

Wastewater Treatment and Resource Recovery

Report of a workshop on high-rate algae ponds,
Singapore, 27-29 February 1980



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Waste treatment and nutrient removal by high-rate algae ponds

G. Shelef, Y. Azov, R. Moraine, E. Sandbank, and G. Oron

One of the only economic uses of mass cultures of algae is their growth on organic wastes, from which they produce oxygen for biodegradation of organic matter. Agricultural wastes, particularly animal wastes, can be treated by these algal systems and produce considerable biomass yields that can be harvested as a source of animal proteins. The work in Israel is a comprehensive study of the use of high-rate algae ponds for treatment of municipal wastewaters. It involves extensive laboratory work and outdoor studies with continuous operation of different sized ponds. This has been coupled with extensive animal feeding experiments and nutritional and toxicological studies with fish, broiler chicks, and laying hens.

Critical factors in the large-scale production of microalgae

E.P. Lincoln and T.W. Hall

An algae culture 0.08 ha in area, integrated into the waste treatment facility of a modern swine operation, has been monitored for various critical factors underlying species succession and productivity losses. The blue-green alga, *Synechocystis* sp., which dominates the culture in midsummer, was found to be toxic to poultry and mice but not to swine. Its occurrence was correlated with the climatic conditions of high temperature and sudden reductions in solar irradiance. Grazing by rotifers *Brachionus* and cladocerans *Diaphanosoma* was the single factor most detrimental to productivity. Zooplankton control was accomplished by raising the free NH_3 concentration of the medium to 20 mg/l. Algae harvest averaged 14.9 kg/day of air-dried algal solids with a maximum of 50 kg/day. One year of harvesting at 40% capacity produced 2.02 t corresponding to a yield of 25.3 t/ha-year. Feeding trials of the sun-dried algal product gave acceptable growth up to a limit of 10% of the diet by weight for broiler chicks and about 5% for swine. Monitoring the entire culture system for enteric bacilli showed a substantial reduction of fecal coliforms at the harvest point. No pathogenic forms were found at any point in the system.

Production of algae from pig wastewater in high-rate ponds

Lee B.Y. and Joseph C. Dodd

The construction and operation of several high-rate ponds designed for pig wastewater treatment and algae production in Singapore are described. During the first year of operation, adverse weather and severe zooplankton predation were experienced. Estimates of gross biomass productivity based on filtered suspended solids determination ranged from a maximum of 25 g/m²-day to a minimum of 4.4 g/m²-day. Removal of BOD in the absence of predators at a detention time of 16 days was greater than 90%. At a shorter detention time, 4–8 days, the BOD removal was reduced. Appearance of a zooplankton predator, *Moina*, coincided with pronounced deterioration of the pond effluent quality and reduction in biomass productivity.