HEAVY METAL POLLUTION AT KAVANADU, KOLLAM, KERALA

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ABSTRACT

This paper discusses heavy metals in the soil collected from three sites from the solid waste dumping ground at Kavanadu. Also, control samples were collected and analyzed for the said heavy metals. The levels of all heavy metals differed significantly among the sites. Average values of heavy metals in different sites were higher than those of the levels proposed by European Union, 2000. The dumpsites in Kavanadu therefore pose negative consequences on the soil and groundwater environment.

Key words: Heavy metals, solid wastes disposal, Kavanadu dumping site, compost.

INTRODUCTION

In Kollam, a large section of household , shops and commercial establishments generally do not practice waste segregation at source. A few households/commercial establishments separate recyclable/reuse waste and sell the same to scrap dealers. Currently residents leave their household refuse at the nearest open temporary storage point in the morning from where it is collected by the Municipal Corporation (MC) staff Market waste is directly collected form large heaps accumulated in front of the market; none of the market stalls have individual containers. At the SNT fish and meat market the common practice is to dump waste in to the adjacent area long side a canals. Every day after1800 hours the waste is openly burnet. Shops have no individual storage bins.

There are 260 waste collection points located with in the M C area using a variety of methods for the primary collection And storage of solid waste comprising : (i) open storage points;(ii) concrete cylindrical bins: (iii) small steal bins. All bins are emptied manually. Secondary open collection point are open places of waste disposal conveniently identified by the conservancy staff for waste disposal from house holds, street sweepings and drain cleanings. These are spread all over the city where waste is stored openly prior to being collected and transported for disposal .Concrete cylindrical bins have been placed in residential areas but are mostly phased out due to difficulty in emptying.

. When the compost from MSW is used as manure some heavy metals are being subject to bioaccumulation and may cause risk to human health when transferred to the food chain. Exposure of heavy metals may cause blood and bone disorders, kidney damage and decreased mental capacity and neurological damage (NIEHS,

2002). Therefore, heavy metal needs serious attention before the application of compost made from MSW. In certain cases the metal contents exceed the specified limits (Merian,1991; Cebula et al., 1995). The occurrence of cadmium, cobalt, manganese, nickel, lead and zinc in MSW compost was reported by Ciba et al. (1999). The environmental impact assessments of heavy metals present in our environment have been well documented (Ipinmoroti et al., 1970). However, the need for continued and effective monitoring of some heavy metals to source and distribution in the environment is highly necessary. Most heavy metals occur at varying extents within all components of the environment. They are present in trace concentrations in soil and vegetation and much more prominent in solid wastes containing non-biological and used products (Thomton, 1982).

MATERIALS AND METHODS

The present study was carried out at Kavanadu about 4 km from Kollam town. Three stations were fixed for the collection of soil samples .This include the centre of dump, 20 m away and 30 m away from the centre of dump. The control samples were collected from 100 m away from the dump site. The soil samples were collected at 0 – 20 cm depth at all

sites. in March & April 2009. The pH was measured using the water and KCl methods (Mathieu and Pieltain, 2003).

All samples were collected same day and kept in polythene bags which have been washed with detergents solution rinsed with distilled water to avoid metal contamination of the sample. All soil samples were air-dried, ground and the samples have passed through a sieving procedure (Smedes et al, 2000; Loring, 1991; Limpenny& Rowlatt,1994).The samples were then sent to Regional Analytical Laboratory, Hyderabad for analysis. Total concentrations of Cu, Ni, Zn, Cd and Pb were determined using the standard procedure of the French Normalization Association (AFNOR, 1987). Cd and Pb were also determined by GFAAS (Graphite Furnace Atomic Absorption), while Cu, Zn, Ni were determined by the Less flame atomization.

All data generated were analyzed statistically by calculating mean and coefficient of correlation, The analysis of variance was carried out using Stat Graphics 3.0. Significant differences were considered at $P < 0.05$ and mean values were separated using the Duncan's multiple range test.

RESULTS AND DISCUSSION

Table shows the mean concentration of heavy metals in the soil samples from all the dump sites. On the average, high concentrations of Cu, Ni, Zn, Cd and Pb were found in

the soil samples collected at the centre of the dump sites that is, 140, 90, 450, 4.2 and 200 mg/kg respectively. The lower concentration was obtained in the soil samples taken at distance 30 m away from the centre of dumpsites, 6.40, 80, 35, 210 ,2.90 and 115 mg/kg respectively. The control registered 30, 15, 42, 0.30, and 20 mg/kg respectively.

On the average, the concentrations (mg/kg) of Cu, Ni, Zn, Cd and Pb are exceptionally high. Similar observations have been reported on Bode-Osidump site and Obafemi Awolowo University central refuse dump respectively (Alloway and Davies, 1971;Amusan et al., 2005). It is also revealed from Table that

there is an obvious gradual reduction in the concentration of heavy metals as we move few meters away from the center of the dump site of a particular location. The surfaces of the soil are better indicators of metallic burdens (Davies, 1973). The high correlation (0.9875) of the metals examined in the soils dump site indicates similarities in the origin of the metals. The sequence of heavy metal available concentrations in soil at the collection sites sites were Zn > Pb > Cu > Ni > Cd. This is in

good agreement with total concentrations. It's known that the bioavailability of metals in soil depend on pH, organic matter and total metal content (Sauve et al., 2000). The available concentrations of all metals in soil differed significantly among sites except Cd for which no significant difference (P > 0.05) was found among months. The mean pH of the soils at the three stations ranged from 6.20 to 7.30. It seems that the lower and the slight variation of the soil pH have favoured the bioavailability of Cd in the sampling. These findings are in agreement with Bingham et al. (1980), Mahler et al. (1980), Hooda and Alloway (1994), and Ramachandran and D'Souza (1998) who reported that Cd and Zn availability and uptake was higher from low pH than higher pH soils. The available concentrations of heavy metals were significantly higher in amended soils than in the control.

The descending order of heavy metal contents is zinc, copper, lead, nickel,and cadmium. Comparison of heavy metal contents with Indian standards for compost shows that zinc, copper and lead exceed the limits. The centre of dump shows higher metal contents than rest stations.

The levels of all heavy metal differed significantly among the sampling sites. The variation of the level of heavy metal could be due to the composition of solid waste. The municipal solid wastes showed large amounts of plastics, paper, accumulators and batteries.

It's known that batteries can be a source of Cd, Ni, Pb and Zn; dust, dirt and clay particles in paper can be a source of Ca; magazine paper is a notable source of Fe, Pb and Zn; other papers can be a source of Cu and Mg (Lisk, 1988). It is recommended that the government should consider a basement treatment for dumpsites before use. This will provide sorption surfaces for pollutant and prevent groundwater contamination. But still the study clearly points out that the concentration of the metal ions is increasing with respect to the vicinity to the dumping site and continued practice of waste dumping in the similar way may result in further increments of metal ions aggregation and pollution of groundwater sources, hence precautionary measures should be immediately taken to avoid the consequences.

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Table showing average concentrations of heavy metals (mg/kg) in the soil at Kavanadu.

Sites	**pH**	**Cu**	**Ni**	**Zn**	**Cd**	**Pb**
Control	6.23	39	31.03	59.2	0.28	30
Centre of dump	6.58	99.80	37.42	380	3.50	307
20 m away	6.91	50.19	43.94	200	2.92	99.38
30 m away	7.36	137	40.85	245	3.85	120

Maximum permissible levels according To European Union, 2000	**5<pH<6**	20	15	60	0.5	70
	6<pH<7	50	50	150	1	70
	pH > 7	100	70	200	1.5	100