to be an ideal process because of its low capital and running costs and simple method of operation.

Anaerobic digestion of the wood-hydrolysate waste containing as much as 50% of pentoses (mainly xylose) among the sugars had posed a problem of sudden souring and failure of the digester when the detention time was decreased to less than 40 days. This was found to be due to the production of propionic acid from the oxidation of the pentose sugars. The fermentation of propionic acid to methane is limited to the species *Methanobacterium propionicum*. Where propionic acid is in large quantity in the medium, the numbers of these bacteria have to be boosted by artificial culturing or by providing a detention time of over 40 days for their natural multiplication. The anaerobic lagooning removed 90–95% of the biological oxygen demand from the wood hydrolysate when nitrogen, phosphorus and seed sludge were supplied in proper proportions.

The wood-hydrolysate waste from a rayon-grade pulp mill contained 5% total reducing sugars, of which 50% were pentoses. *Torula utilis*, a fodder yeast, was grown on this waste; 50% of the biological oxygen demand was removed and the yield of dry yeast was 10g/l of the waste. A good protein was thus made from inorganic nutrients and an industrial waste, simultaneously producing a valuable food material and reducing a water pollution problem. The mother liquor after recovery of the yeast was further processed by anaerobic treatment followed by aerobic treatment.

Stabilization of Waste Water Containing Phenols with Yeast-Enriched Activated Sludge

By B. VENKATA RAO and J. V. BHAT (*Department of Microbiology and Pharmacology Laboratory, Indian Institute of Science, Bangalore-12, India*)

Slow adaptation of activated sludge to phenol and catechol resulted in selective enrichment of the yeasts *Candida tropicalis* and *Trichosporon cutaneum*. The adapted sludge containing these species oxidized phenols efficiently and stabilized the sewage containing the phenols. Non-adapted activated sludge also, when supplemented with these yeasts, acquired the ability to degrade the phenols rapidly. Addition of nitrogenous and phosphatic nutrients, however, was essential for maintaining continuous and efficient operation with the adapted sludges. Urea and KH_2PO_4 were found to be suitable for maintaining a healthy activated sludge, the proportions of nitrogen and phosphorus that are essential for its efficient functioning being 1:80 for N/COD and 1:400 for P/COD. The possibility of using these yeasts for removal of phenols from industrial wastes is suggested.

Treatment of Dairy Wastes by the Activated-Sludge Process

By C. A. SASTRY, G. R. KINI and G. J. MOHANRAO (*Central Public Health Engineering Research Institute, Nehru Marg, Nagpur-3, India*)

During recent years milk-processing units and dairies in different parts of India have increased and have also created the problem of treatment and disposal of the waste water from them. Experiments showed that these waste waters were amenable to treatment by the conventional activated-sludge process and by the contact-stabilization process. The results showed that a steady growth of sludge occurred from the beginning of aeration and that the volatile matter in the sludge increased from 61 to 87% in 27 days. About 0.66–0.73 kg of volatile suspended solids was produced/kg of biological oxygen demand removed (1 kg of biological oxygen demand is defined as the demand for 1 kg of dissolved oxygen by the micro-organisms in the process of stabilization of organic matter). The removal of biological oxygen demand was 98.5% at a loading of 0.75 kg of biological oxygen demand/day per kg of sludge solids. The optimum range for mixed liquor-suspended solids was 2000–3000 mg/l and the aeration period required was 6 h. In the contact-stabilization process the removal of biological oxygen demand was 87–89% and the contact and stabilization periods required were 40–60 min and 3 h respectively.

Control of Environmental Pollution Arising out of Industrial Wastes

By T. R. BHASKARAN (*Geo. Miller and Co. Private Ltd., New Delhi-49, India*)

With the rapid growth of population and technological advances, throughout the world an environmental crisis is developing that is affecting the wholesomeness and decency of the living conditions of the human population.

Waste products from industries are indiscriminately poured out into the air, the water and the land environment. The air around us is becoming polluted with dust, smoke, fumes etc. that are injurious to health. The thermal environment in some industries is also very uncomfortable for the workers involved. Poisonous substances, such as cyanides, arsenic and chromium, discharged through industrial effluents, make water dangerous to human, animal and plant life. Heavy organic pollution from paper factories, sugar mills, distilleries etc. render water obnoxious and unsuitable for the culture of fish. Pollution by industrial wastes also makes the water less useful for agriculture, industries, power development and navigation. The micro-climate of some regions is

deteriorating as a result of the unplanned location of industries and urban development.

Experience in other countries has indicated certain basic requirements for tackling the problems of pollution. These are legislation, technical expertise, funds, the co-operation of industries and the need for a master plan for the location of industries. It is time that the industrialists realize their responsibilities and take effective action in the prevention and abatement of environmental pollution arising out of industrial wastes.

Influence of D-Alanine, Glycine and Egg Albumin on Biochemical Oxygen Demand

By B. L. C. RAJAN (*Visvesvaraya College of Engineering, University of Bangalore, Bangalore-1, India*)

Experiments were carried out by adding D-alanine, glycine and egg albumin in different combinations to domestic-sewage and industrial-waste waters and following the 5-day biological oxygen demand of these mixtures. The results indicated the following.

(1) There was variation in the increase in biological oxygen demand in the presence of equal amounts of the amino acids and egg albumin; the increase was greatest with D-alanine and least with glycine. Of these chemicals D-alanine apparently stimulated bacterial growth to the greatest extent and glycine to the least extent. (2) The increase in biological oxygen demand in the presence of egg albumin was not appreciable during the first 36h, presumably owing to a lag phase in the growth of bacteria. (3) About 90% of the biological oxygen demand was satisfied in 5 days in the presence of D-alanine, whereas 80 and 70% of the biological demand were satisfied during that time in the presence of egg albumin and glycine respectively. (4) With increased concentrations of amino acids and egg albumin in the waste water the increases in biological oxygen demand were not proportional. (5) The 'K' values also closely followed the values for the biological oxygen demand.

These observations suggest that addition of such organic chemicals as those used in this work is useful in the treatment of organic industrial-waste waters deficient in nitrogen.

Effect of Ultraviolet Irradiation on Chlorine Residuals in Polluted Waters

By T. M. AHMEER AHMED (*Civil Engineering Department, Visvesvaraya Engineering College, Bangalore-1, India*)

In this study over 50 samples of river water polluted with sewage and industrial wastes were used. They contained high concentrations of suspended solids and dissolved impurities. All the samples were ex-

posed to ultraviolet irradiation for 6h. There was a decrease of about 60% in the chlorine residuals in the first 2h. The decrease was less at greater depths when the samples were kept in experimental tanks. The decrease was increased with a greater intensity of illumination. Along with the decrease in the chlorine residuals there was a fall in pH value.

A simplified water system obtained by passing distilled water through a column of Amberlite MB-1 resin at pH7 was compared with the polluted waters for the decrease in chlorine residuals. There was about an 80% decrease in 6h. In the same period the polluted waters showed a decrease of about 70%. This was due to the presence of suspended and dissolved impurities.

These results show that the depth of the tank, intensity of illumination, time, pH and the dissolved and suspended impurities of the sample influence the decrease in chlorine residuals effected by ultraviolet irradiation. These observations have a bearing on chlorination practice in the treatment of waste waters.

Biochemical Evaluation of Pesticides

By LEELA IYENGAR, M. P. PANDEY, C. VENKOBACHAR and A. V. S. PRABHAKARA RAO (*Department of Civil Engineering, Indian Institute of Technology, Kanpur, Kanpur-16, India*)

In view of the increasing use of pesticides and insecticides in agriculture and of the problem of development of resistance and effects of insecticide combinations, a biochemical evaluation of pesticides was undertaken. The effects of chemicals such as DDT [1,1,1-trichloro-2,2-di-(*p*-chlorophenyl)ethane], BHC (lindane, 1,2,3,4,5,6-hexachlorocyclohexane), aldrin (1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-dimethanonaphthalene), endrin (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-endo-endo-dimethanonaphthalene), malathion (*S*-1,2-dicarbethoxyethyl *OO*-dimethyl phosphorothiolothionate), Rogor [*OO*-dimethyl *S*-(*N* - methylcarbamoylmethyl)phosphorodithioate], parathion (*OO*-diethyl *O-p*-nitrophenyl phosphorothionate), Diazinon (*OO*-diethyl *O*-2-isopropyl-6-methylpyrimidin-4-yl phosphorothionate), chlordane (1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene) and Thiometon *OO*-dimethyl *S*-2-(ethylthioethyl)phosphorodithioate on amylase, catalase, transaminases, proteases, lipases and dehydrogenases from such different sources as seeds and mosquito larvae were studied. The results indicated that there was a delay or inhibition of germination of some seeds. The inhibitory patterns