A STUDY ON

BIO ACCUMULATION OF SOME SELECTED HEAVY METALS

OF AN ELECTROPLATING INDUSTRY EFFLUENT IN

Oriochromis mossambicus

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Abstract

Increasing population of Sri Lanka and the unplanned development activities particularly the improper siting of industries in the past, have witnessed rapid environmental degradation in the last five decades. Due to rapid industrialization and urbanization, large quantities of toxic substances are being added to the environment causing environmental degradation.

Heavy metal contaminants in aquatic ecosystems pose an environmental hazard because of their toxicity and persistence in aquatic organisms. It is evident from the previous studies that metals are accumulated in fish. As fish are heavily consumed by people, especially in the developing world where about 40%-100% of the animal protein is from fish, there is obviously a risk of such metals reaching human tissues and causing grave health hazards.

Thus the present experiment was designed to determine the bioaccumulation of Chromium, Nickel & Cadmium in *Oreochromis mossambicus* reared in effluents of an Electroplating Industry. Fish were reared in untreated, treated & treated diluted effluents for 90 days and the accumulation of the three heavy metals in selected organs (liver, kidney, gills & muscle) were investigated on 15 day intervals. In addition, differential accumulation of Cr, Ni and Cd in different organs and the effect of these heavy metals on growth of fish were investigated.

Two months old fish fingerlings were used in these experiments utilizing twelve tanks with different concentration of test solutions. Five fish specimens from each tank (i.e., 5x3 fish from each concentration) were harvested on day 15, 30, 45, 60, 75 and 90. Composite samples of liver, kidney, gills and muscle were prepared by dissecting the fish harvested from each tank. Samples were digested in HNO_3 and the analysis of heavy metals were carried out by Atomic Absorption Spectrophotometric method.

With respect to Cr, Ni and Cd, highest accumulation with time was observed in untreated effluent and the lowest accumulation was found in treated diluted effluent.

Highest concentration of Cr was observed in the Gills (117.08 ± 1.55 $\mu g\ g^{-1}$ dry wt.) in untreated effluent while the lowest concentration was found in Muscle (33.10 ± 2.18 $\mu g\ g^{-1}$ dry wt) in treated diluted effluents. The treatment and dilution has significant effect on reduction of Cr in liver and kidney while the treatment and dilution has no significant effect on reduction of Cr in gill and muscle.

Highest concentration of Ni was obtained in Kidney (118.34 ± 2.61 $\mu g\ g^{-1}$ dry wt) followed by Gills (110.83 ± 2.65 mg g^{-1} dry wt) in untreated effluents. Lowest Ni concentration was found in Muscle (13.77 ± 1.35 $\mu g\ g^{-1}$ dry wt) in treated diluted effluents. Treatment and dilution has significant effect on reduction of Ni in all 4 organs.

Highest concentration of Cd was observed in the Kidney (121.40 ± 2.99 $\mu g\ g^{-1}$ dry wt) in untreated effluents and the lowest value was recorded in Gills (7.77 ± 1.15 $\mu g\ g^{-1}$ dry wt) in treated diluted effluents. Treatment and dilution has no significant effect on reduction of Cd in liver and kidney while the treatment and dilution has significant effect on reduction of Cd in gill and muscle.

The study shows that the percentage reduction in accumulation in the organs of fish reared in treated and treated diluted effluent is not in line with the percentage reduction of the heavy metals in treated and treated diluted effluents.

No effect of Cr, Ni and Cd concentration was evident regarding the increase in length of *Oreochromis mossambicus*. But a significant reduction in weight was observed in fish reared in untreated effluent.

Highest rate of accumulation in all four organs was occurred during the first 15 day period in the Untreated effluent.

It is evident from this study that the treated effluent even after diluting by 8 times with clean water is having a considerable effect on the accumulation in a stagnant pool of effluent.

It is therefore, suggested that when considering for giving approvals for siting the industries which generate heavy metals, the relevant Authorities should consider the fact that these effluents are treated to conform to the stipulated standards and discharged into a continuously flowing water body having 1 : 8 dilution factor.

Further it is advisable to amend the clause- "These values are based on dilution of effluents by at least 8 volumes of clean receiving water" indicated in the *Gazette extraordinary* No. 595/16 under General Standards for Discharge of Effluents Into Inland Surface Waters, as "These values are based on dilution of effluents by at least 8 volumes of clean receiving water having an effective flow at the point of discharge".