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ISSN: 0973-4945; CODEN ECJHAO
E-Journal of Chemistry
Vol. 3, No.4, pp 303-306, October 2006

Impact of Textile Effluents on Fresh Water Fish *Mastacembelus Armatus* (Cuv. & Val)

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Received 20 July 2006; Accepted 22 August 2006

Abstract: The textile effluents has been proved to impart adverse effects on humans, animals and plantation. The present study reveals that the impact of textile effluents on a protenious edible fresh water fish *Mastacembelus Armatus* by examining the changes in the ionic regulations of some selected tissues like liver , kidney and muscle before and after exposure to the Acid Blue 92 (CI.No. 13390). *Mastacembelus Armatus* were exposed to sub lethal concentration of textile dye - Acid Blue 92 (CI.No. 13390) for a period of 35 days. After the exposure period it was observed that a decrease in concentration of Sodium and Chloride ions and an increase in concentration of potassium, Calcium and magnesium ions. The magnesium ion concentration increased, but only slightly, when compared to the fluctuations of the other ions. The cationic concentrations of the test individuals indicate that the impact of textile effluents has an adverse effect the ionic regulations.

Keywords: *Mastacembelus Armatus* , edible fresh water fish , textile effluents , ionic regulations , Acid Blue 92 (CI.No. 13390)

Introduction

Textile effluents are known toxicants, which inflict acute disorders in aquatic organisms. Uptake of textile effluents through food chain in aquatic organisms may cause various physiological disorders like hypertension, sporadic fever, renal damage, cramps etc,.

The bio-accumulation of organic and inorganic toxicants depends on availability and persistence of the contaminants in water, food and physiological properties of the toxicants.

The aquatic vertebrates such as fish live in an intimate contact with the environment through the gills making them susceptible to aquatic pollutants. Gills are the primary organs for the respiration, iono and osmoregulation and acid base balance. Due to this environment the function of these organs may cause homeostative disorders. Some physiological functions may breakdown compensatory responses to maintain homeostasis, at least overall life performance of animal.

The study of cauvery Basin Eco-development suggests that there is a heavy reduction of fish species in the oriental region for the past two decades. This may be ascribed to the increasing load of textile effluents. In the present study the authors' aims at evaluating the effect of textile effluents on the concentration subsequent changes occurring in the tissues of the fresh water fish, *Mastacembelus armatus*.

Experimental

Materials and Methods

The experimental fishes were purchased from local aqua form. After disinfecting them with 0.1% $KMnO_4$ and acclimatizing them to laboratory conditions for 15 days in glass aquaria the fishes were fed with standard fish meal. After acclimatization, the fishes were shifted to experimental aquaria. A group of 10 healthy fishes were used for each experiment. The fishes of average length 15 ± 3 cm and weight 80±10 gm were used for experiment. LC_{50} value was calculated according to the standard methods of "American Public Health Association". The method recommended by Sprague[13] (1973) was followed to carryout the toxicity tests. Thus the impact of dyes on the chosen fish was studied by estimating the amount of Na^+, K^+, Cl^-, Ca^{2+} and Mg^{2+} ions, before and after exposure of textile dye solution.

Results and Discussion

The electrolytes are distributed in solution throughout all the body fluids, the cations are the ions of Na^+, K^+, Ca^{2+} and Mg^{2+} with Na^+ and K^+ predominating. The Chief anion are the chloride and bicarbonate ions. Maintenance of constant internal ion concentrations (Eg. Na^+, K^+, Cl^-, $Ca2^+$ and Mg^{2+}) are essential for the active regulation of water influx and ion efflux in aquatic organisms (Mayer 1992)

Owing to the influx and efflux of ions organism in fresh water maintain an internal homeostasis. These ions exist either in the free form or in the bound form. However, both forms platy a major role in cellular metabolism.

Analysis of data using the test showed that the value of Na^+, K^+, Ca^{2+}, Mg^{2+} and Cl^- were significantly altered when compared with that of their respective control.

Studies of Roy *et al.*, (1990) with clarias batrachus have pointed out that monitoring bio-accumulation in specific tissues provides better basis than whole body analysis. The studies of Eisher and Weinstein[1], Nimmo and Blackman[2] and Sivaprasad Rao[3] *et al.* have shown that organic and inorganic pollutants impair the ionic balance in various biological systems.

The concentration of Na^+ ,Cl^- , K^+, Ca^{2+} and Mg^{2+} ions in the tissues of liver, Muscle and kidney of the normal fish treated with sub lethal concentration of textile dye solution for 35 days is given in the Table 1.

Table 1. The concentration of Na^+, Cl^-, K^+, Ca^{2+} and Mg^{2+} ions in various tissues of the fish *Mastacembelus armatus* exposed to sub lethal concentration of textile dye solution in meq kg^{-1}.

Tissues	Na^+ ions		Cl^- ions		K^+ ions		Ca^{2+} ions		Mg^{2+} ions	
	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment
Liver	120 ±1	101±0.1	116±0.6	98±1	10.3±5	13.5±1	12.39±3	15.53±1	8.32±0.6	8.9± 0.6
Muscle	83 ± 1	64±0.2	78± 0.5	59±2	8.6± 2	11.9±2	11.01± 2	14.85±2	9.12±0.5	10.1±0.8
Kidney	61± 0.5	43 ± 1	56± 0.3	39±0.6	7.3±1.2	9.8±3	14.34± 2	17.8± 6	10.6±0.7	11.2±0.4

When the treatment were analyzed irrespective of the exposure period. Both control and experimental group varied significantly from each other, this depicts that textile effluents are toxic to fish at sub lethal level.

Above data indicates that the concentration of Na^+ ions in the Liver, Muscle or Kidney decreases after the exposure period of 35 days.

The decrease in Na^+ concentration suggests a change in permeability properties of different biological membrane system. The fish exposed in dye solution maintained the iso-osmatic condition of the intra cellular milians by pumping out the Na^+ ions and tried to compensate this loss by enhancing the amino acids pool [4], without affecting the water content of the body during effluent stress.

The concentration of Cl^- ion level in the tissues of liver , Kidney and Muscle of the normal fish *Mastacembelus armatus* treated with sub lethal concentration of textile dye is given in the Table 2

Table 2. Cl^- ion concentration in meq. kg^{-1}

Tissue	Control	Treatment
Liver	94	71
Kidney	67	56
Muscle	58	43

The Inorganic electrolytes sodium and chloride has often been used as an index of osmoregulation and they have been reported to react quit similarly in fresh water organisms under situations of strong circulating level of sodium have been indicated as an useful measurement of stress, primarily due to active movement of these ions across the gill structure depending on its concentration in the cultural medium.

Foskeft (1983) stated that blood chlorine is considered as an important extra cellular anion for the regulation of cation-anion balance and osmotic pressure. Similar results were also reported by Sclye (1950), that the decrease in K^+ ion concentration (Hypochormia)have been associated with stressful conditions in mammals. The studies of Pic[5] and Ando[6] revealed that Cl^- ion permeability is increased in stressed animals resulting in an enhanced efflux rate and an appropriate decrease of Cl^- ion concentration in fish might be due to reduced activity of carbonic anhydrase[8] (Thomas and Murthy 1987) or Sterodogensis (Hart *et al*., 1973). Unlike Na^+ and Cl^- the concentration of K^+, Ca^{2+} and Mg^{2+} ions are increased after the treatment with textile dyes.

K^+ is the main cation of inter cellular fluid and it is also an important constituent of the extra cellular fluid. K^+ is essential for the activity of nerves and it is present in nerve fibers which are related to carbohydrate metabolism[9] .The increase in K^+ ion concentration of the sample is attributed to the reduction in the extra cellular space [7]

In this investigation the hyper Ca^{2+} ion may be due to an impaired ability of fish to actively excrete excess of Ca^{2+} ions through Kidney. As reported by Natochin and Cuser (1970) and Larson[12] *et al*., (1976).

Further it has been reported[11] by Hoar (1989) that increase in the divalent cations like calcium and magnesium will also impair the membrane permeability. Ebel and Gunthur [10](1986) stated that renal dosage and dysfunction may result in a significant evalution in Mg^{2+} level . This significant increase in Mg^{2+} and Ca^{2+} level is due to hyperactivity of parathromone due to pesticide stress which in turn release more amount of Ca^{2+} ions in body fluid.[9]

Acknowledgement

The Authors are express their humble gratitude to Udyog Rattan. Thiru. J. Sudhanandhen , Correspondent, Erode Sengunthar Engineering College, Erode and Dr.T. Shanmugam, Principal for their kind Co-operation for the present investigation.

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