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Article : PHYSICOCHEMICAL CHARACTERIZATION OF UNTREATED TEXTILE EFFLUENT AND ITS EFFECTS ON BIOCHEMICAL CONSTITUENTS OF FRESH WATER FISH, TILAPIA MOSSAMBICA

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ABSTRACT

The physico chemical parameters (pH, EC, BOD, COD, TDS, TSS, Chromium, Copper and Zinc) of 100% untreated textile effluents and its effects on the biochemical constituents present in the gills, liver and muscle of *Tilapia mossambica* were studied. The results of analysis of physic chemical parameters of 100% untreated textile effluents revealed that the parameters such as pH, EC, BOD, COD, TDS, TSS were found to be higher than the permissible limits of CPCB (1995) thereby indicating the high pollution potential of the effluent. The biochemical estimation depletion was followed by carbohydrates and protein in all the three organs (ie) gills, liver and muscle in the decreasing trend exposed to untreated textile effluents and gills were most affected compared to liver and muscle.

KEY WORDS: Textile effluents, *Tilapia mossambica*, Physico-chemical parameters, Protein, Carbohydrates, Lipid.

INTRODUCTION

Industrialization is an important tool for the development of any nation. Consequently the industrial activity has expanded so much all over the world the world today,that it has become a matter of major concern of the deteriorating environment (Tiwari, 1994). With the rapid growth of industries in the country, pollution of natural water by industrial waste has increased tremendously (Muthuswamy and Jayabalan, 2001). The pollution of water courses in due to the discharge of waste water from industries such as tanneries, pulp and paper, fertilizer, sago, textile , petroleum, chemical industries etc. (Mohan Rao, 1998). Industrial pollution are known to bring changes in the abiotic and biotic components of the ecosystem. Water pollution caused by the textile industry is mainly by the rel;ease of waste streams coming out from wet processing operations like desizing, scouring bleaching, mercerizing,dyeing and printing etc. due to this chemical pollution , the normal functioning of cell is disturbed and this in turn may cause alteration in physiology and biochemical mechanisms of animals resulting in impairment of important functions like respiration, osmoregulation, reproduction and even mortality (Kumaraguru, 1995 and Mudakkira Fathima and Noorjahan, 2006).

Assessment of toxicity of effluents from analysis of individual physic chemical parameters is often erroneous as most industrial effluents are complex mixtures of various components, they exert synergistic and antagonistic effect on organism. Use of organisms for monitoring water quality was suggested by Somnath (2002). Though many research works have been carried out using different effluents on aquatic organisms but the work pertained to textile effluents on fish is wanting. Keeping this view, a preliminary work as planned and executed to analyse the physic- chemical parameters of untreated textile effluents and also to study the changes that occurs in proteins, carbohydrates and lipids levels in different organs of fish *Tilapia mossambica* by exposing the fish to 100% untreated textile effluents.

MATERIALS AND METHODS

Untreated textile effluents was used as the material I this. The untreated sample was collected from the textile industry situated in Chennai, Tamilnadu, India in a polythene container (5 liters capacity) from the final discharge point where in effluents from all the stages of processing are released together. The physic- chemical parameters such as colour, Odour, pH, Electrical Conductivity (EC), Total Susoended Solids (TSS),Total dissolved Solids (TDS), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Chloride, Chromium, Coper and Zinc of untreated textile effluents were determined by following the standard methods outlined by APHA (1995).

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Healthy fish, *Tilapia mossambica* were collected from the hydrobiological research station, Tamil Nadu Fisheries Department, Chetpet, Chennai in a clean container of 10 liters capacity ensuring that they were not harmed either physically or physiologically during transportation. The fish were acclimatized to the laboratory condition by following the procedure of Behringer(1972) for a week by keeping them in a clean container of 25 liters capacity containing dechlorinated and aerated tap water and fed with formulated fish feed. Fish *Tilapia mossambica* of size 10-12 cms and weight 10 gms was selected for biochemical estimation. 10 fishes were introduced into plastic tubs containing 5 liters of 100%$ untreated textile effluent and this experimental setup was left undisturbed for 96 hrs, after which different organs such as gills, liver and muscle of *T.mossambica* exposed to 100% untreated sample were used for biochemical estimation such as protein, carbohydrate and lipid. The protein was estimated by following the method of Lowry et al.(1951), the carbohydrate by Roe (1955) and the lipid was estimated by following the method of Folch et al.(1957). Data were also expressed statistically using standard methods.

RESULTS AND DISCUSSION

The results of the analysis of physico-chemical parameters of untreated textile effluents is depicted in table 1. The results revealed that colour untreated textile effluents is slightly bluish in colour and odour of treated textile effluents is offensive. This colour and odour could be due to decomposition of organic or inorganic matter (Singh et al. 1998). A large number of pollutants can impact colour, taste and odour to the receiving water, thereby making them unaesthetic and unfit for domestic consumption (Goel,2000). The pH of untreated textile effluent is 8.8 thereby indicating the alkaline nature of the textile effluent sample. Discharge of such effluent with alkaline pH into ponds, river, etc for irrigation may be detrimental to aquatic biota such as zooplankton and fishes. According to Singh et al. (1998), highly alkaline water if consumed would affect the mucous membrane and may cause metabolic alkalosis. The conductivity of the untreated textile effluent is higher than the presence of organic and inorganic substances and salts that would have increased the conductivity (Mudakkira and Noorjahan, 2006 and Jamuna, 2008).

TSS level of untreated textile effluent is 246 mg/l indicating that the value of TSS is higher that the permissible limit (100 mg/l) prescribed by CPCB (1995). High amounts of suspended particles has detrimental effects on aquatic flora and fauna and reduce the diversity of life in aquatic system and promote depletion of oxygen and silting in ponds during rainy season (Goel, 2000) and Shobana, 2008). TDS of untreated textile effluents is 15524 mg/l and this value of TDS is higher than the permissible limits (2100 mg/l) of CPCB (1995). This high levels of TDS (15524 mg/l) may be due to high salt content and also renders it unsuitable for irrigation hence further treatment or dilution of the effluents would be required (Goel, 1997).

BOD level of untreated textile effluents is 180 mg/l which is higher than the permissible limit (30 mg/l) of CPCB (1995). Increase in BOD which may cause hypoxia conditions with consequent adverse effects on aquatic biota. COD of untreated textile effluents is 320 mg/l and this value of the COD is beyond the permissible limit (250mg/l) of CPCB (1995). This indicates that the effluents is unsuitable for the existence of aquatic organisms due to the reduction of DO content (Shobana, 2008). Chloride of untreated textile effluents is 6567 mg/l and the value of the chloride is beyond the permissible limit (1000 mg/l) of CPCB (1995).

Chromium level of untreated textile effluent is 0.00810 mg/l which is within the permissible level (0.05 mg/l) of CPCB (1995). Copper level of untreated textile effluents is 0.00965 mg/l and the value of Zinc is 0.182 mg/ l. The values of copper and Zinc are also within the permissible level of CPCB (1995). Thus results revealed that chromium, copper and zinc level were found to be within the permissible limits of CPCB (1995).

The results of the effects of untreated textile effluents on biochemical constituents of gills, Liver and muscle for 96 hrs, are presented in Table 2.

The protein content in the gills, liver and muscle of control fish were 1.553±0.92, 1.111±0.35 and 1.931± 0.35 respectively. The protein content in gills, liver and muscle of fish exposed to 100% untreated sample were 1.168±0.44, 0.878±0.32 and 1.053 ± 0.22 which revealed the decreasing trend of protein content in gills, liver and muscle of fish in 100% untreated sample compared to control values and this depletion of the protein level may be due to the defective protein synthesis and alterations between the ribosomes and the membranes of endoplasmic reticulum as suggested by Debrium (1976). Similar observations were reported by researchers (Mudakkira and Noorjahan 2006 and Jamuna, 2008).

The carbohydrate content in the gills, liver and muscle of control fish were 1.342 ±0.08, 1,456 ± 0.08 and 1.664 ± 0.01 respectively. The carbohydrate content in gills, liver and muscle of fish exposed to 100% untreated sample were 0.138 ±

0.03, 0.804 ± 0.39 and 0.807 ± 0.38 which indicate a decreasing trend of carbohydrate content in gills. Liver and muscle of fish 100% untreated sample compared to that of control values. This reduction in the carbohydrate may probably be due to the glycolysis and utilization of glucose to meet the increased metabolic rate as suggested by Revathy (1995) and Jamuna (2008).

The lipid content in gills, liver and muscle in control fish were 0.202 ± 0.40, 0.157 ± 0.36 and 0.294± 0.45 respectively. The lipid content in gills, liver and muscle of fish exposed to 100 % untreated sample were 0.151± 0.35, 0.0171 ± 1.70 and 0.142 ± 0.34 which shows a decline of lipid content in gills, liver and muscle of fish exposed to 100% untreated sample compared to that of control values. Lipid forms and important fuel reserve stored in large quantities and it is an essential component of protoplasm and even during extreme starvation, considerable amount would be extracted from the tissue (Hoar, 1984). The results of the lipid content in this study also shows a declining trend in the organs of the fish exposed to 100% untreated sample as lipid is the fuel reserve of the fish, during stress it is metabolized to meet the energy needs.As a change in the lipid content of the animal. This is in accordance with the work of Shobana (2008).

Thus from the results of above study it can be inferred that the carbohydrate, protein and lipid were highly reduced in the gills followed by the liver and muscle compared to that of control values. This could be because of the fact that gills are the first organ which comes to contact with the 100% untreated textile effluents and moreover 100% untreated sample could have affected the gills first because which do not have any kind of covering (Ware, 1980 Singh and Singh 1980 and Jamuna, 2008). The results also revealed that lipid was most depleted followed by carbohydrate and protein.

Hence from the results of the presnt study, it may be conducted that the data obtained for physicochemical parameters, such as pH, EC, BOD, COD, TDS, TSS are higher than CPCB (1995) permissible limits suggesting that untreated textile effluents should be treated or it should be diluted before disposal, so that it does not hamper the aquatic organisms which may affect the food chain. This treated effluent can be further used for aquaculture and agricultural purpose.

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Table 1- Physico-Chemical parameters of 100% untreated textile effluents

S.NO	Parameters	CPCB (1995)	Untreated
1.	Colour	Colourless	Slightly Bluish
2.	Odour	Odourless	Offensive
3.	pH	5.5-9.0	8.89
4.	Electrical Conductivity (µmhos/cm)	400	22131
5.	Total Suspended Solids(mg/l)	100	246
6.	Total Dissolved Solids (mg/l)	2100	15524
7.	Biochemical Oxygen Demand (mg/l)	30	180
8.	Chemical Oxygen Demand (mg/l)	250	320
9.	Chloride(mg/l)	1000	6267
10.	Chromium(mg/l)	0.05	0.00810
11.	Copper (mg/l)	3	0.00965
12.	Zinc (mg/l)	1.5	0.182

Table-2 Effects of untreated textile effluents on different biochemical constituents of *Tilapia mossambica*

Biochemical Constituents mg/100mg of tissue	Organs	Control	100% untreated textile effluents
	Gills	1.553 ± 0.92	1.166 ± 0.44

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Protein	**Liver**		
1.111 ± 0.35	0.878 ± 0.32		
Muscle			
1.931 ± 0.35	1.053 ± 0.22		
	Gills	1.342 ±0.08	0.138 ± 0.03
Carbohydrate	**Liver**		
1.456 ± 0.08	0.804 ± 0.39		
Muscle			
1.664 ± 0.01	0.807 ± 0.38		
	Gills	0.202 ± 0.40	0.151 ± 0.36
Lipid	**Liver**		
0.157 ± 0.36	0.0171 ± 1.70		
Muscle			
0.294 ± 0.45	0.142 ± 0.34		