IDRC FEATURE

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE
Box 8500, Ottawa, Canada, K1G 3H9 • Telephone (613) 996-2321
• Cable: RECENTRE • Telex: 053-3753

A monthly features service on scientific, technical, and educational subjects pertinent to development.

Approx. 995 wcrds

SINGAPORE: WATER TREATMENT PRODUCES FEED FROM WASTES

by JEAN-MARC FLEURY

During the past few months, scientists in Singapore have been carefully filling ponds with water used to clean pig pens. Their aim: to show that the water can be purified and a high protein feed supplement for pigs produced, simply by cultivating algae.

With 11,000 farms annually producing more than a million pigs and 25 million chickens, the city-nation of Singapore is self-sufficient in meat. However, to support the livestock population a large quantity of animal feed has to be imported. The concept of utilising piggery wastewater to grow algae for animal feed therefore has great potential. Converting wastes into algae could also reduce the environmental impact of intensive pig farming estates. Such estates are being developed in Singapore for up to 700,000 pigs within an area of 1000 hectares. Besides nutrient recovery and environmental enhancement, treated wastewater could be recycled to pig farms.

Conventional waste treatment methods rely on aeration to decompose wastes through bacterial growth. These methods are often very expensive. Nature has its own solution to this problem: algae. They are present as microscopic plant life in every river, ocean, lake and pond and produce 70 percent of this planet's oxygen. In well fertilized waters, some algae populations can double each day, feeding on the carbon dioxide, phosphates and nitrogen made available by bacteria, which they supply in turn with oxygen.

.../2

High rate treatment ponds, in which algae and bacteria help each other, have been designed to accelerate the treatment process and permit reclamation of the water. In these ponds, the depth has been reduced in order to increase the exposure of algae to the sun's radiation; photosynthesis provides so much oxygen that it bubbles to the ponds' surface. Wastewater is introduced in the pond and is gently mixed. The process is continuous: each day a certain volume of wastewater is added to the ponds and an equal volume is withdrawn. The algae is then harvested and the remaining water can be recycled to the piggery as wash water.

The harvested algae can be fed to pigs and poultry as a source of protein and minerals. In Singapore, the Primary Production Department is cultivating two types of algae, Scenedesmus and Micractinium which contain 50 percent protein. High rate ponds can produce up to 60 tons of protein per hectare per year, which is more than 50 times the protein output of the best soybean crop.

With financial support from the International Development Research Centre, of Canada, scientists in Singapore have begun demonstrating the validity of this biological approach in a pilot-plant to treat wastewater from 750 pigs. Singapore was chosen because of its tropical climate. Since algae produce oxygen by obtaining their energy from the sun in a process called photosynthesis, climate has a strong influence on productivity. The consistently high ambient temperature here is a boon to algae culture although occasional overcast weather could have adverse effects on the loading rate. Research here therefore aims at determining the best conditions for algae production and waste treatment.

Efforts will also be made to design satisfactory equipment to harvest the algae. It is possible to separate the algae from the water by spinning, a process called centrifugation, and this method will be used to collect algae for feeding tests. The slurry produced has a solid content of 3 to 10 percent and could constitute as much as 10 percent of the pigs' diet. This method of harvesting is, however, too costly to implement on a large scale.

An alternative is to collect the small algae cells after they have been made to cluster by the addition of a substance such as aluminum sulfate. This technique, known as flocculation, is well proven and could be used immediately. Its disadvantage is the high operating cost because of the need for chemicals. Another problem is that the effects of aluminum in pig feeds, are not known; fish and poultry have been fed with algae containing some aluminum sulfate but not pigs.

It may, however, be possible to recover the aluminum from the algae, and recycle it back for reuse in the algae harvester. This would both reduce the aluminum in the feed and minimize the cost of chemicals.

One of the latest mechanical devices put forward is a continuous paper belt filter. At one end, the belt dips into a vat containing pond liquor and the algae are filtered out under a low vacuum. At the other end, the concentrated algae is sucked off and can be fed as slurry to the pigs or processed further into a dry feedstuff. The paper harvester, a relatively untried method requiring more research, demands a high initial investment, but it is inexpensive to operate and produces algae that are uncontaminated by chemicals.

The research is underway and up to now the scientists have established populations of Scenedesmus in four small ponds where they are evaluating loading rates. They have found that the loading rates had to be lowered in December because frequently overcast conditions slowed down the multiplication of algae. As soon as sunnier weather returned, however, higher loading rates could be reestablished. In the coming months, a centrifuge will be used to concentrate algae for feeding tests on pigs. The construction of larger pilot ponds is now completed, and since early summer they have been used to produce Micractinium. Still larger demonstration ponds of 1000 square metres are being designed and will be constructed in the near future.

Researchers in Singapore are excited about this new concept and hope to exploit its potential. Not only should the high rate ponds recycle great quantities of water on the spot, but they will also reduce the amounts of protein that have to be imported to feed the pigs. Such recycling of resources that would otherwise be lost is a must on the island, and the methods developed in Singapore could be of use in a number of tropical cities.

END

IDRC-F87e

September 1978