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BIOACCUMULATION OF HEAVY METALS IN THE VITAL ORGANS OF MYSTUS KELETIUS AT SUB LETHAL CONCENTRATIONS.

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ABSTRACT: *The present study is to expose the bio-accumulation of heavy metals in vital organs of the fresh water fish, M.keletius reared in heavy metal contaminated medium. The experimental fish assayed to Ni, Cd, Cr and Pb at sub lethal concentrations for 28 days. The metals, Ni, Cd, Cr and Pb assayed using Atomic absorption spectrophotometry and the results given as ug/g dry weight. The liver tissue shown high accumulation during the exposure period. All results are statistically significant at p<0.05. The order of heavy metal accumulation in liver and gill tissues was Cd>Pb>Cr>Ni and Pb>Cd>Cr>Ni . The bioaccumulation of cadmium and lead proportion was much increased in the tissues of Mystus keletius.*

KEYWORDS: Toxicity, Mystus keletius, gills, liver, kidney, bioaccumulation, heavy metal.

INTRODUCTION

The pollutants in freshwater pose a serious concern to the environment (Dirilgen, 2001, Canli et al., 1998). Domestic , industrial and other man activities add voluminous heavy metals in the aquatic system (Conacher et al., 1993). Heavy metal contamination may have deleterious effects on the ecological balance and diversity of aquatic organisms (Farombi et al., 2007). Fish is the main organisms being affected by these pollutants (Clarkson, 1998, Dickman and Leung, 1998). Fish occupies a main place in the food chain and hence the death of this organism will lead to the adverse effect in the aquatic ecosystem (Farkas et al., 2002). The heavy metals may alter the physiological and biochemical parameters both in tissues and blood of fish (Basa and Rani, 2003). The toxic effects of heavy metals including bio-accumulation reviewed (Waqar, 2006; Adami et al., 2002). The fish developed a protective defense against the deleterious effects of both essential and non essential heavy metals and other xenobiotics that produce degenerative changes like oxidative stress in the body (Filipovic and Raspor, 2003*). Mystus keletius* is the mostly available and acceptable fish of this region. Further more, fish has shown good adaptation in the polluted aquatic environment. The objective of this study is to quantify the accumulation of heavy metals in the vital organs M.keletius.

Materials and Methods

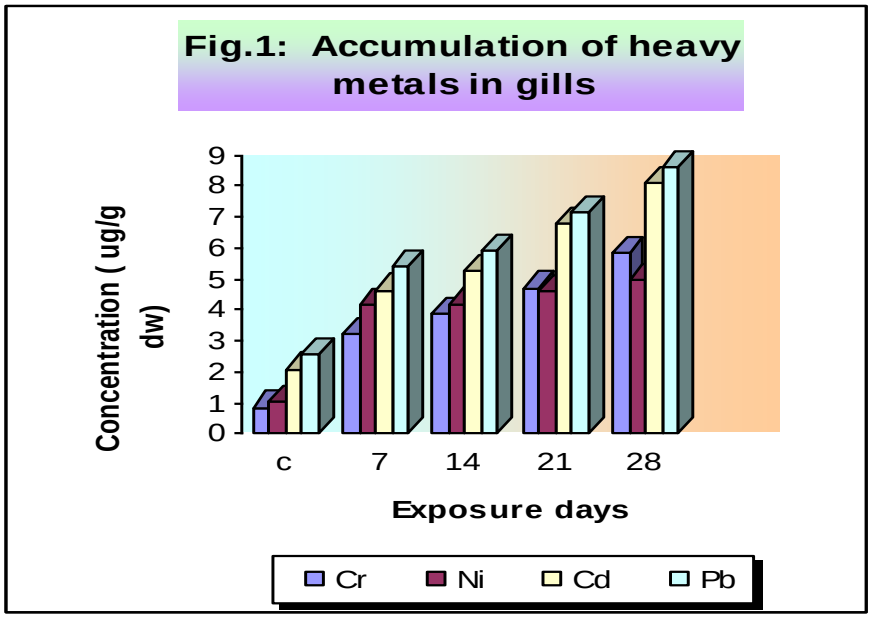
The freshwater Mystus keletius (12-15cm length and 42±0.70g) was collected from the local market and was acclimated to laboratory conditions for a week. The 12h photo period was maintained throughout the experimental work. The fish was fed with commercial fish feed . Analytical graded lead nitrate, potassium chromate, cadmium chloride and nickel sulphate by BDH (in India) were used as the metal toxicant in this experiments. The bioassay of fish

treated in combined metal solution is analyzed through probit analysis method. Thus, Lc 50 value for 96h for fish is detected.

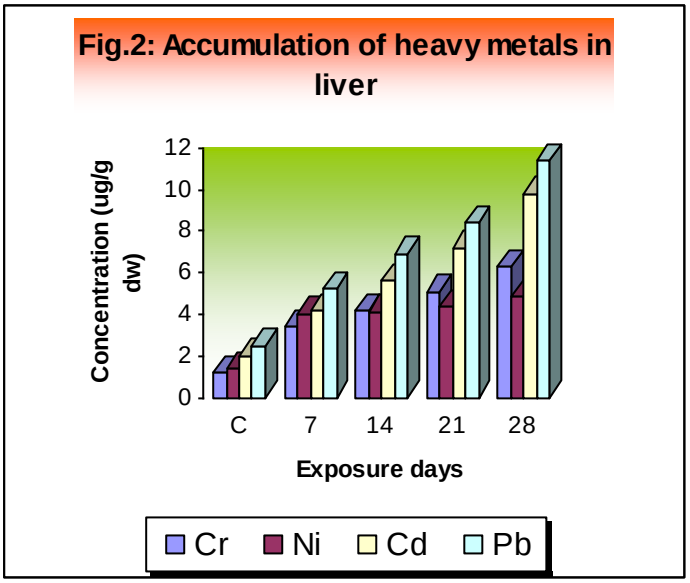
Fish were divided into five groups, with the first group serving as control and other groups as experimental groups. The experimental groups were administered with a sub lethal concentration of 6ppm of combined metal solution (1/10th of Lc 50 for 96h) daily for 7, 14, 21, 28 days. Fish from each group was dissected to separate organs (muscle, gills, liver, kidney) according to FAO methods (Dybem, 1983). The separated organs were put in petri dishes to dry at 120^0 C until reaching a constant weight. The separated organs were placed into digested flasks and ultrapure concentrated nitric acid and hydrogen peroxide (1:1 v/v) was added. The digestion flasks were then heated to 130^0 C until all materials were dissolved. Digest was diluted with double distilled water appropriately. The elements Pb, Cd, Ni and Cr were assayed using atomic absorption spectrophotometer and the results were given as ug/g dw. For cadmium and lead a palladium – magnesium nitrate matrix modifier was employed. The detailed analytical procedures for metal determinations were given in the literature (Ritterholf and Zauke, 1997). Data obtained from the experiments were analyzed and the results were expressed as mean ± S.D. The results were evaluated using one way ANOVA test. Values of $p< 0.05$ were considered statistically significant.

Results and Discussion

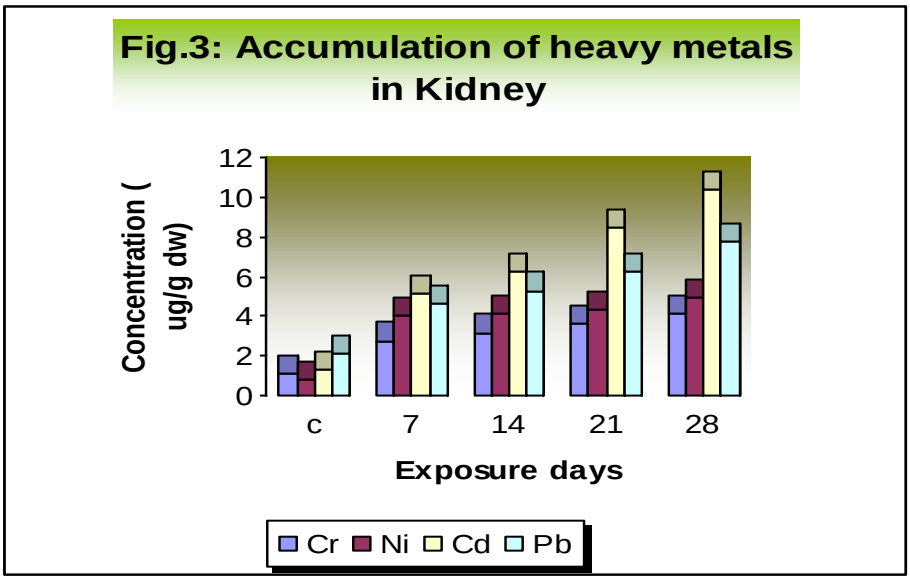
The heavy metals such as chromium (Cr), nickel (Ni), cadmium (Cd) and lead (Pb) were analyzed in different organs like gills, liver, kidney and muscle tissues of control fish. The accumulation of heavy metals in fish species were analyzed at the end of experimental period and compared with experimental fish, which were exposed to selected heavy metals. The gill is an important site for the entry of heavy metals that provide lesions and gill damage (Bols et al., 2001; Lock and Overbeeke, 1981). The range of Cr was 3.25 ± 0.05 – 6.9± 0.07, Ni was 4.15 ± 0.08 – 5.8± 0.17, Cd was 4.65 ± 1.08 – 10.2 ± 0.47 and Pb was 5.38 ± 0.18 – 11.7 ± 0.24 ug/g dw, respectively during 32 days of exposure. The results show that lead and cadmium accumulation was relatively higher than other metals in gills (Fig. 1).



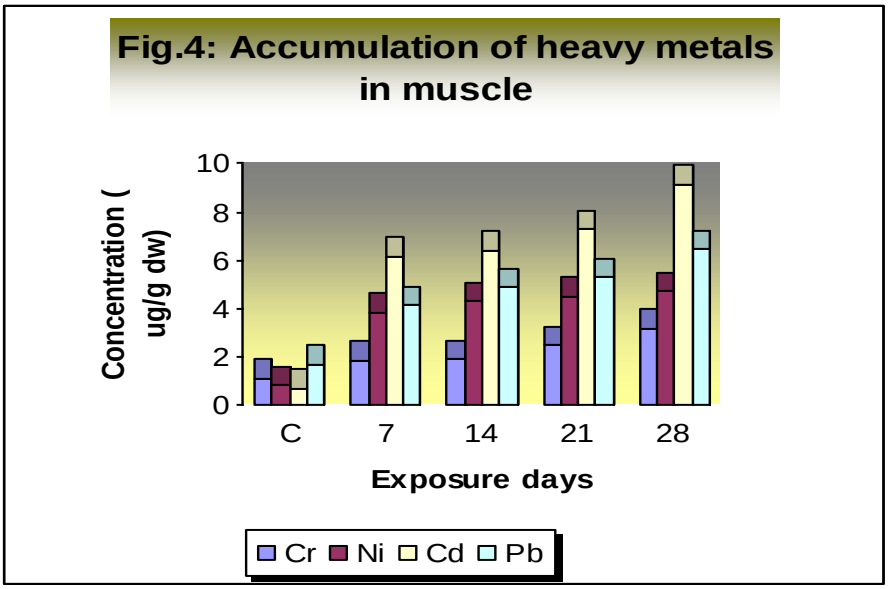
The liver is an important site for detoxification and hence a heavy accumulation of heavy metals . The range of Cr was 3.4± 0.15 – 6.3± 0.37, Ni was 4.02 ± 0.18 – 4.86± 0.32, Cd was 4.2 ± 1.68 – 9.8± 1.42, and Pb was 5.2 ± 0.38 – 11.4± 0.76 ug/g dw, respectively during 28 days of exposure (Fig.2).



This may lead to alter the levels of various biochemical parameters in liver as well as cause severe liver damage (Ferguson, 1989). The results show that cadmium and lead accumulation was relatively higher than other metals in liver (Fig. 2). Kidney is the gateway for heavy metal detoxification in body. In kidney tissue, considerable amounts of heavy metals were accumulated. The range of Cr was 2.75 ± 0.25 – 4.16± 0.67, Ni was 4.05 ± 0.28 – 4.96± 0.42, Cd was 5.15 ± 0.88 – 10.4± 1.12, and Pb was 4.65 ± 0.48 – 7.76± 0.92 ug/g dw, respectively during 28 days of exposure (Fig. 3).



These results show that Cadmium and lead strongly accumulated rather than chromium and nickel in kidney (Fig. 3). Flesh is one ultimate part for heavy metal accumulation. The range of Cr was 1.85 ± 0.45 – 3.16± 0.37, Ni was 3.85 ± 0.26 – 4.70± 0.54, Cd was 6.15 ± 0.48 – 9.16± 1.08, and Pb was 4.15 ± 0.28 – 6.45± 0.22 ug/g dw, respectively (Fig.4) .



The heavy metals uniformly spread over the body muscles. Hence the observed values are relatively lower than the other potential organs. The presence of higher amounts of heavy metals in any parts of body will definitely induce changes in biochemical metabolism and other induced stresses (Fig. 4). Studies on the accumulation of heavy metals in various organs of the fresh water fish exposed to sub lethal concentrations were very important.

The information gained from this study highlighted the biochemical changes in the fish metabolism. In this study, the order of heavy metal accumulation in gills and liver was Cd>Pb>Cr>Ni and Pb>Cr>Cd>Ni . In all heavy metals , the bioaccumulation of lead , cadmium, chromium was significantly increased in tissues of Mystus keletius. Nickel and chromium may produce a combined effect in altering the metabolic functions of fish. There is an indication that heavy metal contamination would affect the aquatic life of fish. Hence a scientific method detoxification is highly essential to improve the health of these economic fish in any stressed environmental condition. Further research studies on the variations in antioxidant enzyme system, due to the influence of heavy metal toxicity in the affected fish , have to be evaluated.

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