

Retrival Status of Paper and Pulp Mill Effluent Treated Fish Fed with *Arthospira (Spirulina Platensis)*

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Abstract: *Spirulina* is an aquatic algae in fresh water; it promotes the growth and biochemical compositions of the animals. Paper and pulp mill effluent affect the aquatic life of flora and fauna *Oreochromis mossambicus* test animals in between the length of 5-10 cm were selected for the study. Test animal exposed to lethal concentration of effluent to the fish in 96 hours and various sub lethal concentrations were prepared as follows 0.5%, 1.0%, 1.5%, 2.0% and 2.5% in 30 days of duration. In the duration, the test animal was tested in the morphometric parameters such as weight, total length, standard length, head length, snout length and length of caudal peduncle and biochemical parameters such as amino acids, protein, carbohydrate, glucose and lipids; in between the interval of 10 days up to 30 days. Next the 30 days, the fishes are reared in the same sub lethal concentration with standard food and *Spirulina* feed. During these experimental days, the same biochemical constitutions were tested. In the experimental days, in first 30 days the biochemical values are reduced, and in the recovery period the reduced values were regained.

Keywords: *Oreochromis mossambicus*, *Spirulina plantensis*, Paper and pulp mill effluent, Biochemical compositions, Sublethal concentrations.

1. INTRODUCTION

Oreochromis mossambicus is one of the most successful largely cultured finfish species in the world, because of their fast growth rate and ability to feed low on the aquatic food chain. Moreover, tilapias are easy to reproduce and handling is having good resistance to disease and tolerance to wide range of environmental conditions. These are being found in over 100 countries (Balarin and Hatton, 1979). Fish meal, a major ingredient of fish feed, has to be imported, especially that with a protein content over 60%. The high protein content of *Spirulina* is one of the main reasons for it being considered as a conventional source of protein. In addition, the amino acid pattern of the algae compares favorably with that of other food protein, its cells being capable of synthesizing all amino acids, thus providing all the essential ones to humans and animals (Spolaore, P. *et al.*, 2006). *Spirulina* are multi cellular and filamentous blue-green algae that has gained considerable popularity in the health food industry and increasingly as a protein and vitamin supplement to aquaculture diets. It grows in water, can be harvested and processed easily and has very high macro and micro-nutrient contents (Habibet *al.*, 2008). The paper and pulp industries discharged their insufficiently treated waste into the water resources, which makes serious problem to aquatic life of flora and fauna. Thus, it is necessary to develop an economical solution on the effluent discharged. Heavy metal accumulation in the aquatic environment could result in toxicity to both aquatic life and human. Edible fish present in aquatic bodies form an important group of organism as heavy metal once accumulated in fish tissues could act as a potential carrier of metal ion along the food chain. At the end, directly or indirectly the metal ion in the aquatic medium reaches to the man. Hence several studies involving bioaccumulation of heavy metals have been conducted in fishes found in river streams generally receiving industrial effluents containing toxic heavy metals and organic pollutants (Linton, *et al.*, 2005).

2. MATERIALS AND METHODS

The common fresh water fish *Oreochromis mossambicus* (Mozambique Tilapia) was selected as animals. *Oreochromis mossambicus* fingerlings (5-10 cm) acquired from local pond, Namakkal

district of Tamilnadu. They are maintained under laboratory condition for 60 days. During this period the water was changed regularly. The fish were feed daily in standard food and spirulina powder.

2.1. Selection of Effluent

The paper mill effluent collected from the local SPB paper mill industries Pallipalayam, Erode district of Tamil Nadu. Estimation of various physicochemical parameters of the effluent and the test water were carried out by following the method given by APHA (1980).

2.2. Acute Toxicity Studies

Acute toxicity tests were carried out using the effluent and the fishes to find out the LC₅₀/96hr value of the effluent. Different effluent concentration namely 5%, 10%, 15%, 20% and 25% were prepared.

2.3. Biochemical Tests

The biochemical parameters such as total protein, total amino acids, total glucose, total free sugars and total lipids were determined by Lowry's method, Desenting paper chromatography, Orthotoludine method, Phenol Sulphuric method respectively, from the tissue extract.

3. RESULT

3.1. Morphometrical Analysis

The morphometric characters of *Oreochromis mossambicus* were calculated to find a comparative study between the fish with effluent and fish with spirulina. Among 5 morphometric characters, parameters showed the values of mean and standard deviation they were weight 10.69±1.4 in (WE) and 12.39±1.27 in (WS), total length 8.43±0.55 in (WE) and 8.42±0.54 in (WS), standard length 6.54±0.33 in (WE) and 6.69±0.27 in (WS), snout length 0.77±0.09 in (WE) and 0.82±0.08 in (WS), head length 2.36±0.20 in (WE) and 2.37±0.21 in (WS) and length of caudal peduncle 0.82±0.10 in (WE) and 0.87±0.09 in (WS). Thus, the increase of synchronized with the different degree of the increase to the above mentioned body parts. The morphometric differences between the populations may have appeared due to effluent and spirulina.

Table1. Comparative Morphometric Analysis of *Oreochromis Mossambicus* Feed with Spirulina (Each Value Is ± SD of 6 Observations)

Morphometric parameters	Fish treated with effluent			Fish treated with spirulina		
	10th day	20th day	30th day	10th day	20th day	30th day
weight (g)	6.48±1.67	8.71±1.43	10.69±1.4	6.54±1.69	9.22±1.56	12.39±1.27
Total length (cm)	7.09±0.7	7.49±0.50	8.43±0.55	7.10±0.7	7.61±0.46	8.42±0.54
Standard length (cm)	5.78±0.62	6.13±0.59	6.54±0.33	5.81±0.6	5.95±0.57	6.69±0.27
Snout length (cm)	0.73±0.11	0.76±0.08	0.77±0.09	0.73±0.11	0.80±0.08	0.82±0.08
Head length (cm)	2.0±0.18	2.19±0.24	2.36±0.20	2.02±0.19	2.27±0.14	2.37±0.21
Length of caudal peduncle (cm)	0.60±0.08	0.77±0.07	0.82±0.10	0.60±0.08	0.84±0.05	0.87±0.09

3.2. Acute Toxicity Studies

The percentage of survival of *Oreochromis mossambicus* on exposed to different concentration of paper mill effluent is evident that LC₅₀/96 hr value was found to be 15 % of the paper mill effluent.

3.3. Biochemical Tests in Different Sub Lethal Concentrations

The biochemical values of 30 days effluent treated fishes in different sub lethal concentrations are listed in Table.2. The values are gradually decreased and the same time after the 30 days in the same sub lethal concentrations fishes were fed with spirulina in next 30 days. During the period the biochemical values are gradually increased, it's also demonstrated in table.2.

Table2. Comparative Analysis of Biochemical Constituents in Effluent Treated *Oreochromis Mossambicus* and Fed with Spirulina for 30 Days.(Each Value is ± SD Of 6 Observations)

Effluent Concentration	Total proteins		Total amino acids		Total glucose		Total free sugars		Total lipids	
	*	s	*	s	*	s	*	s	*	s
Control	26.78±1.96	38.58±1.87	14.89±1.54	21.11±1.13	11.76±0.97	15.27±1.57	37.18±2.43	44.76±2.12	8.19±0.76	15.63±1.67
0.5 %	19.38±1.63	23.32±1.53	10.76±0.97	12.96±0.75	8.73±0.53	10.04±0.73	30.37±1.73	33.63±1.76	5.11±0.16	5.67±0.73
	(-27.63)	(+20.33)	(-27.06)	(+20.44)	(-25.76)	(+15.00)	(-18.31)	(+10.73)	(-37.6)	(+10.95)
1.0 %	19.11±1.76	22.55±1.56	10.58±0.76	12.37±0.81	8.57±0.39	9.69±0.38	30.27±1.44	32.78±1.27	5.08±0.13	5.63±0.76

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	(-28.64)	(+18.00)	(-28.94)	(+16.91)	(-27.63)	(+13.06)	(-18.58)	(+8.29)	(-37.9)	(+10.82)
1.5 %	18.69±1.57 (-30.20)	21.43±1.38 (+14.66)	10.11±0.38 (-32.10)	11.72±0.18 (+15.92)	8.25±0.45 (-29.84)	9.27±0.49 (+12.36)	29.54±1.87 (-20.76)	31.57±1.23 (+6.87)	4.99±0.27 (-39.07)	5.43±0.63 (+8.81)
2.0 %	18.15±1.43 (-32.22)	19.98±1.29 (+10.08)	9.56±0.89 (-35.79)	10.82±0.33 (+13.17)	7.86±0.13 (-33.16)	8.59±0.55 (+9.28)	28.73±1.28 (-22.72)	30.78±1.71 (+7.13)	4.96±0.32 (-39.43)	5.23±0.45 (+5.44)
2.5 %	16.84±1.38 (-37.11)	18.58±1.53 (+10.33)	8.97±0.76 (-39.75)	9.89±0.35 (+10.25)	7.15±0.16 (-39.20)	7.75±0.73 (+8.39)	26.98±1.13 (-27.43)	28.43±1.35 (+5.37)	4.79±0.76 (-41.51)	5.02±0.27 (+4.80)

*-effluent treated fish, s-effluent treated fish with spirulina feed

4. DISCUSSION

In the present investigation resulted 50% of death in *O.mosambicus* the 15% of concentration of paper and pulp mill effluent. Rajendra Kumar *et al.*, (1991), reported the toxicity paper mill effluent to fish *Puntius sophor*, tests were conducted in two groups. In first group dilution were aerated. Where, as in group second dilutions were not aerated. LC50 for 96 hour was estimated at 1.5% whereas in second test it was recorded at 16.5%. Varadaraj and Subramanian (1991), reported the toxicity of paper and pulp mill effluent to fingerlings of *Oreochromis mossambicus* and reported LC50 for 96 hrs. The 96 hrs LC50 value of paper and pulp mill effluent was 6% respectively.

The reducing the growth rate of experimental fish in the Paper and pulp mill effluent, than the normal. Tyor, *et al.*, (2012) reported that the paper mill effluent has the potential to cause developmental effects in fish. The paper mill effluent exposure induced abnormalities including conditions wherein, the yolk sac get protruded upto the head region, deformities in eyes, spinal curvature, abnormal head and overall stunted growth were observed during the a study in *Cyprinus carpio* larvae.

In the present study indicates the reduce the biochemical concentration like proteins, amino acids, carbohydrates, total free sugars, lipids concentration of the fish when they exposed to the paper mill effluent. Parithabhanu.*et al.*, (2014) reported that an overall decrease in biochemical constituents like total proteins, total free sugars and total lipids in all the tissues like gill, liver and intestine due to the toxicity.

In the present study concluded that the paper and pulp mill effluent induces its effects on growth and biochemical alteration of the *Oreochromis mossambicus*. Gradually reduce the biochemical constituents of the test animal when exposure to the Paper and pulp mill effluent. However, during the retrieval period, the depleted growth and tissue components were regained to certain extent which might be due to the Spirulina feed. The spirulina promote the growth and biochemical components of the fish. The Spirulina to give the effluent treated fish, it regain the reduced values.

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