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Chromium contamination from tannery wastes in the soils of Hazaribagh area in Dhaka City, Bangladesh, and aspects of its phytoremediation

K. M. Shams (1), G. Tichy (1), A. Fischer (2), K. Filip (2), M. Sager (3), A. Bashar (4), T. Peer (5), M. Jozic (6)

(1) Department of Geography and Geology, University of Salzburg, Austria (2) Clausthaler Umwelttechnik-Institute GmbH, Germany (3) Austrian Agency for Health and Food Safety, Vienna, Asutria (4) Institute for Geotechnical Engineering and Mine Surveying, TU Clausthal, Germany (5) Department of Organism Biology, University of Salzburg,, Austria (6) Institute of Molecular Biology, University of Salzburg, Austria (shams@shamskm.com / Phone: +43 662-80445462)

Wastes generated from the leather processing industries located in the southwestern part of Dhaka, the capital city of Bangladesh, pose serious threat to the environment. Groundwater as well as the ecosystem of the area are on the verge of huge pollution making its way to be recognized sooner or later as one of the most polluted City in south Asia due to industrial activities. In total, seven sampling profiles have been investigated in Hazaribagh tannery area down to a depth of 5 m. Surface accumulation of total chromium reaching as high as 28000 mg/kg have been encountered at 1 km distance from the waste lagoon. Distribution of Cr(VI) is irregular in the subsurface and a maximum of about 1 mg/kg have been measured at 3 m depth. Although soil pH is alkaline in general, a sharp drop of pH has been observed at some locations both in surface and subsurface layers to as low as 3.4. Such an acidic environment can play a significant role in the fate and mobility of heavy metals in nature. Cr(VI) detected in alkaline environment in subsurface can enhance its mobility both vertical down to the aquifer and lateral towards the river Buriganga, hence again to the aquifer as the river and the aquifer are hydraulically connected.

The study area is situated on the Madhupur Clay formation. The main types of clay

minerals determined in the sediments are kaolinite and illite. Although smectite could not be determined but it has been reported from other studies. Calcium carbonate crystals have been detected in X-ray diffraction analyses, suggesting a huge organic waste input into the lagoon and surrounding area from the tannery effluents. Scanning electron microscope study showed chromium within the structure of clay minerals. The chemical composition suggests illite-smectite as being the residual fraction for chromium (Cr). Presence of lepidocrocite indicates a rather reactive phase which can undergo reductive dissolution and release chromium (Cr) in the environment.

As chromium(Cr) is widely used in many types of industries, wastes from tanneries pose a serious threat to the environment once it is disposed of. Present research conducted greenhouse pot experiments on several plant species to find out the phytoextraction potential of these plants to remove Cr from contaminated soils. *Urtica dioica*, a common nettle, proved to be the most potential candidate for this purpose with minimal addition of potassium (K) as nutrient solution. While a single nettle with 200 mg/l solution can extract as much as 16 mg/kg Cr in its above-ground parts, results with *Zea mays* and *Brassica napus* are not promising enough to be considered for bioremediation purposes. Although maize is highly tolerant showing complete growth with negligible amount of Cr in its leaves, 0.23 and 0. 38 mg Cr /kg with 200 and 500 mg/l chromium solutions respectively, it is not the right plant for Cr-contaminated sites. Mustard plants are extremely vulnerable to insects as it is edible, therefore its growth can be hindered completely leaving no opportunity to use it in the fields for phytoremediation although plants above-ground uptake of chromium (Cr) is accountable. Therefore, it can be concluded that *Urtica dioica* with an application of 200 mg/l K solution is the right plant to clean Cr-contaminated sites.