Research Article

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INFLUENCE OF TREATED SAGO EFFLUENT ON THE GROWTH RATES OF THE FRESH WATER FISH *CATLA CATLA*

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Abstract: Sago industrial effluent was selected in the present study and the effect of this effluent on the growth rates of the fresh water fish *Catla catla* was studied. The LC50 was determined at 72 hours in both the untreated and treated sago effluents using Finney's probit analysis. 2% and 25% were determined as LC50 for untreated and treated sago effluents. The growth rates of the fish *Catla catla* were recorded by exposing them to control, 10%, 15% and 20% concentrations of treated sago effluent. The maximum growth rates were recorded in 15% concentration of the treated sago effluent. At each concentration the feeding rate, conversion rate and conversion efficiency were calculated. The results were discussed in light of the toxicity and the possible utility value of the sago effluent for aquaculture.

Keywords: *Catla catla*, Sago effluent, Growth rates

INTRODUCTION

Today's major environmental problem is pollution. It is the greatest threat posed to humanity and even to the whole biosphere. Pollution of aquaculture habitats is an inevitable problem aqua culturist's face. Various pollutants affect survival, growth and reproduction of organisms, particularly those of economic importance (Lourdes *et al*., 1993). Information on long-term effects of exposure to toxic materials on physiological functions such as growth, reproduction and metabolism are useful to establish safe levels of waste water discharges (Hunter, 1978). Baskaran *et al.,* (1989) have found that energetic parameters like feeding and conversion rates have negative relationships with increasing concentration of dyeing effluent.

Sheela *et al.,* (1992) have studied the rate of feeding, absorption, growth, metabolism and conversion efficiency of the fish *Channa striatus* exposed to fenvalerate and phosphamidon. Aguigwo (2002) has reported the specific growth rate and food conversion efficiency in the sublethal concentration of cymbush pesticide.

Nagarajan and Shasikumar (2002) have investigated the growth rate, conversion rate and conversion efficiency of the fresh water fish *Labeo rohita* subjected to control and different concentrations of sago industry effluent. Similar observations were made in *Catla catla* exposed to sublethal concentrations of dyeing effluent (Nagarajan & Boopathyraja, 2004).

Ramesh Francis *et al.,* (2011) have studied the growth rate, conversion rate and conversion efficiency of the fresh water fish *Clarias batrachus* exposed to control and different concentrations of treated sago effluents. Sago industries are most commonly found in India and Thailand. Tamilnadu (State of India) in and around the city of Salem alone there are over 800 industries are located. It is an agro based industry, which let out lot of its waste water in to the nearby areas. Also it is noted as one of the significant contributors to water pollution by discharging its effluent.

Hence, in the present investigation an attempt is made to study the effect of treated sago effluent on the growth of the fish *Catla catla* and possible utilization of the effluent for aquaculture.

MATERIALS AND METHODS

The experimental studies were conducted in the laboratory, department of Zoology, Sri Vasavi College, Erode, Tamilnadu, India. The concentrations chosen for growth studies were 10%, 15% and 20% of treated sago effluent. The experiments were conducted in plastic trough capacity of 20 liters. For each experiment 10 individuals were reared in respective troughs and controls were maintained in effluent free medium. The fish were utilized for the experimental studies only after the acclimatization for a minimum period of 15 days. Four experimental sets were maintained for 21 days by changing the same quantity of effluent to the respective sets. During the period of growth studies, the fish were fed on known amount of fresh goat liver pieces once a day for an hour (9-10am). Care was taken to collect the unfed liver

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pieces remains with a pipette without causing disturbance to the fish. The rearing medium was changed daily after the feeding hours. Control food was dried in a hot air oven for 24 hours to weight constancy and the water content of the food was estimated. The fish were maintained in these media for 21 days at 25 + 1°C with normal light. After 21 days of rearing, the test individuals were starved for a day to ensure complete evacuation of gut. They were weighed alive and then killed. The killed fish were dried to constant weight at 80°C. The dry weight of the individuals was calculated. Estimation of growth was calculated by weighing the fish at 7th, 14th and 21st days of the experiments. On the initial day (0 day) control and experimental fish were weighted and the values were recorded.

Definition of Terms and Calculation Procedure Related to Food Utilization

The scheme of energy balance followed in the present work is that of IBP formula (Petrusewiez & Mac Fadyen, 1970). Quantitative estimations of the 'C' were made in terms of mg, where 'C' is the food energy consumed. The term conversion has been used to refer to growth, i.e. the P of the IBP terminology. The P was estimated by subtracting the initial weight of the individual at the time of commencement of experiment from the final body weight of the individual at the end of the experiment. Rate of feeding and conversion were calculated to the respective amount (mg) per unit initial weight (g) of the fish per unit time (day).

Conversion efficiency was calculated to the respective amount (mg) per unit initial live weight (g) of the fish per unit time (day). The conversion efficiency was calculated in percentage. Standard deviation and standard error were calculated following Bailey (1959).

Calculation

Feeding rate =

$$\text{(mg/g live fish/day)} \quad \frac{\text{Average food consumed (C) (mg/ fish /day)}}{\text{Initial live weight of fish (g)}}$$

Conversion rate =

$$\text{(mg/g live fish/day)} \quad \frac{\text{Average food converted (P) (mg/day)}}{\text{Initial live weight of fish (g)}}$$

Conversion Efficiency % =

$$\frac{\text{Mean food converted (mg/fish/day)} \times 100\%}{\text{Mean food consumed (mg/fish/day)}}$$

RESULTS

The growth rates were recorded in the fresh water fish *Catla catla* in control and 10%, 15% and 20% concentrations of treated sago effluents for a period of 21 days. The control fish were able to record a growth of 0.84± 0.11g whereas the individuals exposed in 10%, 15% concentration of treated sago effluent recorded a growth of 0.65± 0.06g, 1.36±0.11g respectively. But the fish introduced in 20% concentration of treated sago effluent showed a negative rate of -0.19±0.01 Figure 1 and Table 1.

Table 1: Growth rates of *Catla catla* exposed to control and different concentrations of treated sago effluent. Each value represents the average performance (± SE) of 5 individual for a period of 21 days

S.No	Concentrations of Effluent	Initial wt (g)	Final wt (g)
1.	Control	6.49 ± 0.81	7.33 ± 0.92
2.	10%	7.85 ± 0.58	8.50 ± 0.64
3.	15%	8.78 ± 0.68	10.14 ± 0.79
4.	20%	8.11 ± 0.52	7.92 ± 0.51

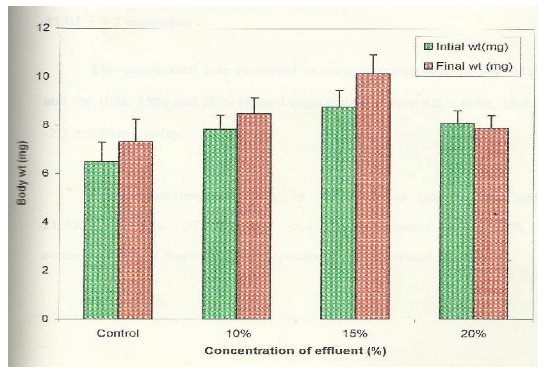

Fig.1: Growth rates of *Catla catla* exposed to control and 10%, 15%, 20% concentrations of treated sago effluent. Each value represents the average performance (± SE) of 5 individuals for a period of 21 days

The maximum feeding rates were recorded in 15% concentrations of treated sago effluent. The feeding rates recorded for control, 10%, 15% and 20% of treated sago effluents were 60.43± 19.4 mg/g/day, 61.95± 11.6 mg/g/day, 56.48± 13.4 mg/g/day and 42.01± 4.2 mg/g/day. The maximum conversion rates were recorded in 15% concentration of treated sago effluent (15.5± 0.09 mg/g/day) and the conversion rates for the other concentrations were 12.9± 0.09 mg/g/day, 8.3± 0.08 mg/g/day and -2.3± 0.01 mg/g/day in control, 10% and 20% respectively.

Conversion efficiency of the different experimental groups were 21.35%, 13.40%, 27.44% and -5,47% for control, 10%, 15% and 20% concentrations of treated sago effluents. It is of interest to note that conversion efficiency was maximum at 15% concentration, while it is on negative side for the 20% concentration of the treated sago effluent.Figure2 and Table 2.

Table.2: Feeding rate, conversion rate and conversion efficiency of the fish *Catla catla* exposed to control and different concentrations of treated sago effluent. Each value represents a mean performance of 5 individuals (± SE) at 24 ± 1°C.

S.No	Concentrations of Effluent	Feeding rate (mg/g live fish/day)	Conversion rate (mg/g live fish/ day)	Conversion Efficiency (%)
1.	Control	60.43 ± 19.4	12.9 ± 0.09	21.35%
2.	10%	61.95 ± 11.6	8.3 ± 0.08	13.40%
3.	15%	56.48 ± 13.4	15.5 ± 0.09	27.44%
4.	20%	42.01 ± 4.2	-2.3 ± 0.01	-5.47%

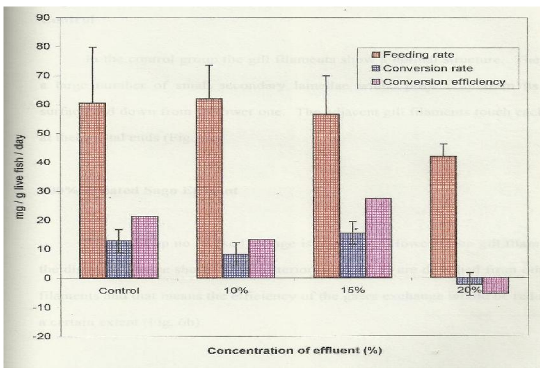

Fig.2: Feeding rates, conversion rates and conversion efficiency of the fresh water fish *Catla catla* in control and 10%, 15%, 20% concentrations of treated sago effluent. Each value represents the average performance (± SE) of 5 individuals for a period of 21 days.

DISCUSSION

Growth represents the net outcome of a series of biological processes such as food intake, digestion, assimilation, metabolism and excretion (Brett & Groves, 1979; Beamish *et al*., 1975). The net energy is partitioned between maintenance activities, metabolism, growth and reproduction. Energy metabolism and growth compete for the net energy. Thus if metabolism is elevated, growth will be limited unless the intake of food is increased. Food intake is an important factor governing growth and reproduction. Certain environmental factors and pollutants influence the feeding rate, growth rate, and conversion rate and conversion efficiencies of fish (Webb & Brett, 1972; Palanichamy *et al*., 1985; Palanivelu & Balasubramanian, 1997; Rani *et al*., 1998).

In the present study the fresh water fish *Catla catla* were exposed to control and different concentrations of treated sago effluent to study their growth rate, feeding rate, conversion rate and conversion efficiency. The growth rate was more in 15% concentration of treated sago effluent when compared to other concentrations. The conversion rate and conversion efficiency were also more in the fish exposed to 15% concentration. This could be due to the fact that the starch present in this concentration would have been effectively utilized by the fish to show a better conversion rate.

In 20% concentration of the effluent the fish could not record a positive growth and it could be due to the starch and other macromolecules concentration is more and they form a thin film of sediment over the gills which will definitely have a bearing growth. The control group showed a steady and consistent increase in the conversion rate and conversion efficiency.

Similar observations were made by Shasikumar (2001) in the fish *Labeo rohita* reared in sago effluent. Ramesh Francis *et al.,* (2011) while studying influence of sago effluent on the bioenergetics of the fresh water fish *Clarias batrachus* observed the reduced rates of feeding, conversion and conversion efficiency when they were subjected to sub-lethal concentrations.

The feeding rate, conversion rate, conversion efficiency and growth rates of the fish *Catla catla* were comparatively reduced in the group exposed to sub-lethal concentrations of dyeing effluent than the control group (Nagarajan & Boopathyraja, 2004).

Baskaran *et al.,* (1989) have found that energetic parameters like feeding and conversion rates have negative relationship with increasing concentrations of dyeing effluent. Reduction in food intake in *Mystus vittatus* reared in the chemical factory effluent which leads to reduced growth (Palanichamy *et al*., 1989).

Sivakumar *et al.,* (2003) have investigated the decrease in food intake, growth metabolism and conversion efficiency of *Oreochromis mossambicus* reared in different groups of detergents. Varadaraj *et al.,* (1997) have observed the significant decrease in growth and conversion efficiency of the fish *Oreochromis mossambicus* reared sub lethal concentrations of the tannery effluent

Sheela *et al.,* (1992) have observed the decreased rates of feeding, absorption, growth, metabolism and conversion efficiency of the fish *Channa striatus* exposed to fenvalerate and phosphamidon with increasing concentrations. Baskaran *et al.,* (1989) had studied the similar phenomenon and reduction in rates of absorption, growth and metabolism were also decreased with increasing concentrations in *Oreochromis mossambicus* when exposed to different concentrations.

CONCLUSION

The present study reveals that the treatment process of sago effluent not only makes it less toxic but also a suitable dilution makes it more conducive for fish culture. It could be due to the fact that the nutrients like starch present in the effluent utilized by the fish. Hence, it is concluded that prudential utilization of sago effluent not only solves the problem of pollution but also a resource for aquaculture.

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