Treatment of Sewage and Industrial Wastes

Little information has hitherto been available on the relative merits of the various filter media used in the biological filtration of sewage. Since April 1959 a portion of the Stevenage domestic sewage has been treated on a battery of eight small filters filled with two different sizes (nominally about 1 in. and 2½ in.) of four different media (clinker, blast-furnace slag, broken rock and rounded gravel). With the exception of the gravel which, in the smaller size, gave some ponding trouble during last winter, the smaller media have consistently produced better effluents than the larger media. The media with the larger surface area per unit bulk volume, namely, the clinker and slag, gave better results than those of more regular shape, namely, the broken rock and rounded gravel. These relative efficiencies of treatment applied not only to the removal of biochemical oxygen demand but also to the reduction in bacterial counts.

Investigations into the activated sludge process have been principally concerned with the efficiencies of various methods of aeration. The work has suggested ways in which the efficiencies (on a basis of oxygen put into solution per unit of power supplied) accepted in normal sewage treatment practice could be considerably improved by such means as altering the geometry of the aeration tanks. Whether the gain in efficiency would be outweighed by other disadvantages such as increased capital cost would depend on local conditions.

Interesting fundamental studies have been started on the kinetics of the activated sludge process, to determine the relative importance of the method and intensity of aeration, the level of dissolved oxygen and the concentration of sludge maintained in the tanks, the degree of turbulence and longitudinal mixing and other variables.

There is an increasing demand for investigations into methods of pre-treating specific industrial wastes, and this work is done by the Laboratory on repayment. Recent and current work of this nature includes the removal of ferrocyanide from engineering wastes, the electrolytic oxidation of cyanide, the bacterial oxidation of thiocyanates, the use of beds of calcined magnesite to neutralize acid wastes, and the treatment of washings from cattle sheds and other farm premises—this last being a growing problem which sometimes causes difficulty at small sewage works.

River Pollution

A large part of the work on rivers is devoted to assessing the relative effects of surface aeration, photosynthesis and plant respiration on the oxygen balance. As a positive step towards increasing the oxygen content of a polluted river, experiments are being performed on air entrainment in a Venturi tube, which could be inserted in an effluent pipe near the point of discharge to a river. The method is simple and, on the laboratory scale, has shown promising results.

Work on the toxicity to fish of ammonia and other chemicals has continued, and the effects of mixtures of toxic substances are now being examined.

Measurement Techniques

It is inevitable that a laboratory such as this should from time to time find that existing standard methods of analysis and measurement are unsuited to its needs in many specialized lines. A valuable part of its work is therefore the improvement of old methods and the development of new. Among its contributions in this way are the improvement of established methods for determining nitrites and nitrates, the introduction of new techniques for assessing organic carbon and for the separation of radioactive strontium and barium, and the design of automatic sampling equipment for sewage, and recorders for dissolved oxygen and suspended solids.

The work of the Water Pollution Research Laboratory is thus seen to be a judicious combination of fundamental investigation and practical application for the benefit of the man on the job. On the impressive evidence put forward during the open days, it seems to be doing this work very well indeed.

F. E. Bruce

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, AUSTRALIA

THE thirteenth annual report of the Commonwealth of Australia Scientific and Industrial Research Organization for the year ended June 30, 1961, besides being a general review and a brief survey of some of the more important developments arising during the year out of the research being carried out by the Organization, includes a list of papers published during the year and details of the membership of the Advisory Council, the State Committees and staff*. Total expenditure amounted to £9,603,963 and the Treasury appropriation to £7,571,104, of which £1,058,246 was in the animal research laboratories, £886,518 on plant research, £334,613 on food preservation, £396,600 on forest products, £856,192 on the chemical research laboratories, £246,683 on fisheries and oceanography, £767,705 on the National Standards Laboratory, £451,278 on radio physics, £574,252 on wool research, £280,904 on fuel research, £333,237 on land research and regional survey, £51,700 on research association grants and £95,069 on overseas research studentships. While since 1950 the total budget increased from £2·7 million to £9·6 million, the research staff only increased from 750 to 880, and the Executive believes that this increase in staff is quite insufficient.

The giant radio telescope being erected at Parkes for the Division of Radiophysics is structurally completed and is in fact now available full time for research. The Controlled Environment Research Laboratory is scheduled for completion early in 1962.

Among the research developments noted in the review are a new method of stimulating the germination of legume seeds by exposing water-soaked seeds

* Commonwealth of Australia. Thirteenth Annual Report of the Commonwealth Scientific and Industrial Research Organization for the year ending June 30, 1961. Pp. iii+150. (Melbourne: Commonwealth Scientific and Industrial Research Organization, 1961.)

to low concentrations of carbon dioxide; a practical and economic means of controlling posthitis in wethers by implanting under the skin small pellets of the male hormone, testosterone; progress in work on worm parasites of sheep and cattle; and evidence that selection of cattle for their resistance to ticks may be a highly satisfactory means of minimizing losses due to tick infestation. Codling moth infestations have been found to depend largely on the larvæ which over-winter in an orchard, and these, in turn, on the amount of cocoon shelter available in the orchard. This can be reduced by adequate management, and, if trap bands are provided to which the overwintering individuals are attracted in large numbers and destroyed by special toxic deposits, relatively few insecticidal treatments are needed in the following season. Work at Katherine has shown that nitrogen in a form available to plants concentrates just under the soil surface during the dry season and the greatest loss occurs during the wet season, owing to leaching by rain.

It has now been demonstrated that when the appropriate fertilizer dressings to overcome deficiences in nitrogen, phosphorus, potassium, sulphur, calcium, zinc and molybdenum are applied to the infertile coastal lowlands of southern Queensland, pastures can be grown on these soils which grow and fatten cattle at stocking-rates of a beast to 1·5 acres, with annual live-weight increases of 300 lb. per beast. Investigations on the role of elements in plants have shown that manganese deficiency inhibits a reaction involved in the evolution of oxygen during photosynthesis and also that manganese is a constituent of normal chloroplasts. Studies on the life-habits of the freshwater snail *Lymnea tomentosa*, which infests grazing lands, have revealed great difficulties in applying effective control measures, as if the population is drastically reduced each surviving snail will harbour so many liver flukes that the end result is much the same. Spoilage of dried prunes of high-moisture content has been prevented by hot-filling the prunes into laminate bags.

A direct-reading tester for increasing the regain of wool has been developed, consisting of a hot-air blower to dry the wool and a balance which indicates regain directly. Evidence has been obtained that substantial numbers of freezing nuclei occur at altitudes of 50,000–60,000 ft., and work has been completed on a recorder, designed to operate for periods up to 12 months, to provide continuous records of water-level in streams, dams or bores for gauging purposes, or of rainfall, temperature, humidity, wind speed or evaporation. A process has been devised for production of pure thorium by converting thorium carbide to volatile thorium iodide and depositing thorium metal from this on to a heated surface. A new cyclone elutriator, the 'Cyclosizer', developed for precise separation of solid particles in the subsieve ranges, is based on the stable flow patterns and high centrifugal forces obtainable in hydraulic cyclones of suitable dimensions.

A thorough examination has been made of resistance measurements to establish clearly the possible limits of accuracy using both direct and low-frequency alternating current; and fundamental investigations of cell wall organization of the tissue elements of wood and of the pits between them has demonstrated that in hardwoods the initial penetration path is through the vessels and then via the pits to the rays and adjacent fibres or vertical parenchyma. In softwoods the path is from tracheid to tracheid, or tracheid to parenchyma, through the pits. A notable advance in the metal-staining technique for the electronmicroscopy of wool has revealed further structural details within the microfibrils and a resolution of 1 in 4,000 has been achieved with a mass spectrometer constructed at the Chemical Research Laboratory, while new techniques, involving an optical filter of narrow band-width, have provided photographs showing the velocity distribution in selected areas of the solar chromosphere.

SCIENTIFIC RESEARCH IN NEW ZEALAND

THE report of the Department of Scientific and Industrial Research, New Zealand, for the year ended March 31, 1961*, includes the Minister's Statement, the report of the Council of Scientific and Industrial Research and that of the Secretary, while the third annual report of the Ross Dependency Research Committee is appended. Lists of publications during the year are given under the respective branches of the Department together with lists of projects in hand.

Expenditure during the year amounted to £1,963,486 net, of which £201,421 was on the Dominion Laboratory, £225,114 on the Dominion Physical Laboratory, £131,777 on the Grasslands Division, £124,885 on the Geophysics Division, £114,532 on the Geological Survey and £111,986 on the Soil Bureau. The Council again points out that New Zealand is still lagging behind in the application of science and the scale of research, and her expenditure in 1959–60 of about £3·98 million on scientific work or 0·32 per cent of the gross national produc compares with 2·3 per cent in Britain and 2·7 pe cent in the United States in 1957–58. Professional staff at April 1 was 401 compared with 390 in 1959–60, total staff being 1,121 and 1,067, respectively, and the Secretary refers to a loss of 30 professional staff during the year, overseas, nearly all experienced scientists, although the overall calibre of the Department's staff has substantially improved over the past decade. During the past five years M.Sc. graduates in physics in New Zealand universities have averaged 10, in chemistry 21 and in mathematics 13, but about half those obtaining first-class honours accept posts overseas and do not return. The Secretary stresses the importance of being able to attract scientists of high quality and indicates some of the factors, besides adequate salary, which are important. In 1960 the establishment of two senior research fellowships tenable in the Department's laboratories for up to two years was approved and two fellowships have now been awarded. The Council is gravely concerned, however, that no action has been taken towards securing the 40–50 increase in staff per annum

* New Zealand: Report of the Department of Scientific and Industrial Research for the year ended 31 March, 1961. (H. 34.) Pp. 87. (Wellington: Government Printer, 1961.)