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Research Paper :

Immobilization of Pb and reduce uptake in edible and non edible crops under long term sewage irrigated soil

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ABSTRACT

To check the transfer of metals in the food chain $FeSO_4.7H_2O$ and $CaSO_4$ were used to rapidly immobilize the metals in a larger area. In batch experiment, application of $FeSO_4$ @ 5% showed greater decrease in soil pH from 7.54 to 5.55 in half an hour shaking period and consequently water soluble and exchangeable Pb concentrations decreased by 100%. Pot experiment was carried out with two flowers and two leafy vegetables as test crops with $FeSO_4$ @ 1% and 2.5%. The application $FeSO_4$ @ 2.5% decreased the bioavailability of Pb and the performance of *Tagetes erecta* was superior among the four crops.

Key words : Sewage irrigation, Chemical amendments, Immobilization, $FeFO_4$, Pb accumulations

The use of urban wastewater in agriculture is a common practice for diverse reasons, not least of which is water scarcity, fertilizers value, and lack of an alternative source of water. (Raschid *et al.*, 2006). Sewage, often untreated, is used to irrigate 10% of the world's crops, especially in urban areas, reveals the first global survey of the hidden practice of wastewater irrigation (Scott *et al.*, 2004). More than 20 m ha are irrigated with urban wastewater. Wastewater has an important impact on agricultural productivity and livelihoods. India has a population of one billion people (as of the 2001 census), with a population increase of 181 million during the 1990s alone. More than 28% of this population lives in cities with a percentage decadal growth in the urban population at 31%. Strauss and Blumenthal (1990) estimated that 73,000 ha is irrigated with wastewater in India. Consideration of the potential availability of sewage revealed that 2600 million m^3 of sewage is produced per annum in India (Bhatia *et al.*, 2001). Most wastewater irrigation in India occurs along rivers, which flow through such rapidly growing cities as Delhi, Kolkata, Coimbatore, Hyderabad, Indore, Kanpur, Patna, Vadodara, and Varanasi. The Musi alone in Andhra Pradesh approximately 40,500 ha is irrigated with waste water.

A city with a population of 500,000 and water consumption of 200 L d^{-1} per person would produce approximately 85,000 m^3 d^{-1} (30 Mm^3 $year^{-1}$), carefully irrigate to an area of some 6000 ha, the fertilizer contribution of the effluent would be N-250 kg ha^{-1} $Year^{-1}$, P-50 kg ha $Year^{-1}$, K-150 kg ha^{-1} $Year^{-1}$ (IDRC., 2006). Although lots of macro nutrients are added to soil the sewage accumulates trace quantities of heavy metals to soil unlike organic contaminants, most of the metals do not undergo microbial or chemical degradation. It persists for long time. Remediation options generally include chemical and biological immobilization of metal using a range of inorganic and organic compounds. The more localized contamination found in urban environments is remediated by metal immobilization and mobilization that include bioremediation and chemical washing (Naidu, 2004). Removal of metals through chemical washing is attracting research and commercial interest. However, very few works have been documented on heavy metal contamination of crops via sewage irrigation and none exist in relation to *Amaranthus cruentus* which is one of the most popular leafy vegetables in India. The relative importance of lead (Pb) and cadmium (Cd) in relation to other heavy metals regarded as environmental pollutants have been stressed.

Soil physicochemical properties are adversely affected by high concentrations of heavy metal, rendering contaminated soils unsuitable for crop production (Udom *et al*., 2004). It has been documented that soils polluted by industrial effluents or wastes tend to exhibit a reduced porosity, have poor hydraulic conductivity and increased acidity (Hermenez-Allica *et al*., 2007). Sewage sludge has been used successfully as a source of adding nutrients in the soil (Poykio *et al.*, 2007), at the same time it increase