

ABSTRACT

The present study was carried out to investigate the efficiency of some chemical and natural substances for heavy metals adsorption.

Ethylene di amine tetra acetic acid as a chemical chelator and both rice husk and orange peel as natural chelators, were used as chelators for 2 mg/l and 12 mg/l Cu and Pb aqueous solutions, respectively.

The 1st (pilot) experiment along one month period had been carried out to determine the optimum concentrations of the investigated materials which were used during the 2nd experiment. Concentrations of 0.007, 0.5 and 0.5 g/l for 2NaEDTA, rice husk and orange peel respectively, were chosen for the 2nd experiment.

Experimental design

The 2nd (main) experiment, carried out along a period of two months, where *Oreochromis niloticus* fingerlings (37.5 ± 2.5 gm) were divided into non-polluted and polluted groups. The non-polluted group subdivided into 4 subgroups: control, 0.007 2NaEDTA, 0.5 g rice husk/l and 0.5 g orange peel/l. The polluted group divided into 2 main subgroups: Cu-polluted water and Pb-polluted water. Cu-polluted water in turn subdivided into 4 subgroups, one of them received 2 mg Cu/l and the other 3 subgroups received in addition to copper, 0.007, 0.5 and 0.5 g/l of

2NaEDTA, rice husk and orange peel, respectively. Pb-polluted water main sub group subdivided into 4 subgroups, one of them received 12 mg Pb/l and the other 3 subgroups received in addition to lead, 0.007, 0.5 and 0.5 g/l of 2NaEDTA, rice husk and orange peel, respectively. All treatments represented in 2 replicates with 12 fish for each aquarium (40 × 50 × 50 cm). Results obtained at the end of the study were as follow:

Residual analysis

Water residues

The addition of EDTA, rice husk or orange peel to the Cu-polluted water reduced its concentration in water significantly from a value of 0.65 ± 0.05 mg/l to values of 0.00 ± 0.00 , 0.07 ± 0.01 and 0.1 ± 0.01 mg/l at the end of the study, respectively. The mean concentration of water lead in 12 mg/l lead-polluted water was 5.055 ± 0.685 mg/l at the end of the study period (after 60 days). Its average mean concentrations in treatments received EDTA, rice husk or orange peel were 0.01 ± 0.00 mg/l for all of them at the end of the study period (after 60 days).

Residual analysis in muscles and selected organs

Residues of both copper and lead in muscles, gills, livers and kidneys recorded at the end of the study period (after 60 days) were significantly higher in treatments exposed to copper or lead than their values in control, however, the addition of EDTA, rice husk or orange peel as adsorbing materials significantly reduced both metals concentrations in muscles and different selected organs at the end of the study period (60 days).

Biochemical investigations

Some biochemical parameters were measured alongside the study period to investigate the influence of treating polluted water with the investigated materials on their biochemical equilibrium. Obtained results indicated that serum glucose, serum total protein and serum transaminases values were significantly increased in fish raised in either Cu or Pb polluted water. Serum total lipid values were significantly decreased. As a result of applying any of the investigated materials (EDTA, rice husk and orange peel), the values of the tested biochemical parameters returned to their normal values recorded in control fish raised in non-polluted water.

Histological examination

At the end of the study, gills and livers obtained for histological examination. Histological sections of gills revealed that exposure to copper or lead caused a sever damage to it. Gills of fingerlings raised in either 2 mg Cu/l or 12 mg Pb/l polluted water showed a sever hyperplasia, sloughing of secondary lamellae and sever congestion of blood vessels. The application of the tested adsorbing materials reduced the damage occurred in fingerlings gills. Histological sections of liver samples also showed sever damage in fish raised in either copper or lead polluted water. Liver of fingerlings raised in 2 mg Cu/l polluted water showed sever congestion of blood vessels and inactivation of pancreatic acin. Congestion, hyperplasia of epithelial cell, lining of bile ductules and dissociation of pancreatic acins were the sign of damage occurred in liver of fingerlings raised in 12

mg Pb/l polluted water. Livers of fish that received adsorbing materials, showed no affective lesions.

The most important results that could be concluded from the present study, that the application of 2NaEDTA, rice husk or orange peel greatly reduced the concentrations of copper and lead in water, and consequently in muscles, gills, livers and kidneys of *O. niloticus* fingerlings, hence the biochemical parameters had been returned near to its normal values, as well as histological sections reflected normal images of gills and livers.

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