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REUSE OF CAMPUS SEWAGE FOR PISICULTURE AND AGRICULTURE

by R PITCHAI and V S GOVINDAN

INTRODUCTION

Treatment of waste waters by stabilisation pond method has been widely accepted in tropical countries because of its simplicity, easy operation and maintenance and low cost. The waste water in a stabilisation pond is treated by the symbiotic action of aerobic bacteria and algae. Aerobic bacteria decompose the complex organic matter into simpler soluble forms which, in turn, are absorbed by algae as nutrients for their metabolic activities. The algae multiply rapidly in the system and, in turn, supply photosynthetic oxygen to bacteria to break down organic matter. The algae-laden effluent can be used for pisciculture and harvesting algal protein. The nutritive value of algae and the utilisation of effluents from fish ponds for irrigation are widely discussed in the literature. In this paper, the studies conducted on the performance of series stabilisation ponds, algal yield, utilisation of algae-laden effluent for pisciculture, rate of growth of fish in primary and secondary ponds, conversion of algal biomass into fish biomass and the utilisation of fish pond effluents for irrigation, have been discussed.

EXPERIMENTAL STUDIES

Experimental studies on waste water treatment and reuse were conducted at the Centre for Environmental Studies, Perarignar Anna University of Technology, Guindy Campus, Madras, India in a series of stabilisation ponds of size 43.5m x 16m x 1.5m. The campus raw sewage, about 160,000 lpd, was admitted, after screening, into the stabilisation pond system. The characteristics of raw sewage and effluents from ponds are presented in Table 1. The rate of purification in terms of BOD and bacterial reduction was better in the secondary pond than in the other two ponds.

ALGAL HARVESTING

The algae-laden effluents from the ponds were used for harvesting of algae by centrifugation. The amount of algae thus harvested was found to vary from 27 to 389 kg/hect/day in the stabilisation pond and 37 to 348 kg/hect/day in the primary pond. The yield of algae in the secondary pond ranged from 62 to 391 kg/hect/day.

TABLE 1. Characteristics of raw sewage and effluents

Parameters	Raw sewage	Effluents from Stabilisation pond	Primary pond	Secondary pond
pH	6.1-7.1	6.9-8.2	8.0-9.1	8.7-9.6
D.O.	-	0-14.6	0.8-21.6	1.2-29.2
BOD	108-349	42-136	18-104	14-80
Ammonia (N)	9-18	5-10	2-6.7	1-2
Organic (N)	8-15	6-13	5-11	2-9
Nitrite (N)	0.1-0.3	0.3-0.5	0.4-0.7	0.6-1.0
Nitrate (N)	0	0.6-1.6	1.2-3.7	3-5
Phosphate	9-19.5	8-12.6	4.6-10.9	2.3-8.0
Coliform reduction in percentage	-	97.95-99.88	99.88-99.99	99.99
Primary productivity g $O_2/m^2/day$	-	1.8 to 13.4	13 to 25.48	7 to 45.48

All values except pH and primary productivity are expressed in mg/l.

PISCICULTURE STUDIES

Fingerlings of four varieties of carps, viz. Cyprinus carpio, Cirrhina mrigala, Labeo rohita and Labeo fimbriatus with an average weight of 1 g and length of 1.3 cms were stocked in the ponds in a polyculture system and the growth of fish was observed by periodic netting. The results are shown in Fig.1. The average weight and length of Cyprinus carpio in primary and secondary ponds were 656 g and 32.7 cm and 831 g and 35.1 cm respectively in 205 days. In the same period, Cirrhina mrigala grew to an average weight and length of 612 g and 39 cm in primary pond, while the corresponding figures were 532 g and 35.7 cm in the secondary pond. Similar observations on comparative growth were made in the case of L.rohita and L.fimbriatus. It is interesting to note that the growth rates of C.carpio, L.rohita and L.fimbriatus were higher in the secondary pond whereas the growth rate of C.mrigala was higher in the primary pond. The total yield of fish in the primary pond was estimated to be 4245 kg/hect/yr and in the secondary pond, 7300 kg/hect/yr. The conversion factor for algal biomass into fish represented by the ratio Fish : Algae (F/A) in the primary pond ranged from 0.71 to 1.452 and in the secondary pond ranged from 0.47 to 1.24.

UTILISATION OF WASTE WATER FOR IRRIGATION

The effluent from the fish pond was used for irrigating 146 coconut trees and the yield from each tree was of the order of 50 to 120 kernels per year which could be further increased with improved agricultural practice. The data collected on the utilisation of fish pond effluents for cultivation of vegetables (Hibiscus esculentus) are recorded in Table 2. Higher yields were obtained from the plots irrigated with waste water. It is interesting to note that the number of vegetable pieces per plant and average weight were larger in all the waste water-irrigated subplots. The pieces obtained from waste water-irrigated subplots were longer and larger in circumference when compared with those obtained from fresh water irrigated subplots.

TABLE 2. Observations on growth of Ladies Finger crop

Description	Fresh water irrigated plots		Fish pond effluent irrigated plots (without fertilizer)				
	with fertilizer	without fertilizer					
	1	2	3	4	5	6	7
Number of plants	68	51	133	126	137	92	156
Total yield obtained (kg)	6.443	2.782	13.963	20.169	20.157	14.445	21.301
Calculated yield (kg/hect)	9500	5500	10500	16000	16200	15700	13700

Thus, it could be concluded that substantial benefits could be derived by controlled reuse of waste water.

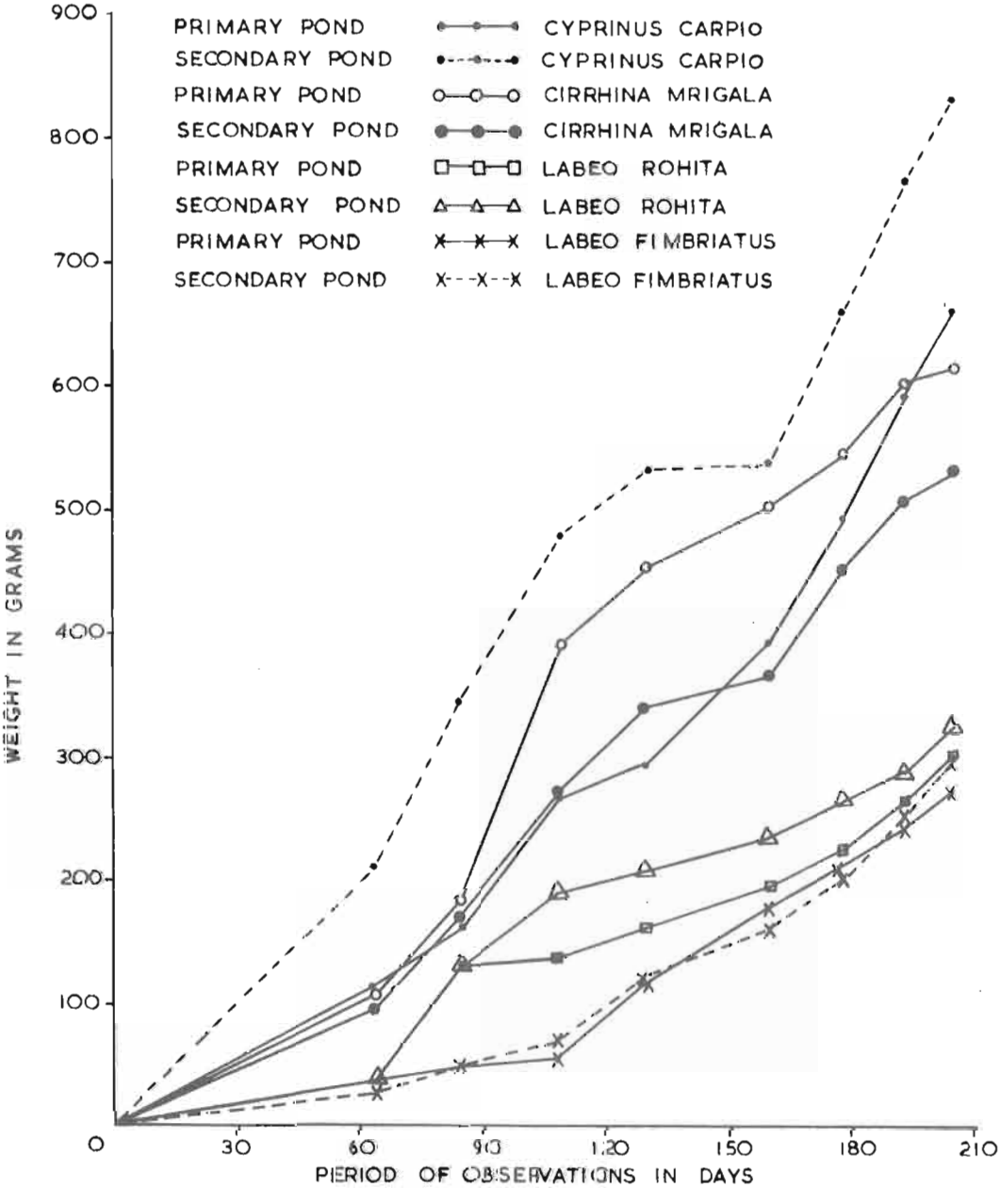

FIG. I FISH GROWTH PATTERN IN PRIMARY AND SECONDARY EFFLUENT PONDS