ABSTRACT

The effluents and sludge discharged by the industries and Common Sewage Treatment plant (CSTP) within the Biyagama Export Processing Zone (BEPZ) were analysed for heavy metals with a view to identify whether any wastes are being discharged by the BEPZ in hazardous concentrations with regard to heavy metals. The heavy metal content in the effluents was compared with the standards specified by the Board Of Investment of Sri Lanka (BOI) with regard to effluent discharge and the leachable heavy metal content in the sludge was compared with the standards specified by the United States Environmental Protection Agency (USEPA) for solid waste disposal by landfill. Duration of the study was from June 1994 to December 1994.

The sludge was analysed for leachable and total heavy metal content. The leachable metal in the sludge, was analysed using the Toxicity Characteristic Leaching Procedure (TCLP) test as recommended by the USEPA. The metal content in the effluents and sludge was determined using an atomic absorption spectrophotometer as the detection limits of this equipment for each metal analysed are lesser than those specified in the standards. The effluents were analysed for Cadmium, Chromium, Copper, Nickel, Lead and Zinc content. The sludge was analysed for the same metals except for Nickel. In the USEPA standards, a tolerance limit has not been specified for Nickel.

All the effluents and sludge samples tested were in conformity to the specified standards except; the Copper content in the effluents and sludge discharged by the electronic industry and leachable Zinc content in the sludge obtained from the sand drying beds of the CSTP. The corresponding standards for above are; 3 mg/l, 100 mg/l and 100 mg/l respectively.

The Copper content in the effluents of the electronic industry ranged between 2 - 25 mg/l with a mean value of 8.94 $\pm$ 6.69 mg/l. This was found to be significantly higher (using t - test, $P<0.05$) in comparison to the BOI specified standard.

The leachable Copper content in the sludge obtained from the in-house treatment plant of the electronic industry ranged between 50 - 300 mg/l with a mean value of 167.3 $\pm$ 69.47 mg/l. The leachable Zinc content in the sludge obtained from the sand drying beds of the CSTP ranged between 110 - 300 mg/l with a mean value of 181.9 $\pm$ 46.34 mg/l. As such, the sludge obtained from the in-house treatment plant of the electronic industry is hazardous with regard to the Copper content and sludge obtained from the sand drying beds of the CSTP is hazardous with regard to the Zinc content.

The total content of each metal analysed was found to be considerably high in most of the sludge samples. This observation reflects the fact that the treatment methodologies adopted at BEPZ for the treatment of effluents have been

effective in preventing metals leaching into the environment in hazardous concentrations. Mechanisms similar to the treatment methodologies adopted at BEPZ operate in nature which are responsible for bonding of the metals into the particulate matter so that the movement of metals among various components of the environment is prevented.

The Copper from the effluents of the electronic industry could be removed by sulphide precipitation process. This would also help in the reduction of the leachable Copper content in the sludge generated from the in-house treatment plant of the electronic industry. The excess Zinc in the sand drying beds of the CSTP can be reduced by modifying the in-house treatment plants within the BEPZ. In addition to above methods of sludge treatment, few other methods also could be recommended such as disposal of sludge in a specific area where there is no provision for the leachate to reach the ground water table/inland surface water body, lining of landfill with an impervious material and use of sorbents capable of removing metals. However, practicability of implementing such measures could be considered only after carrying out tests at pilot scale.

Except of Copper and Zinc other metals were not detected in hazardous concentrations. However, the study carried out was confined to the industries present during the study period. There would be more industries established in the future. Therefore, it is necessary to continuously monitor the effluents as well as the solid wastes generated for heavy metals from now onwards so that any possible undesirable effects could be identified from the beginning.

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