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DETERMINATION OF TOTAL CONCENTRATION OF CD, CR, PB, CU, NI AND ZN IN CITY AND WASTEWATER.

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Annotation

Heavy metals are one of the important factors that affect the final disposal of sewage sludge. In this paper, the metal mobility and bioavailability metals in sewage sludge were studied by using Community Bureau of Reference (BCR) sequential extraction procedure to get more information for the reasonable disposal of sludge. Sewage sludge was collected from five municipal wastewater treatment plants and three industrial wastewater treatment plants. The sludge was examined for and the total concentrations and different chemical fractions of Cd, Cr, Pb, Cu, Ni and Zn. The total metal concentrations of heavy metals in sludge varied greatly. The contents of Zn and Cu were the highest, followed by then Cr, Ni and Pb and the content of Cd was the least. There was no significant difference in total metal concentration between municipal and industrial wastewater treatment plants. Fractions extracted by the BCR sequential procedure were acid soluble/exchangeable, reducible and oxidizable fraction. Sludge pH was found to have profound effect on the chemical fractions of heavy metals. Acidic sludges (Xiamen and Jinlin Petrochemical Group Co., wastewater treatment plant) had higher proportion of the acid soluble/exchangeable fractions than in neutral sludge. In neutral sludges, Pb and Cr were principally distributed in between the oxidizable fraction and the residual fraction; Cu was in the oxidizable fraction; Cd mainly in the residual fraction in municipal wastewater treatment plants and had high percentage of acid soluble/exchangeable and reducible fractions in industrial wastewater treatment plants; Ni and Zn had higher percentage in the acid soluble/exchangeable and the oxidizable fraction.

Key words

Cd, Cr, Pb, Cu, Ni, Zn, municipal, industrial wastewater, treatment,plants, proteins, peptides, enzymes.

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Sewage sludge contains many organic contaminants (such as PCBs and PAHs), heavy metals and pathogens. Non-hazardous treatments of sewage sludges can degrade parts of the organic pollutants, effectively kill some pathogens, but heavy metals present in sludge cannot be removed by common treatment technologies such as composting, aerobic or anaerobic digestion. So the sludge disposal may result in secondary environmental pollution if treated improperly. Among the different ways of sewage sludge disposal, land application is low cost and high effective and has been used widely. However, application of sewage sludge may result in heavy metal accumulation in cultivated soils. This fact has received more and more concern in recent years.

Detailed information on heavy metals present in sewage is necessary before their land application. The threshold values of toxic limits heavy metals in sludge have been set in many countries for their safe disposal to agricultural fields and to reduce their potential risk hazard on agricultural ecological system. Some studies have shown that the available fraction of heavy metals mainly decided the mobility, bioavailability or phytotoxicity of heavy metals in soils. Therefore, the quantification of different chemical fractions of heavy metals in sewage is necessary for information on metal mobility, as well as on their bioavailability or phyto-toxicity.

On the other hand, the source of heavy metals in wastewater, whether domestic or industrial, also has profound effects on the total content as well as chemical fractions of heavy metals in sludge. For example, industrial effluents are the predominant source of Cd, Hg, Cr and Ni, while Cu and Zn are mainly of domestic origin, and the major source of Pb may be both surface runoff and domestic wastewater. In China, mainly the domestic wastewater and partly industrial wastewater and surface runoff are used in municipal wastewater treatment plants. Wastewater treatment plants are run by the large scale corporations to treat their effluents before their ultimate discharge into environment. So there might be some differences in total content and chemical fractions of heavy metals in selective sewage sludge samples.

In the present paper, sewage sludge collected from five municipal wastewater treatment plants and three industrial wastewater treatment plants of petrochemical, brew and paper industry was examined for the total concentrations of Cd, Cr, Pb, Cu, Ni and Zn and chemical fractions of heavy metals to get a preliminary assessment for the land application of sewage sludge.Wet anaerobic sludge samples were obtained from selective wastewater treatment plants listed in Table 1. The samples were air-dried, passed through a sieve having openings of 2 mm

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diameter and stored in dry glass bottles at room temperature. Sludge pH was measured in 1:2.5 sludge and water suspensions. Organic carbon of the sludge samples was determined by ashing at 360 °C for 2 h. Cation exchange capacity (CEC) values were determined following the procedure outlined by Grauer. The data contained in Table 2 show that the properties of sludge from selective wastewater plants varied widely. The ranges were from 250 to 560 kg−1 for organic carbon, 4 to 26 kg−1 for total N, 0.8 to 19.3 g kg−1 for total P and 2.0 to 12.6 g kg−1 for total K. Their contents are similar to or above them in farmyard manure. In China, the mean contents of soil were 10–40 g kg−1 for organic matter, 1.0–2.0 g kg−1 for total N, 0.44 to 0.85 g kg−1 for total P and about 16 g kg−1 for total K, respectively.

Conclusions.Sewage sludge collected from eight sewage treatment plants has high organic carbon, and is rich in nutrient like N and P, so they can be used as good organic fertilizers. But the impact caused by heavy metals after their agricultural application of sludge should be assessed. Total concentration of Cr, Ni and Cu in S3 and Cd and Zn in S5 exceeded the permitted values of GB 18918-2002, so S3 and S5 cannot be used in agriculture due to high metal concentration. Total metal concentrations in sludge.

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