

Selected Summaries of

WATER RESEARCH

Research and Development

Robert A. Taft Water Research Center, Cincinnati, Ohio

MAY 1970

ARTIFICIAL DESTRATIFICATION IN IMPOUNDMENTS (W69-16)

Recently, much attention has been given to the influence of thermal stratification on water quality in reservoirs and the possible improvement of reservoir water quality by artificial destratification. During the past several years, the authors have investigated water quality in three northern Kentucky fishing lakes to determine the effectiveness of controlling water quality by artificial destratification.

The purpose of this paper is to show the phytoplankton populations that existed during destratification. Enumerations of plankters were made of total and generic groups existing before and after mixing. These data were compared to physical and chemical data collected at the same time, to determine if the plankton populations were modified by chemical and physical conditions. Finally, the results of both years' studies were compared to determine any similarities or differences.

Robinson, E. L., Irwin, W. H., and Symons, J. M., "Influence of Artificial Destratification on Plankton Populations in Impoundments," *Transactions of the Kentucky Academy of Science*, 29, Nos. 1-2, 1-8, 1968.

FECAL STREPTOCOCCI IN STREAM POLLUTION (W69-17)

Occurrence of fecal streptococci is used increasingly as one bacteriological measurement of stream pollution. Yet the true sanitary significance of fecal streptococci has been confused somewhat by controversies concerning procedures for quantitation, definition of the group, and differing concepts as to their occurrence in the water environment and in warm-blooded animal fecal discharges.

Renewed interest in the streptococcal group as a pollution indicator followed application of the KF Streptococcus agar used with a pour plate procedure giving the bacteriologist a choice of direct enumeration methods.

With the development of KF Streptococcus agar for fecal streptococcus determinations, a long-term research program was initiated to evaluate this bacterial indicator system in stream pollution studies.

Geldreich, E. E. and Kenner, B. A., "Concepts of Fecal Streptococci in Stream Pollution," *Journal Water Pollution Control Federation*, 41, No. 8, Part 2, R336-R352, 1969.

COLLOIDS IN TREATMENT PROCESSES (W69-18)

A discussion of the colloidal matter derived from the microbial organisms which remains in effluents from biological treatment plants. This biological treatment usually is called secondary treatment because many large plants precede it by primary settling and skimming. The microorganisms may be used in a homogeneous aerated reactor, as in the activated sludge process, or they may be attached to surfaces in a heterogeneous reactor called a trickling or biological filter. A trickling filter has large pores (2-5 cm.), and removes particulate matter by adsorption rather than by straining. Most experimental work has been done with activated sludge; however, the effluents from trickling filters are qualitatively similar. Flocculants, bacteria, slimes, and application of filtration, electrodialysis and other separation processes are discussed.

Dean, R. B., "Colloids Complicate Treatment Processes," *Environmental Science & Technology*, 3, No. 9, 820-824, 1969.

SULFIDE DETECTOR (W69-19)

The presence of sulfides is a positive indication of poor water quality; the compounds affect water uses by their objectionable odor, by their toxicity to aquatic life, and by corrosion of metal and concrete structures.

The toxicity of hydrogen sulfide to aquatic life has been reported at widely ranging values.

Corrosion of metallic and concrete structures by sulfides is important and costly. Oxidation of sulfides produces sulfuric acid that will attack concrete.

Sulfide is one of the very few naturally occurring ions that reacts chemically with silver. The resulting silver sulfide, Ag_2S , is the only naturally occurring black inorganic silver compound.

The silver-sulfide reaction also occurs in the aquatic environment. Results of placing 10-cent pieces (an alloy of 90-percent silver and 10-percent copper) in the Pigeon River in North Carolina and Tennessee are reported.

Keup, L. E. and Ballinger, D. G., "A Ten-Cent Sulfide Detector," *Journal Water Pollution Control Federation*, 41, No. 8, Part 1, 1533-1535, 1969.

TRACE METALS IN WATERS OF THE UNITED STATES (W69-21)

A five-year summary of the FWQA's Water Quality Surveillance Program. Highlights of the report:

- a. Information on changes in water quality at key points in river systems, as it relates to the implementation of water quality standards.
- b. Basic data on chemical, physical and biological water quality which may be used to establish water quality baselines and determine trends.
- c. Data which are useful in the development and operation of comprehensive water resource management programs.

Adequate water quality surveillance is essential in order to quickly identify compliance with water quality standards, to document violations for corrective actions and to identify new pollution trends, sources and types before problems develop.

In general, sampling points are in the vicinity of:

- a. people and/or animal concentrations;
- b. industrial activity including agricultural and heat emission sources;
- c. recreational use areas;
- d. state and national boundaries; and
- e. potential problem areas.

Some 50 sampling stations were established when the program started, October 1, 1957. The number has now grown to over 130.

Kopp, J. F. and Kroner, R. C., "Trace Metals in Waters of the United States—A Five Year Summary of Trace Metals in Rivers and Lakes of the United States (Oct. 1, 1962-Sept. 30, 1967)," FWPCA, U.S. Department of the Interior, Cincinnati, Ohio.

PHOSPHORUS REMOVAL (W69-22)

This report concerns the addition of sodium aluminate directly on the filter media through the dosing siphon. The precipitation of insoluble aluminum phosphate, therefore, takes place on the filter media surface. This is analogous to processes for phosphorus removal in activated sludge plants which dose the aeration sludge directly with soluble metallic compounds.

Because of the difficulties in making a realistic scale model of a trickling filter, this investigation was carried out on one of the full-scale trickling filters of the Fairborn, Ohio, wastewater treatment plant.

The objectives of the study were to determine the efficiency of phosphorus removal by this method, to observe any changes in the biological film, and to note any physical effects such as ponding or excessive sloughing of the filter.

Barth, E. F., Jackson, B. N., Lewis, R. F., and Brenner, R. C., "Phosphorus Removal From Wastewater by Direct Dosing of Aluminate to a Trickling Filter," *Journal Water Pollution Control Federation*, 41, No. 11, Part 1, 1932-1942, 1969.

DIAGNOSES OF MORTALITY OF FISH (W69-23)

Catfish, *Ictalurus nebulosus* (Le Sueur), were exposed to various concentrations of technical grade parathion dissolved in water for time periods of up to 30 days. Analyses of the blood revealed that the concentration of parathion in the blood and in the water is closely related, and can be used to predict death due to acute toxicity. Several methods of chemical analyses, including infrared spectra, demonstrate that the material is unaltered parathion and not paraoxon. The presence of unaltered parathion in the blood suggests that the metabolism of parathion in cold-blooded vertebrates, such as fish, should be studied further to determine if there is a significant accumulation in such animals.

Mount, D. I. and Boyle, H. W., "Parathion—Use of Blood Concentration to Diagnose Mortality of Fish," *Environmental Science & Technology*, 3, No. 11, 1183-1185, 1969.

ULTIMATE DISPOSAL OF WASTEWATER (W69-24)

Not until 1967 was a formal program of ultimate disposal established, and recognition given to the fact that different wastes required different types of ultimate disposal.

A careful examination of the environment shows seven possibilities for disposal. These are, in order: outer space, atmosphere, freshwater, saltwater, land surface, underground, reuse.

Disposal in outer space is repeatedly mentioned and not always facetiously in this day of lunar exploration. The author contends that this is by far the most expensive and least efficient method of ultimate disposal. If we could shoot wastes into the sun, they would presumably be burned up, and even highly toxic radioactive wastes would be safe against the background of radioactivity in the sun. Even here it is hard to conceive of a waste that could not be taken care of at lower cost in some other way.

The author continues in this vein to illustrate the importance and difficulty of ultimate disposal, then suggests more immediate solutions by describing successful disposal methods by various industries. Water reuse is emphasized.

Dean, R. B., "Ultimate Disposal of Waste Water: A Philosophical View," *Chemical Engineering Progress Symposium Series*, 65, No. 97, 1-4, 1969.

ALGAL RECORDS FOR STABILIZATION PONDS (W69-25)

Algal identifications have been recorded from 376 samples collected from three Indiana sewage stabilization ponds during a period from May 1962 to August 1968. Although certain genera were found frequently in all three ponds, each pond had a distinctive algal flora. Green algae were invariably the most abundant of the algal groups present.

However, flagellates were also prominent. Of a total of 64 genera of the most significant and abundant algae there were 29 green algae, 19 flagellates, 10 blue-green algae, and 6 diatoms. Some genera were limited to the summer season, while others were most prominent in spring and fall or in the winter. The pollution-tolerant algae *Euglena* and *Nitzschia* were abundant and persistent in all three ponds.

Palmer, C. M., "Algal Records for Three Indiana Sewage Stabilization Ponds," *Proceedings of the Indiana Academy of Science for 1968*, 78, 139-145, 1969.

PRESSURE FILTRATION (W69-27)

A pressure filtration system can be an effective tool for the clarification of wastewaters. With good quality secondary effluent and low suspended solids, the process can compete favorably with other methods such as conventional flocculation, sedimentation, and filtration or diatomaceous earth filtration. Until wastewater character is better understood, however, this type of filtration may encounter the problems of variable polyelectrolyte dosages, mudballing, poor product quality, or unusually short runs. Any of these conditions, which can result in an uneconomical percentage of product water necessary for backwash, makes it difficult for this process to compete with those that produce water for less than 8 cents per 1000 gal.

Berg, E. L. and Brunner, C. A., "Pressure Filtration of Secondary Treatment Plant Effluent," *Water and Wastes Engineering*, 6, No. 10, 54-58, 1969.

LIME CLARIFICATION, RECOVERY AND REUSE (W69-28)

Lime treatment of secondary effluents to remove phosphates produces a sludge which can be recovered and reused for its lime content. Lime reuse does not affect removal efficiencies and substantially increases filter cake yield rates.

Secondary effluent characteristics profoundly affect system performance and lime sludge characteristics. Generally, a sludge produced from a mineralized, alkaline water with a low magnesium hydroxide to calcium carbonate ratio will exhibit superior thickening and dewatering characteristics. Lime recoveries depend on the wastewater's calcium, alkalinity, and phosphorus concentration, and the re-carbonation pH.

Mulbarger, M. C., Grossman, E. III, Dean, R. B., and Grant, O. L., "Lime Clarification, Recovery, Reuse, and Sludge Dewatering Characteristics," *Journal Water Pollution Control Federation*, 41, No. 12, 2070-2085, 1969.

CHARACTERIZATION OF (LPP-2) BLUE-GREEN VIRUSES (W69-29)

Viruses infecting the blue-green alga *Plectonema boryanum* are common constituents of waste stabilization ponds distributed throughout the United States. Although all the viruses isolated on *Plectonema* have the same host range and requirement for Mg^{2+} as the archetype LPP-1, a number of new isolates are not neutralized by LPP-1 antiserum.

The authors show that the isolates not neutralized by LPP-1 antiserum are all members of a second serologically distinguishable class, termed LPP-2. Several members of this class were examined in the electron microscope and found to be morphologically similar to LPP-1.

Safferman, R. S., Morris, M. E., Sherman, L. A., and Haselkorn, R., "Serological and Electron Microscopic Characterization of a New Group of Blue-Green Algal Viruses (LPP-2)," *Virology*, 30, No. 4, 775-780, December 1969.

TASTE AND ODOR RESEARCH (W70-2)

Taste, as a specific sensory process, is rarely a problem in water supply. It is an aspect which has caused very little concern.

On the other hand, three classes of odors are discussed:

1. Sensory methods for the measurement, description, and recognition of odors.
2. Chemistry of odorous contaminants in water—identification and correlation with odor problems.
3. Odor treatment research, which makes use of identification and analyses of specific odorants to guide treatment methods.

New precise methods being developed for identifying odors are discussed.

Rosen, A. A., et al., "Committee Report: Research on Tastes and Odors," *Journal American Water Works Association*, 62, No. 1, 59-62, 1970.

FWQA

In April 1970, President Nixon signed the "Water Quality Improvement Act of 1970," which changed the name of the Federal Water Pollution Control Administration (FWPCA) to the Federal Water Quality Administration (FWQA).

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