concentrated without the occurrence of growth by use of a blending-simple centrifugation procedure. The cell concentrate was then frozen-etched and viewed by transmission electron microscopy. Criteria were established for detecting microbial cells among the residual soil debris. The freeze-etching of the soil cell concentrate provided results on cell size distributions in agreement with those obtained by thin sectioning. However, the blending-simple centrifugation procedure for cell release and concentration from soil allowed the observation of large cells (greater than or equal to 1.0 micron in diameter) which apparently are missed by the 'exhaustive centrifugal washing' cell separation-concentration procedure. The procedure of blending-simple centrifugation combined with the viewing of frozen-etched preparations allowed evaluations of the soil microflora for cellular diameters, length-width ratios, shapes, and structure.

INDEX TERMS: Soil microorganisms, Methodology, Separation techniques, Cytological studies, Clay loam, Silts, Evaluation, Freeze etching, Transmission electron microscopy, Sample preparation, Cell morphology.

AMIC-8066
"SENSITIVITY OF VIBRIO PARAHAEMOLYTICUS TO COLD IN OYSTERS, FISH FILLETS AND CRABMEAT", Johnson, H. C., Liston, J., Journal of Food Science, Vol. 38, No. 3, March/April 1973, pp 437-441.

Raw and slightly cooked Pacific oysters (Crassostrea gigas) and, in some instances, crabmeat (Cancer magister) and fish fillets (Parophrys vetulos) were used in a study to determine if Vibrio parahaemolyticus does survive freezing when present naturally in seafood materials. Oysters were contaminated by feeding or injecting the organisms into the digestive tract. Fish fillets and crabmeat were contaminated within Polymylar pouches by pipetting 1 ml of an appropriate dilution onto the surface of the meat and massaging the pouch for even distribution. In various experiments the inoculated oysters were refrigerated or frozen at 11, 8, 5, 1, -15 and -30 C and subsequently stored for varying periods of time at the same respective temperature. Fish and crabmeat were treated in a similar manner, except that only 1, -15 and -30 C were utilized. Samples were removed from storage at intervals, thawed at room temperature and the content of V. parahaemolyticus or V. alginolyticus determined by a surface plate count. Duplicate plates for each appropriate dilution were incubated at 37 C and/or 43 C for 18-20 hr, and counts of V. parahaemolyticus obtained on plates containing 30-300 colonies. Counts were confirmed after an additional 18-20 hr incubation at the appropriate temperature to allow for growth of 'sub-lethally' damaged cells that might not have appeared after the original 18-20 hr of incubation. Only those colonies which conformed to the characteristics of V. parahaemolyticus (or V. alginolyticus) on the appropriate medium were counted. The pattern of death observed in crabmeat appears to be different from that observed in oysters and fish, in that death at 1 C and -15 C was essentially linear with little evidence of the two-stage

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mortality seen in oysters and fish fillets. The two strains of V. parahaemolyticus did show a marked two-stage mortality pattern at -30 C, although the extent of the first-stage and second-stage death varied; the V. alginolyticus strain yielded an indication of two-stage mortality at -30 C. Crabmeat appeared to offer less protection against chilling and freezing lethality to vibrios than either fish or oyster tissue, but further investigations would be required to elucidate this point. The results of this study indicate that chilling, freezing, or frozen storage temperatures per se cannot be relied upon to successfully eliminate the organism from seafoods or prevent the health hazard that is presented by V. parahaemolyticus.

INDEX TERMS: Temperature, Cold resistance, Pathogenic bacteria, Freezing, Freeze-thaw tests, Shellfish, Marine fish, Pollutants, Vibrio parahaemolyticus, Seafood, Sensitivity, Survival, Vibrio alginolyticus, Mutants.

AMIC-8152
"ISOLATION OF SALMONELLAE FROM PORK CARCASSES", Carpenter, J. A., Elliot, J. G., Reynolds, A. E., Applied Microbiology, Vol. 25, No. 5, May 1973, pp 731-734.

Four hundred and twenty pork carcasses from four abattoirs were examined for the presence of salmonellae by use of swabbing-enrichment techniques and contact plate methods. Carcasses from only one abattoir were found to be contaminated by swabbing-enrichment (23.3 percent) and contact plate (17.9 percent) methods. The area of the skin side of the ham, near the anal opening, was determined to be the area to examine for isolating salmonellae from pork carcasses with the greatest frequency. The most frequently isolated species of salmonellae in this study were Salmonella derby, S. anatum, S. typhimurium, and S. indiana. (Reprinted from Applied Mibrobiology, Vol. 25, No. 5, May 1973, pp 731-734. Copyright 1973 by the American Society for Microbiology. Reprinted by permission of the copyright owner.)

INDEX TERMS: Pollutant identification, Hogs, Isolation, Enteric bacteria, Aerobic bacteria, Livestock, Mammals, Pollutants, Pathogenic bacteria, Salmonella derby, Salmonella anatum, Salmonella typhimurium, Salmonella indiana, Culturing techniques.

AMIC-8155
"ABOLITION OF AWARMING OF PROTEUS BY p-NITROPHENYL GLYCERIN: APPLICATION TO BLOOD AGAR MEDIA", Williams, F. D., Applied Microbiology, Vol. 25, No. 5, May 1973, pp 751-754.

Comparative plate counts were made of Staphylococcus aureus and Streptococcus pyogenes growing on blood agar supplemented with individual chemicals to abolish the swarming of Proteus. B-phenylethanol, sodium azide, and p-nitrophenyl glycerin (PNPG) were used as anti-swarm agents. Each anti-swarm agent effectively abolished swarming for 24 h, but azide failed to control swarming for longer periods of incubation. In addition, azide displayed growth inhibition towards the staphylococci and streptococci resulting in no hemolysis and reduced viable cell numbers with the streptococci. Phenylethanol showed reduced viable cell numbers with the streptococci and unreliable hemolytic reactions. At 0.1 to 0.3 mM, PNPG proved to be a superior anti-swarm agent in that it showed no growth inhibition and allowed normal hemolysis, but abolished swarming for extended periods of time. When laboratory strains of Streptococcus pneumoniae, Klebsiella pneumoniae, Pseudomonas aeruginosa, Listeria monocytogenes, and Vibrio cholerae were screened on a blood agar medium containing 0.1 mM PNPG, they displayed similar growth and hemolytic characteristics to the identical medium without PNPG. (Reprinted from Applied Microbiology, Vol. 25, No. 5, May 1973, pp 751-754. Copyright 1973 by the American Society for Microbiology. Reprinted by permission of the copyright owner.)

INDEX TERMS: Inhibition, Inhibitors, Aerobic bacteria, Pathogenic bacteria, Swarming, Proteus, Culture media, Blood agar, p-Nitrophenyl glycerin, Plate counts, Comparative tests, Sodium azide, B-Phenylethanol, Bacterial physiology.

AMIC-8156
"ESTIMATION OF GROWTH RATE FROM MITOTIC INDEX", Chung, K., Nilson, E. H., Case, M. J., Marr, A. G., Hungate, R. E., Applied Microbiology, Vol. 25, No. 5, May 1973, pp 778-780.

The growth rate of a eukaryotic population dividing at a constant rate can be estimated from the equation, t sub m/g ln 2 equals to ln (1 plus R), in which t sub m is the time required for mitosis, g is the generation time, and R is the fraction of cells undergoing mitosis. Values for t sub m and R can be determined by direct microscope examination of the population. The validity of the derived equation has been checked with an exponentially growing culture of a prokaryote, Escherichia coli, in which chloramphenicol was administered to inhibit protein synthesis. Cells having enough protein completed the division process whereas the rest of the population was inhibited. From the plot of the growth curve before and after administration of chloramphenicol, t sub m and R were estimated. The calculated and actual growth rates were almost identical. (Reprinted from Applied Microbiology, Vol. 25, No. 5, May 1973, pp 778-780. Copyright 1973 by the American Society for Microbiology. Reprinted by permission of the copyright owner.)

INDEX TERMS: Growth rates, Cytological studies, Estimating, Microorganisms, E. coli, Growth, Equations, Inhibitors, Mitosis, Data interpretation, Chloramphenicol.

AMIC-8159
"EVALUATION OF POTENTIAL RISK OF BOTULISM FROM SEAFOOD COCKTAILS", Lerke, P., Applied Microbiology, Vol. 25, No. 5, May 1973, pp 807-810.

Freshly cooked and peeled meat of the Pacific Coast crab Cancer magister or the coastal shrimp (Pandalus jordani) was used to determine the risks of botulism from seafood cocktails. The meat was homogenized in a blender with an equal weight of water containing NaCl and sucrose. An equal mixture of citric and acetic acids were used to adjust pH, after which the homogenate was placed in test tubes, autoclaved, and cooled. Tubes of crab meat and shrimp homogenates were inoculated with C. botulinum E in six runs and four runs, respectively, and peroidically tested for toxin. Crab leg muscles were inoculated with about 10,000 spores, placed in sauces of different pH values, stored at 10,24, and 30 C, and periodically tested for toxin. Leg muscles were also tested for acid penetration. Clostridium botulinum E could not be detected in 35 samples of commerical seafood cocktails, ranging in pH from 4.10 to 4.85. At 30 C, toxinogenesis in homogenates acidified with a citric-acetic acid mixture was prevented at pH 4.86 or lower for crabmeat and at 5.03 or lower for shrimp. Measurements of the rate of acid penetration into the centers of large pieces of flesh indicated that the already small risk of botulism from seafood cocktails could be completely eliminated by using a cocktail sauce at a maximum pH of 3.70 and by cooling the final product to at least 10 C for 24 h.

INDEX TERMS: Evaluation, Shellfish, Toxicity, Botulism, Crabs, Shrimp, Hydrogen ion concentrations, Toxins, Anaerobic bacteria, Pathogenic bacteria, Marine bacteria, Temperature, Organic acids, Laboratory tests, Seafood, Clostridium botulinum E, Sample preparation, Cancer magister, Pandalus jordani, Citric acid, Acetic acid.

AMIC-8161
"IDENTIFICATION OF ACTINOMYCES, ARACHNIA, BACTERIONEMA, ROTHIA, AND PROPIONIBACTERIUM SPECIES BY DEFINED IMMUNOFLUORESCENCE", Holmberg, K., Forsum, U., Applied Microbiology, Vol. 25, No. 5, May 1973, pp 834-843.

Fractionated fluorescein-isothiocyanate (FITC)-conjugated immunoglobulin G (dye-to-protein ratio less than 10), produced against whole cells of Actinomyces spp, Arachnia, Bacterionema, Rothia, and Propionibacterium spp, give species-specific conjugates with controlled nonspecific staining reactions when appropriately diluted on the basis of their antibody content (10 mg/ml). Using this standardization in immunofluorescence, serotype-specific conjugates are also available after dilution for all serotypes of these organisms except for Actinomyces viscosus type 2, and Propionibacterium acnes type 1. Adequately adsorbed conjugates could be used to differentiate these serotypes from A. viscosus type 1 and P. acnes type 2, respectively. A serological classification in defined immunofluorescence corresponded to species and serotype designation proposed on the basis of other serological analysis and biochemical characteristics. This includes a separation in immunofluorescence of two serotypes of Propionibacterium acnes. The detection of certain actinomycetes of the family Actinomycetaceae and Propionibacterium species by the defined immunofluorescence in direct smears prepared from clinical specimens agreed to 88 percent with parallel culturing when including a prereduced (PRAC) medium technique for isolation. Qualitative studies revealed that single cells of these organisms could be specifically identified by immunofluorescence when admixed with morphologically similar bacteria and a large number of other contaminants. (Reprinted from Applied Microbiology, Vol. 25, No. 5, May 1973, pp 834-843. Copyright 1973 by the American Society for Microbiology. Reprinted by permission of the copyright owner.)

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INDEX TERMS: Pollutant identification, Pathogenic bacteria, Anaerobic bacteria, Aerobic bacteria, Methodology, Isolation, Actinomycetes, Immunofluorescence, Characterization, Serotypes, Sample preparation, Culturing techniques.

AMIC-8211
"DEEP-SEA MICROORGANISMS: IN SITU RESPONSE TO NUTRIENT ENRICHMENT", Jannasch, H. W., Wirsen, C. O., Science, Vol. 180, No. 4086, May 1973, pp 641-643.

Since microbial conversion of organic substrates was rather retarded when lab cultures and mixed populations of surface-born marine bacteria were incubated in the deep sea, it was assumed that microflora indigenous to the deep water or sediment would respond differently. To check this possibility, a housing for sterilized sample bottles was devised that permitted inoculation directly on the deep-sea floor. A rack holding 20 120-ml bottles was enclosed in a pressure-tight aluminum cylinder. As in earlier experiments, the bottles contained the media in concentrated form in quantities of 1 to 10 ml and were equipped with punctured serum caps for self-inoculation. This sample-housing vessel was attached to the research submarine Alvin. The samples were incubated at 1830 m depth and 4 C. The bottles filled at the incubation site contained 0.1 percent starch, 0.033 percent agar or 0.1 percent gelation. After retrieval and poisoning with $HgCl_2$, starch, agar, and gelatin concentrations were determined. Sterile samples of bond paper, paper towels, balsa wood, beech wood, Ulva thalli were incubated in separate bottles for 51 wk and their decompositon determined. 30,10,5 and 2 micrograms/ml of isotopically-labeled mannitol, sodium acetate, sodium glutamate, and casamino acids were also deposited for 14 wk and the degree of substrate conversion into cell material and CO_2 was measured. Total recovery of labeled material averaged 97 percent. After inoculation of sterile organic materials on the deep-sea floor and in situ incubation for 1 year, relatively minute rates of microbial transformation were recorded. This extremely slow conversion rate, as well as the type and quantity of organic matter normally reaching the ocean floor, appear to characterize microbial life in the deep sea.

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INDEX TERMS: On-site tests, Deep water, Sea water, Marine microorganisms, Microbial degradation, Organic matter, Nutrients, Organic compounds, Methodology, Enrichment, Substrate utilization, Degradation products.

AMIC-8223
"pH AND Eh CONTROL OF CULTURES OF SULPHATE-REDUCING BACTERIA", Brown, E. B., Groves, G. R., Miller, J. D. A., Journal of Applied Chemistry and Biotechnology, Vol. 23, No. 2, February 1973, pp 141-149.

Batch cultures of Desulfovibrio vulgaris, carried out in a 5-litre stirred fermenter, are described. Bacterial counts and sulphide formation are reported for experiments carried out under a selection of controlled Eh and pH conditions. Specific growth and sulphide formation rates are determined and compared. Variations in the growth rates under the different controlled conditions are examined and discussed in terms of product inhibition by sulphide. A relatively high specific rate of exponential growth was observed at Eh equals -150 mV and pH equals 6.95, when sulphide inhibition was believed to be at a minimum.

INDEX TERMS: Sulfur bacteria, Hydrogen ion concentration, Oxidation-reduction potential, Cultural control, Inhibition, Solubility, Sulfides, Growth rates, Variability, Laboratory tests, Batch cultures, Desulfovibrio vulgaris, Culturing vessels.

AMIC-8249
"ISOLATION AND PROPERTIES OF RIBONUCLEASE-DEFICIENT MUTANT OF SALMONELLA TYPHIMURIUM", Wehr, C. T., Journal of Bacteriology, Vol. 114, No. 1, April 1973, pp 96-102.

A mutant of Salmonella typhimurium has been isolated that has less than 5 percent of the ribonuclease activity of the parent strain. Mutant screening and enzyme assays were done in the presence of ethylenediaminetetraacetic acid, a substance that activates ribonuclease I and inhibits other known microbial nucleases. The enzyme may perform a scavenge function in the utilization of exogenous ribonucleic acid. Loss of this enzyme seems to have no detrimental effects on the growth of Salmonella.

INDEX TERMS: Enzymes, Separation techniques, Growth rates, Salmonella typhimurium, Mutants.

AMIC-8415
"MICROBIOLOGY OF WATER", Geldreich, E. E., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1244-1259.

Literature from 1972 concerning microbiological methods for water and wastes is reviewed. Among the topics discussed are culture media, adequacy of methods for detecting fecal pollution, microbiological indicators for mercury, use of microorganisms for tracing water movement, rapid methods for determining bacterial quality of water, and microbiology of rivers, lakes, ponds, reservoirs, potable water, estuaries, and coastal waters as influenced by various types of pollution.

INDEX TERMS: Bioindicators, Bacteria, Water quality, Waste water (pollution), Reviews.

AMIC-8416
"MICROBIOLOGY OF WASTE TREATMENT", Unz, R. F., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1259-1265.

The 1972 literature is reviewed on the identification of microorganisms in wastewaters and their abilities to degrade or remove pollutants and nutrients. Optimum conditions for growth of the organisms are also considered.

INDEX TERMS: Waste water (pollution), Nutrient removal, Microorganisms, Microbial degradation, Pollutant identification, Reviews, Microbiology, Waste treatment, Sewage treatment, Growth rates, Algae, Rotifers, Protozoa, Organic matter, Viruses, Proteins, Carbohydrates, Survival, Inactivation, Enrichment.

AMIC-8417
"MICROBIOLOGY - WATERBORNE OUTBREAKS", Craun, G. R., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1265-1277.

This report gives brief accounts of illnesses resulting from waterborne pathogens as described in the 1972 literature.

INDEX TERMS: Water pollution effects, Potable water, Human diseases, Reviews, Epidemiology.

AMIC-8418
"MICROBIOLOGY-DETECTION OF BACTERIAL PATHOGENS AND THEIR OCCURRENCE", Reasoner, D. J., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1278-1289.

The occurrence of various pathogenic bacteria is discussed along with methods for detecting such organisms.

INDEX TERMS: Pathogenic bacteria, Distribution, Pollutant identification, Water pollution sources, Water pollution effects, Pollutants, Isolation, Methodology, Reviews, Aerobic bacteria, Anaerobic bacteria, Enteric bacteria, Human diseases, Public health, Coliforms, Zoonoses, Domestic wastes, Waste water (pollution), Animal diseases, Epidemiology, Epizootiology, Wildlife, Laboratory animals, Animal wastes (wildlife), Solid wastes, Domestic animals, Industrial wastes, Enumeration, Serotypes, Recovery, Culture media, Culturing techniques, Enrichment, Biological samples, Environmental samples.

AMIC-8419
"MICROBIOLOGY-DETECTION AND OCCURRENCE OF VIRUSES", Berg, G., Journal Water Pollution Control Federation, Vol. 45, No. 6, June 1973, pp 1289-1294.

This literature review is concerned with the occurrence and methods of detecting viruses in polluted water and organisms.

INDEX TERMS: Viruses, Pollutant identification, Shellfish, Methodology, Waste water (pollution), Water pollution, Public health, Distribution, Reviews, Pollutants, Swimming pools, Water wells, Natural streams, Human diseases, Epidemics, Aquatic environment, Estuarine environment, Equipment, Recovery, Marine environment.

AMIC-8541
"MODIFICATIONS OF THE TECHNIQUE FOR DIFFERENTIATING CULTURES ISOLATED BY THE OFFICIAL AOAC SALMONELLA METHOD", Poelma, P. L., Romero, A., Journal of the Association of Official Analytical Chemists, Vol. 56, No. 4, July 1973, pp 1027-1028.

Modifications are suggested for the official AOAC Salmonella method, 41.024-41.040, by which all colonies picked from selective plates are subcultured in both triple sugar and lysine iron agars. The techniques will detect Salmonella and Arizona cultures which might have been discarded. The revisions have been incorporated into the official method.

INDEX TERMS: Salmonella, Pollutant identification, Methodology, Separation techniques, Cultures, Pathogenic bacteria, Aerobic bacteria, Isolation, Coliforms, Culturing techniques, Arizona, Selective media, Culture media.

AMIC-8587
"ESCHERICHIA COLI SEROTYPES IN MICROBIAL POLLUTION OF WATER", Glantz, P. J., Pennsylvania State University, Institute for Research on Land and Water Resources, University Park, Pennsylvania, Research Project Technical Completion Report, Contract No. DI-14-31-0001-3238, February 1973, 24 pp. NTIS Report No. PB-218 710.

Spring Creek (Pennsylvania) and its tributaries, Thompson Run and Slab Cabin Creek, were sampled from October 1970 to March 1971, and analyzed for total and fecal coliforms. On the basis of the results, it appears that microbial pollution has declined in areas where a sewer line has been installed. Pollution continues unabated in areas which receive water polluted at upstream locations. The E. coli serotypes isolated were also compared with those found in humans and animals with respect to pathogenicity. All strains were examined for their O, K, and H antigens.

INDEX TERMS: E. coli, Water pollution sources, Serotyping, Fecal coliforms.

AMIC-8596
"THE METABOLISM OF LONG-CHAIN FATTY ACIDS AND ALCOHOLS BY CANDIDA TROPICALIS AND SACCHAROMYCES CEREVISIAE", Bell, G. H., Antonie van Leeuwenhoek, Vol. 39, No. 1, pp 137-149, 1973.

The factors affecting the growth of Candida tropicalis and Saccharomyces cerevisiae on medium- and long-chain fatty acids and alcohols in batch culture were investigated. Growth on solid acids and alcohols dispersed in the medium is a maximum for tetradecanoic acid and tetradecanol. The poorer growth observed on shorter chain lengths can be ascribed to their toxicity to the yeasts, while the fall off in growth on the higher members is explained by their increasing insolubility in the medium. When the longer-chain-length acids are dissolved in a non-metabolizable hydrocarbon, the growth of C. tropicalis is improved, but that of S. cerevisiae is unaffected. This suggests that acids can enter the cells of the former organism by direct contact with the hydrocarbon droplets. The surface of S. cerevisiae is too hydrophilic for this transfer mechanism to be possible. Fatty acids dissolved in gas oil are utilized as substrates for the growth of Candida tropicalis in competition with the n-paraffins contained in the gas oil. Each fatty acid contributes to a constant proportion of yeast produced, but this proportion decreases as the chain is lengthened. Thus, in mixtures of gas oil with dodecanoic acid, 65 percent of the yeast is produced from metabolism of the acid, while with octadecanoic acid only 15 percent is produced. The log specific rates of utilization of the fatty acids within this range diminish linearly with increaseing chain length.

INDEX TERMS: Metabolism, Yeasts, Alcohols, Growth rates, Fatty acids, Substrate utilization, Batch cultures.

See also: Category 2, AMIC-8270, 8575.

AMIC-6387
"CAREER DEVELOPMENT GUIDE FOR WASTEWATER FACILITY PERSONNEL", Voegtle, J. A., Water Pollution Control Federation Highlights, Vol. 10, No. 7, July 1973, pp D1, D4-D10.

Studies have shown that manpower planning is the basic solution to problems of personnel recruitment, retention, education and training, and certification. The Career Development Guide (CDG) was developed to bring into focus the various interrelated problems of wastewater facility management. The CDG defined jobs, training and educational requirements, job titles, and other aspects of personnel development to provide a basis for uniform certification of personnel.

INDEX TERMS: Quality control, Personnel management, Training, Education, Certification.

AMIC-8446
"ESTIMATING PRECISION FOR THE METHOD OF STANDARD ADDITIONS", Larsen, I. L., Hartmann, N. A., Wagner, J. J., Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1511-1513.

An estimate of the uncertainty term expected in the method of standard additions using linear regression analysis is presented. The method agrees favorably with the standard deviation for values which are not corrected for a blank as well as with the population standard error of difference for corrected samples. Analysis for zinc in an environmental sample yielded a concentration range within the expected value. (Reprinted from Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1511-1513. Copyright 1973 by the American Chemical Society. Reprinted by permission of the copyright owner.)

INDEX TERMS: Estimating, Regression analysis, Zinc, Aqueous solutions, Standard addition technique, Errors, Precision, Orchard leaves, Uncertainty.

AMIC-8494
"ULTRAPURIFICATION OF WATER FOR ELECTROCHEMICAL AND SURFACE CHEMICAL WORK BY CATALYTIC PYRODISTILLATION", Conway, B. E., Angerstein-Kozlowska, H., Sharp, W. B. A., Criddle, E. E., Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1331-1336.

Recently, domestic and industrial water supplies have become contaminated by organic impourities that cannot be removed by ordinary or oxidative distillation because of steam volatility of the impurities of their derivatives. The results of using a pyrocatalytic distillation system for preparation of ultrapure water for electrochemical and surface chemical work are described. Exacting electrochemical and optical criteria are defined for judging and characterizing the purity of water, with respect to organic impurities, especially with regard to their effects at Pt and Hg electrodes. (Reprinted from Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1331-1336. Copyright 1973 by the American Chemical Society. Reprinted by permission of the copyright owner.)

INDEX TERMS: Water purification, Organic matter, Optical properties, Ultrapure water, Catalytic pyrodistillation, Ion selective electrodes.

AMIC-8555
"MACHINE-PLOTTED PROBABILITY CHARTS", Anderson, H. E., Journal of Quality Technology Vol. 5, No. 3, July 1973, pp 135-137.

A computer program is presented which can plot cumulative probability charts. The program assumes that the mean and standard deviation have been calculated and that the sample data have been arranged in ascending order. The maximum sample size is 1000 with the program as presently written.

INDEX TERMS: Data processing, Computer programs, Probability, Statistical methods, Plotting.

See also: Category 3, AMIC-8033.

AMIC-3769
"DESIGN OF USAF WATER QUALITY MONITORING PROGRAMS", Schultz, S. E., U. S. Air Force Academy, Frank J. Seiler Research Laboratory, Colorado, Report Nos. SRL-TR-72-0018, USAFA-TR-72-06, August 15, 1972, 195 pp. NTIS Report No. AD-756 504.

The Air Force has been directed to establish and implement programs to insure that its activities are conducted in a way to protect and enhance environmental quality. The key to effective Air Force management of water pollution abatement practices is water quality monitoring programs which can assess water quality for compliance with applicable standards of quality and detect emerging water quality problems in time that corrective action can be taken before they become critical. This effort has elucidated the significant parameters and framework for the design of water quality monitoring programs Air Force wide. The analysis framework together with the supporting descriptive design criteria comprises an integrated analysis in that all pertinent considerations inherent to the establishment of a water quality monitoring system at any Air Force installation are sequentially evaluated. The general analysis and design factors were then applied in their relevant importance to the establishment of a water quality monitoring program at the U. S. Air Force Academy as an example of how such programs should be developed for the Air Force. The Academy program is presented in detail including: objectives of the program; parameters measured; locations of monitoring stations; sample collection system; analytical measurements; and data transmission, handling and dissemination. All water quality data are permanently stored, statistically analyzed and instantly available by means of the STORET System.

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INDEX TERMS: Water quality, Monitoring, Water quality control, Project purposes, Project planning, Design, Water quality standards, Water pollution control, Water pollution, Water sampling, Water properties, Analytical techniques, Data transmission, Data processing, Data storage and retrieval, Waste water (pollution), Waste identification, Automatic control, Methodology, Water pollution sources, Chemical analysis, Water utilization, Instrumentation, Costs, Water analysis, Pollutant identification, Laboratory tests, On-site tests, On-site data collections, Data interpretation, Sample preservation, Sampling frequency, Sampling equipment, Water chemistry.

AMIC-6895
"A SIMPLE, OFF-LINE MASS SPECTRA DIGITIZER", Leferink, J. G., Leclercq, P. A., Analytical Chemistry, Vol. 45, No. 3, March 1973, pp 625-626.

An apparatus has been designed which reduces the time involved in manually measuring, writing, and punching data from a spectral chart to a simple, one-step action. The set-up described consists mainly of standard instruments to be found in an analytical laboratory. Paper tape is used as preferred over magnetic tape and cards, from a viewpoint of reliability and economics. Discussed are algorithms which assign the data obtained with this system to different arrays. By using the equipment described a saving of 70 percent in time can be achieved easily over manual methods for digitizing and punching mass spectral data. Because of the general design, the system is very versatile. The instruction-set can be changed and extended; only the software has to be adapted. If a card puncher is available, it can be substituted for the paper tape puncher.

INDEX TERMS: Data transmisson, Laboratory equipment, Fabrication, Automatic control, Data collections, Instrumentation, Mass spectra, Mass spectra digitizer, Algorithms.

AMIC-7883
"DISC STORAGE FOR MINICOMPUTER APPLICATIONS", Davis, S., Computer Design, Vol. 12, No. 6, June 1973, pp 55-64.

Basic descriptions are given of disc drives, design tradeoffs, and performance and environmental limitations as well as a state-of-the-art review of recent minidisc offerings to assist computer systems engineers in choosing and using modern disc drives as expanded minicomputer storage.

INDEX TERMS: Design, Digital computers, Minicomputers, Disk drives, Reliability, Maintenance.

AMIC-7884
"PREDICTING CROSSTALK IN DIGITAL SYSTEMS", DeFalco, J. A., Computer Design, Vol. 12, No. 6, June 1973, pp 69-75.

Crosstalk, or coupling between transmission lines, is becoming an important factor in digital system design because of high transmission speeds. An engineering discussion of crosstalk is presented in terms of both its physical and mathematical developments under systems conditions. Equations are derived for predicting crosstalk, and curves of basic constants and a table of general waveforms enable the designer to rapidly quantify crosstalk in specific systems.

INDEX TERMS: *Equations, Digital computers, Data transmission.

AMIC-7954
"INFLUENCE OF ABSORPTION COEFFICIENT ON REFLECTANCE OF WATER", Look, D. C., Crosbie, A. L., Armaly, B. F., Nelson, H. F., Journal Water Pollution Control Federation, Vol. 45, No. 5, May 1973, pp 936-939.

To determine one effect that an absorption coefficient, represented by the imaginary portion of the index of refraction, has on reflectance, the computed reflectance for the real values of the index of refraction was compared with the value of index of fraction equal to zero. The values of the imaginary portion of the index of refraction less than 0.02 have no effect on the reflectance from a water surface. It therefore can be assumed in computing reflectance that, except for the X absorption bands in the near infrared and all of the far infrared, water is a perfect nonconductor.

INDEX TERMS: Reflectance, Remote sensing, Absorption, Light.

AMIC-8198
"NEW METHOD FOR EVALUATION OF DISSOLVED OXYGEN PROBE RESPONSE FOR K SUB L a DETERMINATION", Wernau, W. C., Wilke, C. R., Biotechnology and Bioengineering, Vol. 15, No. 3, May 1973, pp 571-578.

Previously adopted methods for the measurement of the volumetric liquid phase mass transfer coefficient, K sub L a, in various liquid systems using dissolved oxygen probes have been problematic. The problems ranged from inability to define time in reference to step changes to the necessity of having very thin, highly permeable membranes in order to get accurate results. In order to alleviate such problems, a new method (the slope method) for finding K sub L a based on the transient response of dissolved oxygen probes was devised. Since the origin of time (time of the step change) is so poorly defined in actual experimental situations, measurement of the slope of the response curve (d(Et/Eo)/dt) would appear to be dependent upon the accurate estimation of the time of the step change. This problem is alleviated by taking the slope at its maximum value. This procedure is illustrated diagramatically. This method is independent of the time of the step change and is applicable for slow probes at K sub L a values from approximately 20/hr to values in excess of 500/hr. The method is least accurate at high K sub L a values, where the sensitivity of the slope to beta is considerably reduced. It is recommended that the method of Linek be used at K sub L a values below 20/hr and that faster probes than that used in this study be employed for K sub L a values above 500/hr.

INDEX TERMS: Evaluation, Methodology, Laboratory equipment, Automation, Equations, Permselective membranes, Dissolved oxygen, Resistance, Instrumentation, Mass transfer coefficients, Volumetric liquid phase, Dissolved oxygen probes, Slope method, Response time, Slope (mathematics), Accuracy.

AMIC-8203
"LAB AUTOMATION AT LOW COST", Glover, D., Research/Development, Vol. 24, No. 5, May 1973, pp 22-25.

This discussion covers those factors that must be considered in choosing a low cost laboratory computer system. Such a system may be either (1) a small system which is expandable to a medium size system or into a satellite interfaced to a large central system, as the lab requirements expand, or (2) a full-blown, time-shared system. This, of course, depends on the need of the laboratory, funding and the resources it commands. Those common elements that exist in the instrumentation in the laboratory should be considered in choosing from the variety of approaches available. The approach obviously depends on the desired end result and the decision as to how it should be attained. Computer output, data storage, and resolution enhancement are also very important considerations.

INDEX TERMS: Laboratory equipment, Costs, Automation, Computers, Instrumentation, Data storage and retrieval, Data transmission, Flexibility, Computer design, Interfaces.

AMIC-8335
"INVESTIGATION OF LAKE WATER QUALITY IN EASTERN SOUTH DAKOTA WITH REMOTE SENSING TECHNIQUES", Tipton, M. J., Schmer, F. A., Schmulbach, J. C., et al., South Dakota State University, Remote Sensing Institute, Brookings, South Dakota, Research Project Technical Completion Report, Contract No. 14-01-001-3332, December 1972, 131 pp. NTIS Report No. PB-215 156.

This study was directed toward hydrological research with special emphasis on geology and its relationship to lake water quality. The applicability of remote sensing techniques for the evaluation and monitoring of lake water quality and as an aid for geological mapping was investigated. Thirteen lakes and their surrounding area approximately 16 km (10 mi) square in northeastern South Dakota were selected for the study. Photographic and thermal remote sensing imagery aided in the interpretation of chemical, geological, and biological features and events, but water quality-imagery correlations were largely unsuccessful. The majority of the lakes may be considered magnesium sulfate lakes with sodium becoming the more dominant cation in the more senescent lakes. Poor aquifer flushing resulted in an accumulation of total dissolved solids in the ground water. The ground water averaged 2153 mg/liter total dissolved solids with an accumulation of sulfate which averaged 40 percent of the total dissolved solids by weight. With the exception of Grass Lake, the study lakes all occupy closed depressions with little or no ground-water movement between, and exist in various stages of senescence depending upon local climatic and edaphic conditions. All lakes except Grass Lake are also similar in chemical composition with sulfate again the dominant ion averaging between 63 percent and 70 percent by weight of the dissolved solids. Evaporation appears to be the principle cause of water loss and consequent

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mineralization. Medicine Lake is a permanetly stratified lake with a total dissolved solids concentration increasing from about an average of 5 percent to 17 percent with depth. In a narrow zone at a depth of 3.2 - 3.7 meters, intense photobacterial activity existed during the icefree season. This bacterial plate was found at 4.3 meters in the late fall and winter. Surface water carbon-fixation rates usually were below 25 mg C/cu m day, but an early July rate of 200 mg C/cu m/day was recorded. Bluegreen algal production in the upper-chemocline resulted in rates in excess of 300 mg C/cu m/day. Photobacterial production rates between 1000 - 2000 mg C/cu m/day were common in the summer months with the photobacteria accounting for approximately 43 percent of the recorded pelagic production. Total summer sq meter pelagic production rates were below 700 mg C/cu m/day which would put Medicine Lake in the mesotrophic lake category. However, Chara production rates were not assessed, and had the rates of these littoral producers been averaged with the pelagic production rates, a higher estimate of productivity and lake trophy may have resulted.

INDEX TERMS: Remote sensing, Water quality, Methodology, Biological properties, Chemical properties, Geology, Physical properties, Saline lakes, Aerial photography, Monitoring, Evaluation, Mesotrophy, Chemical analysis, Water analysis, Water chemistry, Primary productivity, Thermal stratification, Secondary productivity, Chemical stratification, Medicine Lake, Multispectral sensing system, Data interpretation, Thermal infrared imagery, Autotrophic bacteria.

AMIC-8466
"ROLE OF SOLVENT EXTRACTION PARAMETERS IN GOVERNING THE POTENTIAL SELECTIVITY OF LIQUID MEMBRANE ELECTRODES", Back, S., Sandblom, J., Analytical Chemistry, Vol. 45, No. 9, August 1973, pp 1680-1684.

The relationship between solvent extraction parameters and the potential selectivity of liquid membranes has been examined. An expression for the electrode potential has been derived containing measurable solvent extraction parameters. This expression is used to compare the potential selectivity of a liquid membrane-consisting of tetraalkylammonium salts dissolved in methylene chloride-with the solvent extraction properties of the same system. The potential selectivity constant is related to the extraction constant by a square root dependence which is interpreted in terms of surface diffusion phenomena. The pH-dependence of the electrode potential in the presence of weak acids as well as the role of solvent is also examined. It is concluded that extraction processes determine the potential selectivity of liquid membranes if the extraction constants are sufficiently large and if the solvent favors the counter ions. (Reprinted from Analytical Chemistry, Vol. 45, No. 9, August 1973, pp 1680-1684. Copyright 1973 by the American Chemical Society. Reprinted by permission of the copyright owner.)

INDEX TERMS: Selectivity, Solvent extractions, Zeta potential, Properties, Hydrogen ion concentration, Acids, Equations, Mathematical studies, Electrical properties, Membrane electrodes, Liquid membranes, Extraction coefficients, Organic solvents, Ion selective electrodes.

AMIC-8492
"PREPARATION AND PROPERTIES OF THE SULFATE ION SELECTIVE MEMBRANE ELECTRODE", Mohan, M. S., Rechnitz, G. A., Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1323-1326.

Detailed information is provides concerning the construction of sulfate selective membrane electrodes in terms of composition, membrane preparation, and electrode assembly. Special attention is given to the effect of surface treatment on electrode response and to the attainment of optimum response characteristics by conditioning. The effect of other ions on sulfate response is evaluated. (Reprinted from Analytical Chemistry, Vol. 45, No. 8, July 1973, pp 1323-1326. Copyright 1973 by the American Chemical Society. Reprinted by permission of the copyright owner.)

INDEX TERMS: Fabrication, Properties, Sulfates, Anions, Electrical properties, Construction, Selectivity, Nitrates, Chlorides, Bromides, Iodides, Sulfites, Hydrogen ion concentration, Physical properties, Ion selective electrodes, Membrane electrodes, Sulfate electrodes, Chemical composition, Ionic interference, Perchlorates, Orthophosphates, Sensitivity, Response time, Selectivity coefficients.

AMIC-8543
"OIL SPILLS: MEASUREMENTS OF THEIR DISTRIBUTIONS AND VOLUMES BY MULTIFREQUENCY MICROWAVE RADIOMETRY", Hollinger, J. P., Mennella, R. A., Science, Vol. 181, No. 4094, July 6, 1973, pp 54-56.

A series of eight controlled oil spills was investigated over a 1-yr period to determine if it were possible to measure oil slick thickness with passive microwave radiometry. The spills were 200-630 gallons of either No. 2 fuel oil or No. 4 or No. 6 crude oil, carried out according to EPA guidelines for oil discharges for research purposes. Relatgy calm sea conditions (swells less than 2 m and surface winds less than 10 m/sec) were chosen. Aircraft-borne multifrequency passive microwave observations of the eight marine oil spills revealed that, in all cases, over 90 percent of the oil was confined in a compact region comprising less than 10 percent of the area of the visible slick. These measurements show that microwave radiometry offers a means for measuring the distribution of oil in sea-surface slicks; for locating the thick regions; and for measuring their volumes on an all-weather, day or night, and real-time basis.

INDEX TERMS: Oil spills, Measurement, Distribution, Volume, Sea water, Methodology, Pollutant identification, Aerial photography, Dimensions, Width, Size, Oil pollution, Multifrequency microwave radiometry, Passive microwave radiometry, Marine environment, Color photography, No. 2 fuel oil, No. 4 crude oil, No. 6 crude oil.

AMIC-8563
"THERMAL REMOTE SENSING ON THE MISSISSIPPI RIVER IN IOWA", Tuthill, S. J., Taranik, J. V., Hoyer, B. E., In: Water-1972, AIChE Symposium Series No. 129, Vol. 69, 1973, pp 391-400.

On 4 June, 1971, the Iowa Conservation Commission, Commonwealth Edison, and the Iowa Geological Survey studied the surface temperature distribution of the Mississippi River bordering Iowa. Airborne thermal mapping data was collected along a 180-mile length of river concurrent with surface measurements at 13 preselected areas. Density slicing the thermal imagery provided a method for generating an isothermal map. Results indicate further refinement of thermal mapping techniques could rapidly produce accurate thermal maps for complete river systems.

INDEX TERMS: Water temperature, Remote sensing, Mississippi River, River systems, Surface waters, Automation, Thermal pollution, Telemetry, Aerial photography, Water pollution effects, Thermal mapping, Thermal infrared imagery, Accuracy, Isothermal maps, Isodensitracing.

AMIC-8566
"SOME INSTRUMENTS AVAILABLE NOT FOR THE MEASUREMENT OF WASTEWATER PARAMETERS", Brown, D. L., In: Water-1972, AIChE Symposium Series No. 129, Vol. 69, 1973, pp 585-588.

A brief summary as well as a student review and critique is given of the instruments presently available for measuring wastewater parameters. These instruments include the following: dissolved oxygen analyzer, multi-parameter water quality monitor, total carbon analyzer, organic carbon analyzer, total oxygen demand analyzer, an on-line, automatic titrator, and an instrument for measuring carbon dioxide demand.

INDEX TERMS: Instrumentation, Monitoring, On-site data collections, Waste water (pollution), Laboratory tests, Water properties, Measurement, Water quality, Chemical analysis, Automatic control, Pollutant identification, Operations, On-line measurement.

AMIC-8568
"PRACTICAL EXPERIENCE OF THE WATER RESOURCES DIVISION IN THE USE OF MULTIPARAMETER ELECTRONIC RECORDERS AND AUTOMATED TECHNIQUES FOR MONITORING WATER QUALITY IN STREAMS", Pickering, R. J., In: Water-1972, AIChE Symposium Series No. 129, Vol. 69, 1973, pp 603-606.

The stream monitoring practices of the U. S. Geological Survey are reported along with the difficulties experienced in using field monitoring equipment. The parameters measured are as follows: specific conductance, temperature, dissolved oxygen, pH, turbidity, ammonia, nitrate, nitrite, and hydrolyzable phosphates. The first five parameters are electronically monitored; the last four are monitored by wet chemistry techniques. A bubbler method is used for stream flow measurements. The wet chemistry analyzers require the most attention. Telemetering of data involves the collection of measurements taken at several sampling sites. The recorders are digital to make telemetering simpler. Perhaps in the future such data can be collected and transmitted by satellite to a centrally located ground acquisitioning site for computer management.

INDEX TERMS: Monitoring, Water quality, Automation, Electronic equipment, Water analysis, Data transmission, Methodology, Data collections, Water properties, Recorders.

See also: Category 1, AMIC-8343, 8569
Category 2, AMIC-8087.