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Evaluating the Reuse of Sewage in Egypt: Environmental Disciplines, Pollutants and Treatment

ABSTRACT

The aim of the present investigation is to evaluate the reuse of sewage in Egypt from the point of environmental discipline, pollution and treatment. The work given in this thesis deals with two essential parts, the first part includes the reuse of sewage water for irrigation the sandy soil present at El-Gabal El-Asfar, Abu-Rawash and Alexandria.

The second part includes the treatment processes of wastewater and treated sewage water by using different materials to remove heavy metals.

Many soil profiles were taken to represent soils irrigated for different periods (5, 7, 12, 23, 25, 40, and 45 years) besides one profile irrigated with canal water and other profile from the virgin soil were found in the same area for both El-Gabal El-Asfar and Abu-Rawash. Water samples were collected from sewage drain and from canal water. Samples from vegetable crop of cabbage plant, woody trees (E. camaldulensis and C. glauca) and also some citrus trees (Naring, Orange and Lemon) grown in the different soils were analyzed for their content of heavy trace metals. Also, treated materials were collected for treating both treated sewage water and synthetic solution to remove heavy metals as (Pb, Cd, Ni, Co, Cr, Zn, Cl^-, NO_3^- and SO_4^{2--})

The obtained results showed that:

A very slight variation in texture was observed upon irrigating soil with sewage water especially soils irrigated for 40 and 45 years, as soil texture was loamy sand in the canal water irrigated and the virgin soils and sand clay loam in soils irrigated for 40 and 45 years with sewage water

Organic matter content is generally higher in soils irrigated with sewage water than those irrigated with canal water or virgin soils and tended to accumulate in the surface layers.

Irrigating soils with sewage water decreased $CaCO_3$ content and pH of the surface layers, generally there was an increase in EC values of the soils irrigated with sewage water than those of the irrigated canal or virgin soils.

In respect to DTPT and/or HNO_3-extractable, heavy metals (Fe, Cu, Mn. Zn, Pb, Cd, Ni, Co and Cr) in both soil cultivation with (Citrus and Woody) trees and soil cultivation with cabbage plant which irrigated with sewage water at different periods under investigation, increased as the irrigation periods increased. The region of cultivated with (Citrus and Woody) trees maintained higher heavy metals concentrations than the region of soil cultivated with cabbage plants.

Data indicate that the bioavilability of trace elements to plant can be varying according to plant species. Plant heavy metals were concentrated mainly in the edible parts of cabbage plants and citrus trees. However, their accumulation in cabbage leaves are higher than citrus trees leaves. E. camaldulensis and C. glauca were capable of taking heavy trace metals, so, they can be used as filters for the purification of sewage water and reduced of the spread of these pollutants in the soil.

Evaluating the treatment process of sewage water and waste water by using different treatment materials as Amberlite, CM-cellulose, Cellulose phosphate, Dowex, DEAE-cellulose and

water hyacinth at different heavy metals cations and anions were recorded under the study of three factors: time of shaking, pH of solution and the concentration of metal ions. Generally, uptake of metal ions increased by increasing the contact time, also, increases concentration increased the uptake percent metal ion except at high concentration remained constant according to Langmuir model while water hyacinth uptake percent of metal ions decrease by increasing the concentration. On the other hand, decreased pH increasing the uptake percent of Amberlite, CM-cellulose, Phosphate cellulose, Dowex and DEAE-cellulose. And the *vice versa*, uptake percent of water hyacinth increased by increasing pH values

Removal of some cations and anions from treated sewage water increased by increasing weight of different treatment materials.

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CHAPTER III
REULTS & DISCUSSION

III. 2. Soil