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Investigating levels of selected heavy metals in surface water of Shah Alam River, Khyber Pakhtunkhwa

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Over the last few decades fresh water contamination has become a matter of concern. Among other organic and inorganic pollutants, our aquatic systems may extensively be contaminated with heavy metals. Heavy metal contamination of aquatic system has attracted the attention of several investigators both in the developed and developing countries of the world. The fact that heavy metals cannot be destroyed through biological degradation and have the ability to accumulate in the environment make these toxicants deleterious to the aquatic environment and consequently to humans who depend on aquatic products. The most common heavy metal pollutants are arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), lead (Pb), mercury (Hg) and Zinc (Zn). Their source of entry into the aquatic system could either be a single, identifiable or dispersed (and often difficult to identify). Industrial wastes create a potential source of heavy metal pollution in the aquatic environment.

Pakistan is one of the countries facing fresh water pollution mainly due to untreated discharge of industrial wastes into rivers. Here only 1% of industrial waste is treated before its discharge to the rivers. River Kabul is an important river of Khyber Pakhtunkhwa province; it receives 80000 m^3 industrial effluents every day. River Shah Alam branches off river Kabul that receives all the sewage from Peshawar, as well as from 30 surrounding villages. It also receives effluents from Sugar mills, distilleries, paper mills, tanneries, ghee mills and textile mills in that area.

The purpose of this study was to investigate the levels of heavy metals (Cd, Cr, Cu, Mn, Ni, Pb and Zn) in the surface water of the Shah Alam River. The surface water samples were collected at five sampling sites, selected on the basis of upstream and downstream industrial and domestic sewage discharge locations. Surface water samples were collected from each site in a six month period, from December to April. The elements Cd, Cr, Cu, Mn, Ni, Pb and Zn were assayed using an atomic absorption spectrophotometery and the results are given as mg of heavy metal/L of fresh water sample (mg/L). The order of heavy metal concentration was Mn ≥ Ni > Zn > > Cu > Cd ≈ Pb > > Cr. The concentrations of Ni were 20 -30 times higher than the permissible World Heatlh Organization (WHO) limits for water, Cd levels were 10 times, whereas Mn and Pb were 2-3 times higher than WHO limits. The levels of Cu, Cr and Zn were within those limits.

Although a weak correlation existed between metal concentration and temperature increase, but since the temperature change was only within 2-3°C over the sampling period, therefore, we could not deduce concentration dependence on water temperature. Except for the Mn, no strong correlation existed between water pH and metal concentration. Although metal concentration has

been reported to increase with decreasing pH, in our studies no such correlation existed (except for Mn). The absence of such correlation could be due to the dilution factor that occurs after river Naguman joins river Shah Alam. The concentrations of almost all metals detected were higher in all downstream locations. Declines in those levels occur at site where Naguman River joins river Shah Alam. Metals could accumulate in sediments and can become bioavailable to aquatic fauna (bottom feeders). An investigation into the concentrations of heavy metals in river sediments is needed for better assessment of heavy metals bioaccumulation in fish.