NEW DIMENSIONS IN WATER POLLUTION RESEARCH

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A MAJOR research effort, which is now known as the advanced waste treatment research program of the Public Health Service, has been underway for the past 2 years at the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.

Because of this country's enormous population growth and industrial expansion, there is need for waste treatment procedures that go beyond any current methods. This is particularly true in view of the new types of wastes caused by modern industrial processes.

Today's methods of treating wastes rely on the metabolic activity of micro-organisms for the destruction of organic substances. This biological treatment does not efficiently remove many chemical compounds which may get through treatment plants and persist indefinitely in receiving water. These chemicals can manifest themselves by killing fish, by tainting the flesh of fish without killing them, by producing objectionable tastes and odors in drinking water, or by producing foam in receiving water.

Even the problem of identifying the myriad pollutants that may appear in water supplies is formidable. Studies made at the Sanitary Engineering Center have revealed that new and unusual contaminants are appearing in drinking water. Among these compounds are DDT, o-nitrochlorobenzene, pyridine, detergents, diphenyl ether, kerosene, nitriles, and a variety of substituted benzenes. The concentrations of such materials in drinking water are usually low, but they cannot be considered insignificant.

Two important objectives must be achieved if the concept of advanced waste treatment is to be feasible. First, it will be necessary to concentrate impurities into volumes small enough to be economically and ultimately disposed of, and second, to produce water of a quality suitable for re-use.

The concentrated wastes removed by advanced waste treatment processes cannot, of course, be discarded back into surface waters. If this were done, pollution problems would not be diminished and downstream water users would have to remove those same contaminants again and again. The order of concentration of wastes must be very high indeed, perhaps 1,000-fold or even more, to permit their permanent disposal.

A number of approaches to this end are now under study. Perhaps useful products can be recovered from wastes, or organic matter may be turned into a fuel, or it may be that wastes will have to be pumped underground. Much research will be required to determine what ultimate disposal methods will work.

When contaminants are separated from water at high efficiency, the water produced will be of high quality. It is possible, therefore, that the development of successful advanced waste treatment processes will lead at one step to the alleviation of both water pollution and water supply problems.

The advanced waste treatment program, both in intramural research and through outside contracts, is focusing its attention on physical-chemical separation principles, among which are adsorption, evaporation, foaming, freezing, and oxidation.

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Adsorption. The use of activated carbon to separate adsorbable material from liquids is as old as industrial technology. Because of the vast supply of literature available on activated carbon, including its use in capturing trace organics in water, there is strong justification to exploit this process as a method of advanced waste treatment. However, the cost of activated carbon will clearly limit its use in waste treatment unless a method is developed for economical reactivation of carbon to permit re-use. The Public Health Service is currently supporting research on reactivating carbon by oxidants and by heat.

Both the phenomenon and mechanism of adsorption represent a research area of profound interest. While activated carbon has recognized value as an adsorbent, other materials may have unique charactertistics for the separation of particular impurities. Conceivably, a wide spectrum of versatile adsorbents will ultimately be available to treat waste waters.

Evaporation. Recent progress in lowering the cost of evaporation suggests that this process may be useful in waste treatment. An analysis made for the Public Health Service by Dr. J. A. Gerster of the University of Delaware indicated that when waste heat is available, as from steam powerplants, multiple-effects or multistage flash distillation of a stabilized sewage effluent may produce distilled water at less than 30 cents per 1,000 gallons. The cost will be about 10 cents more per 1,000 gallons if waste heat is not available.

A parallel study conducted by Dr. K. C. D. Hickman, technical director of Aquastills, Inc., Rochester, N.Y., concluded: "It is probable that a reclaim plant can be designed now to operate within an overall cost of $1 per 1,000 gallons. This will include all present sewage collection costs and drying down and disposal of residue." Dr. Hickman stated further: "With orderly improvements and without miraculous breakthroughs costs can be reduced by at least a factor of 2 and possibly by 4 or 5." He described the product of a sewage effluent distillation as: "The physical properties, flavor and odor of the distillate were excellent. With mild chlorination or equivalent the distillate would be potable and acceptable for municipal re-use."

Double advantages may be derived from use of excess powerplant heat in advanced waste treatment. In addition to benefiting the waste treatment process, the already important problem of thermal pollution would be reduced by the cooling of powerplant effluents in the process. It has been conservatively estimated that growth of the electrical requirements in the United States in the next 40 years will produce a sixfold increase in the amount of heat to be rejected to rivers (*1*).

Foaming. Separation of soluble organic pollutants by foaming promises to provide fruitful research opportunities in advanced waste treatment. Foaming is a common step in concentration systems in industry. Our own interest in foaming originated in studies of synthetic detergents, which are among the most persistent of the newer pollutants.

It is remarkable that an effective method has not yet been devised for removal of detergents, since these contaminants literally force themselves on our attention by concentrating in bubbles and floating on top of the waste water. The practice has been to collapse the foam by spray or other means, thus keeping the surface active ingredient in the sewage where it does not really belong. Some progress in detergent removal has been made by workers at the University of California (*2*) and in Germany (*3*). However, very little work has been done on the fundamental principles involved in the application of the foaming technique to waste treatment.

Freezing. The worldwide interest in the application of freezing in desalination warrants an evaluation of this process for separation of soluble organic impurities.

Oxidation. The removal of persistent organic contaminants would be simplified if oxidation processes could be developed to convert them directly to carbon dioxide and water. Since chlorination as applied at the sewage treatment plant does not carry oxidation far enough, it is possible that larger doses or that other oxidants would be more effective. Among the oxidants of interest are ozone, chlorine, chlorine dioxide, peroxide, and such exotic oxidants as the peroxy compounds now emerging from industrial laboratories.

Additional physical-chemical separation pro-

cedures now being studied include the use of special ion-exchange resins. The feasibility of using solvent extraction is being examined, and we are even considering electrolysis of waste water with the recombination of hydrogen and oxygen in a fuel cell to produce pure water and byproduct electricity.

The measure of success in waste treatment is one of economics. Our goals can be reached today, but at completely unreasonable costs. It will be necessary to develop the technology which will enable us to reach these goals at the very lowest possible costs. However, future, not current, economics must be the yardstick by which to assess the potential for new, unconventional techniques for waste treatment. The history of technical development offers many examples of costly processes which have been brought to practical application.

REFERENCES

(1) Berger, B. B.: Does production of power pollute our rivers? Power Engr. 65: 60 (1961).

(2) McGauhey, P. H., and Klein, S. A.: Removal of ABS by sewage treatment. Sewage & Indust. Wastes 31: 877 (1959).

(3) Klotter, H. E.: Zum problem der beseitigung von detergentien aus abwasser durch entschaumung. Third International Congress for Surface Active Materials, sec. C, subgroup C/V, vol. 3, No. 48, pp. 302–314.

Task Force Reports on Syphilis Control

Specific measures directed toward the elimination of syphilis as a public health hazard in this country are outlined in the report of the special task force on syphilis control appointed last year by Surgeon General Luther L. Terry of the Public Health Service.

In its report, the task force pointed out that almost 19,000 persons contracted infectious syphilis during fiscal year 1961, the highest number since 1950. The group is "particularly disturbed" by:

1. Evidence of a chain reaction in the spread of syphilis infection, especially among teenagers.

2. Evidence that the actual number of cases occurring far outnumbers the cases reported.

3. Evidence that effective techniques of control and therapy to stop the spread of syphilis are available but are not being applied widely enough.

4. Evidence that unless a vigorous, stepped-up program is begun now, the current increased spread of syphilis may become accelerated.

The report went on to state that, despite such disturbing evidence, "It is the consensus of the task force that the rising trend of infectious syphilis can be reversed through intensification and further improvement of the casefinding process, through quicker access to, and use of, operational information, through increased participation in venereal disease control by private physicians, and through a fact-based, plain-talking venereal disease education effort."

The task force described six vital control activities which it believes could eliminate syphilis as a public health hazard in this country if the activities are adequately coordinated and continued unabated for at least 10 years. These activities are:

- An intensive national effort providing for at least two visits a year by a qualified health worker to the country's 100,000 general practitioners and one visit per year to the remaining 130,000 physicians.
- Establishment of a program to insure that all blood-processing laboratories report all positive specimens to health departments by name of patient.
- Intensification and extension of current interview-investigation services to cover all infectious syphilis cases.
- Development of a comprehensive and dynamic education program for professional workers and the general public.
- Continuation of research in syphilis immunology, therapy, and laboratory procedure together with greater expansion of research in adolescent and young adult sex behavior.
- Unstinted support of the program by Federal, State, and local governments even after the reported number of syphilis cases begins to decline.

Films

Handwashing in Patient Care. *Motion picture, 16 mm., color, sound, 562 feet, 15 minutes, 1961; cleared for television; order No. M–462; list price $118.50.*

AUDIENCE: All professional and ancillary patient-care personnel.

SUMMARY: Demonstrates importance of the conscientious practice of handwashing to avoid transmission of pathogens.

Use of Anticoagulants in Rodent Control. *Motion picture, 16 mm., color, sound, 11 minutes, 396 feet, 1961; cleared for television; order No. M–474; list price $82.42.*

AUDIENCE: Federal, State, local and other health personnel engaged in rodent control activities.

SUMMARY: Filmograph which describes various types of anticoagulants and their advantages over other poisons, preparation and placement of baits, and safety measures necessary when using these materials.

Eaton Agent Pneumonia. *Motion picture, 16 mm., color, sound, 17 minutes, 624 feet, 1961; cleared for television; order No. M–479; list price $130.76.*

AUDIENCE: Medical research scientists, physicians, and medical students.

SUMMARY: Reports study of a typical virus pneumonia, confirming the findings of Dr. Monroe Eaton. Film was sponsored by the National Institute of Allergy and Infectious Diseases, Public Health Service, and the U.S. Navy. Experiments were performed at Parris Island and on human volunteers at NIAID.

The Nurse Combats Disease. *Filmstrip, 35 mm., color, sound on 12-inch disk, 13 minutes, 89 frames, 1961; cleared for television; order No. F–360; list price $9.10.*

AUDIENCE: Student and graduate nurses and allied personnel.

SUMMARY: Shows relationship of the various factors in the cause, prevention, and control of communicable disease.

Radioactive Waste Disposal. *Motion picture, 16 mm., color, sound, 847 feet, 23½ minutes, 1961; order No. M–443.*

AUDIENCE: Personnel dealing with radioactive waste or concerned with its disposal.

SUMMARY: Shows extreme precautions used at the National Institutes of Health in handling radioactive waste and the care used in its ultimate disposal in the ocean.

AVAILABLE: On short-term loan only, as indicated below.

Chemical Lab Safety. *Motion picture, 16 mm., color, sound, 909 feet, 25 minutes, 1961; cleared for television; order No. M–445.*

AUDIENCE: Chemical laboratory workers.

SUMMARY: Depicts several of the most common accident situations arising in chemical laboratory activities and offers suggestions for routine safety precautions.

Plague in Sylvatic Areas. *Motion picture, 16-mm., color, sound, 909 feet, 25 minutes, 1961; cleared for television; order No. M–440; list price $190.*

AUDIENCE: State and local public health officials, medical students, and uniformed services.

SUMMARY: Reviews history of plague in the world and describes its introduction into the United States, particularly the sylvatic areas of the west. Emphasizes importance of control of transmission agents, rodent-borne fleas, and methods of rapid diagnosis and treatment.

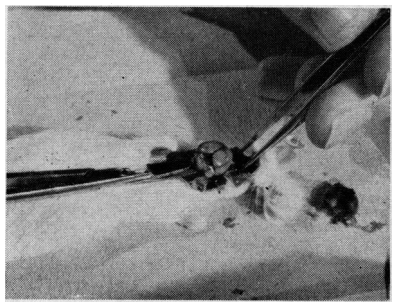
Antigen Analysis by Cellulose Chromatography and Gel Diffusion of Hydatid Fluid. *Motion picture, 16 mm., color, sound, 975 feet, 27 minutes, 1961; order No. M–545.*

AUDIENCE: Professional research workers in medical science.

SUMMARY: Reports research project on analysis of the antigens in human hydatid fluid by cellulose chromatography and gel diffusion techniques. Demonstrates application of the techniques.

AVAILABLE: On short-term loan only, as indicated below.

Laboratory Diagnosis of Rabies in Animals. *Motion pictures, 16 mm., color, sound, 30 minutes, 1,087 feet, 1961; cleared for television; order No. M–458; list price $220.68.*



AUDIENCE: Laboratory directors and technicians, virologists, and veterinarians.

SUMMARY: Demonstrates latest laboratory techniques for examination of animals in the diagnosis of rabies. Shows preparation of brain impressions, animal inoculation, serum neutralization test, and fluorescent antibody test.

These films are available on short-term loan, United States only, from the Communicable Disease Center, Atlanta 22, Ga., Attention: Audiovisual. Unless otherwise noted, they can be purchased from Norwood Studios, Inc., 926 New Jersey Ave., NW., Washington 1, D.C.