Journal of Aquatic Biology and Fisheries Vol. 2/2014/ pp. 755 to 758

ANALYSIS OF SLUDGE DREDGING FOR HEAVYMETALS IN TWO CONTAMINATED SITES AND POSSIBILITY OF SOURCES CONTAMINATION – A CASE STUDY

Subha. M[1]*. and Srinivas, N[2].
[1]*Engineering Staff College of India,Hyderabad 500032, A.P, India*
[2]*Environmental Studies, GITAM Institute of Science, GITAM University,Visakhapatnam, A.P, India - 530 045*
**Email: shubha_kc@yahoo.co.in*

Received on: 10 October 2013, accepted on: 12 December 2013

Abstract: The increases in population, industrialization and urbanization have led heavy metal contamination in both terrestrial and aquatic ecosystem. As a result, the ecological balance of the ecosystem is distressed which leads to variation in the biotic and abiotic factors of the particular habitat. In this present study, two sites in Hyderabad were selected to assess heavy metal concentration. The sites are near to Hussainsagar lake, a water body and Amberpet near to Sewage treatment plant. The dry sludge samples were collected from these sites and are subjected to acid digestion. Seven heavy metals were analyzed by using Atomic absorption spectrophotometer. The results have shown that the sludge's are having Cu, Ni, Zn, Pb and Hg in higher proportion followed by Ni, Cr and Ag. The possible source of contamination of metals in sludge's are industrial effluents mixing with sewage, especially metal plating and metal polishing industries effluent entering through nallas to the sewerage drain and it is the main source of effluent entering in to sewage. The results have shown that the heavy metal concentrations in sludge's are within the per missible limit s fo r lan d r ec lamation stu d ies. The application of low cost remediative method like phytoremediation may useful in long run to arrest leaching in to soil or water body. Phyotoremediation experiment with suitable hyper accumulative plants for absorption of toxic metals for sludge's will help for safe sludge disposal.

Keywords: Sludge, Heavy metals, Remediation

INTRODUCTION

Rapidly increasing population, industrialization, and urbanization in India are responsible for waste generation in epic proportions. A miserable waste management strategy translates to overflowing land fill sites with more unsorted waste getting added every hour. Currently India is generating nearly 68.8 million tones of municipal waste including sewage sludge per annum and the management of waste in an environmentally sustainable manner is a challenging task. Sewage sludge contains various micro nutrients, non essential toxic metals, organic pollutants and microorganism (Alloway and Jackson, 1991). The characteristic of sludge varies with area and time. It depends on pollution load of treated water and technical characteristics of the sludge treatment facility (European commission, 2001). The major sludge recycling or disposal routes are landspreading, incineration or landfilling. The sewage sludge is not only generating from discharges of residential areas but also from industry. The sludge contains heavy metals, which may vary considerably with time and activities (Baveye et al., 1999). Hence, the removals of heavy metals are necessary from sewage sludge before disposal of application to farmland (Saleem E Gaber et al., 2011). As a national capacity building programme Ministry of Environment and Forest, Government of India (GOI) has started bioremediation of lakes all over India, with world bank support on "Capacity Building for Industrial Pollution Management (CBIPM) project" which will help the GoI to establish a National Programme for Rehabilitation of Polluted Sites (NPRPS) as a framework for scaling up the clean up and rehabilitation of polluted sites and facilitate the reduction of environmental and health risks associated with legacy polluted sites.

In this present study, two sites in Hyderabad are identified a site near to Hussainsagar lake, a water body and site near to Amberpet Sewage treatment plant, a UASB treatment facility of Municipal Sewage. Both sites have huge sludge deposition in nearby area. A study is carried out to analyze the heavy metal elements from these sludge's through Atomic absorption method and its concentration. The data will be useful to get an idea about its suitability to low cost remediation studies such as Phytoremediation.

MATERIALS AND METHODS

Study Area

Area Near Hussain Sagar lake: Hussain Sagar, the man-made lake set up in the year 1562, provided drinking water to the city till early 1930s.The latitude and Longitude coordinates are 17.4500° N, 78.5000° E (Fig. 1a). However, it has over the years been polluted to levels that has been described as 'unfit for use in any human activity .Presently untreated sewage and Industrial effluent (Campbell *et al.,* 1983), Cattle Washing, Vehicle washing, dumping of domestic solid waste along the shorelines, immersion of ganesh, durga idols which created high sediment, bad Odour and leads to Eutrophication (Branomand Sarkar, 2004).

As Government Initiative Hussain Sagar catchment improvement project has started with goal of Dredging and Disposal of Sediments, Construction of Alternative Idol Immersion Places, Repair of Surplus Weir, Installation of Aeration Equipment, Shoreline Improvement Nalla Improvement. The Dredged sludge from the lake is stored in temporary facility and after treatment it will be transferredto permanent facility for secured Land fill.

Area Near Amberpet Sewage treatment plant (339MLD): It is Asia biggest STP using UASB Technology andtreated effluent is let out to musi river. The latitude and Longitude coordinates are 17.3771° N, 78.4923° E (Fig. 1b). The UASB Sludge is stored in their facility and later it will be sent to Secured landfill.

The present study is aimed to analyze heavy metal analysis of Sludge for both sites and its concentration to get preliminary idea about its suitability to remediation studies.

METHODOLOGY

The Dry sludge sample are taken from two sites according EPA Guidelines of Composite Soil Sampling methodology(SESD Operating Procedure - Soil Sampling, EPA, 2012).The sample is subjected to analysis of Atomic absorption spectrometer.

AAS Procedure

The sample is analysed in Variant Spectra 220.A representative 0.3g (wet weight) sample is heated with repeated additions of nitric acid (HNO_3) and hydrogen peroxide (H_2O_2) Hydrochloric acid (HCl)is added to the digestate. This digestate will be filtered. Then the filter paper and residues are rinsed with reagent water. After all, the digestate is diluted to a final volume of 100 mL.

Analysis by Atomic Absorption Spectroscopy (AAS)

Recorded the absorbance values of the standard solutions, the sediment sample, and the blank for each of the metals. Also recorded the wavelength of the lamp used for each metal. From the absorbance values of the standards, made a calibration curve for each of the metals by plotting absorbance on the vertical axis and concentration on the horizontal axis. Subtracted the absorbance value of the blank from the sample value for each of the metals. Then determined the concentration of each metal in your sample from the corresponding calibration curve. The values is expressed in units of ppm & ppb

RESULTS AND DISCUSSION

Heavy Metals in Sludge's: Heavy metal concentration of the two areas are representaed in Table 1. The sludge taken near Hussain Sagar sites and analysed have Chromium(Cr) less than 10 ppm, Silver (Ag) less than 2 ppm, Copper (Cu) 124 ppm, Nickel (Ni) 33 ppm, Zinc (Zn) 323 ppm, Lead (Pb) 97 ppm, Cadmium (Cd) 39 ppm, Mercury (Hg) 922 ppm.The Sludge taken near Amberpet STP and analysed have Chromium less than 10 ppm, Silver (Ag) 21 ppm, Copper (Cu) 568 ppm, Nickel (Ni) 74 ppm, Zinc (Zn) 1401 ppm, Lead (Pb) 76 ppm, Cadmium (Cd) 299 ppm, Mercury (Hg) 4600 ppm. Copper, Mercury, Zinc and Cadmium concentration are high in the sludge above the standard limits of contaminated site (Fig. 2).

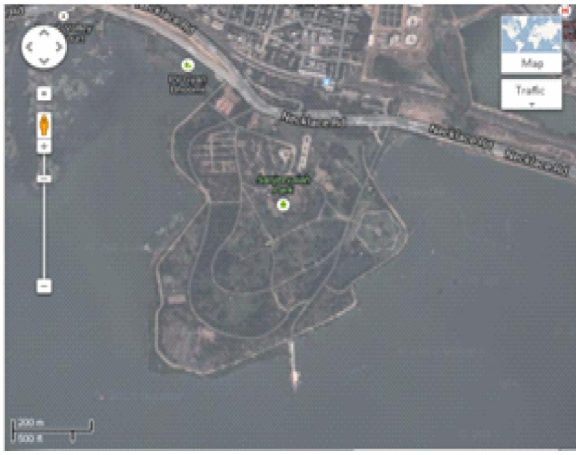

Fig. 1a. Showing Satellite Imaginary of Hussainsagar

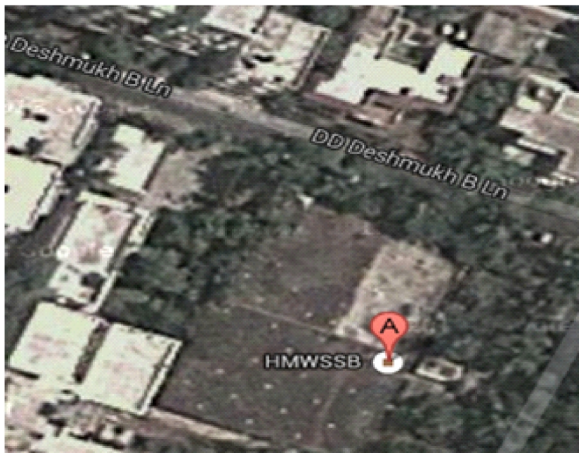

Fig. 1b. Showing Satellite Imaginary of Amberpet STP 339MLD

Table 1. Heavy Metal Concentration

Sample	Fe_2O_3 (%)	Cr (ppm)	Ag (ppm)	Cu (ppm)	Ni (ppm)	Zn (ppm)	Pb (ppm)	Cd (ppm)	Hg (ppb)
Area Near Hussain Sagar Site	5.69	<10	<2	124	33	323	97	39	922
Area Near Amberpet STP	4.47	<10	21	568	74	1401	76	299	4600

The possible source of contamination of metals in sludge's are industrial effluents mixing with sewage, especially metal plating and metal polishing industries effluent entering through nallas to the sewerage drain and it is the main source of effluent entering in to sewage. Mercury is high in the sludge and possible source is bulbs dumped in the sewage and also effluent entering from industry situated round. Fig. 3 illustrate the mercury absorbance and Fig. 4 shows the Copper curve

The presence of numerous metals in sludge's are reported in literature. Once sludge is mixed with soil the heavy metals accumulate in upper layers of the soil. The metals bind with organic or mineral particles. However, the bioavailability of metals to plants and micro-organisms influenced by several factors particularly pH (European commission, 2001).

The results have shown that the heavy metal concentrations in sludge's are within the permissible limits for remediation studies. The maximum acceptability of heavy metals in sewage sludge for soil fertilization and land reclamation are reported by chefetz et al., 1996; Moreno et al., 1999.

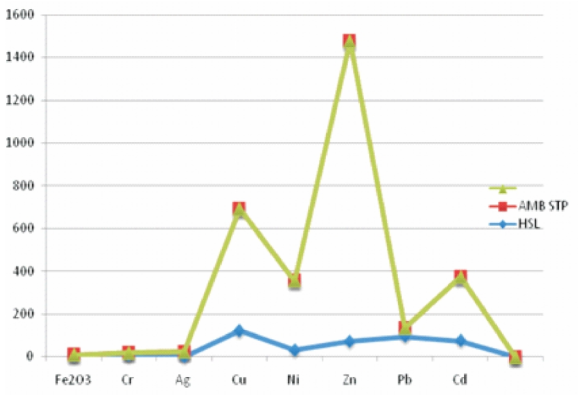

Fig. 2. Concentration graph in ppm

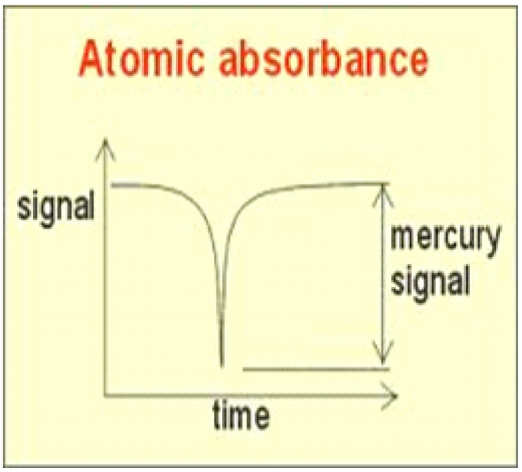

Fig. 3. Mercury absorbance

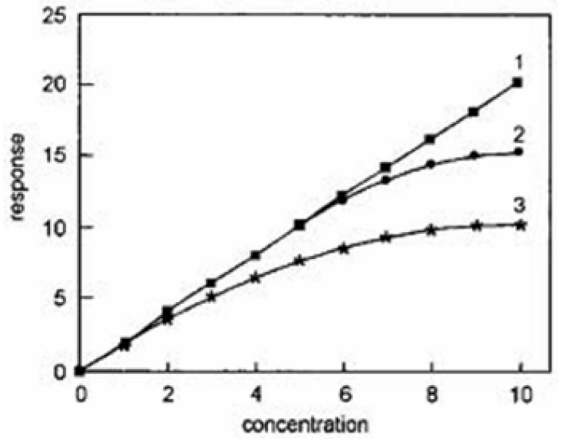

Fig. 4. Copper concentration curve

CONCLUSIONS

The contaminated sludge which cause health hazards in long term. Large variety of neutralization methods for sewage sludge is available but the cost is a limitation practice. The application of low cost remediative method like phytoremediation may useful in long run to arrest leaching in to soil or water body. Phyotoremediation experiment (Salt et al., 1995), with suitable hyper accumulative plants for absorption of toxic metals for sludge's will help for safe sludge disposal.

REFERENCES

Alloway, B.J. 1990. In Heavy Metals in Soils (edAlloway B. J.), Blackie, Glasgow.

Baveye, P., McBride, M.B., Bouldin, D., Hinesly, T.D., Dadhoh, M.S.A. and Abdel-sabour, M.F. 1999. Mass balance and distribution of sludgeborne trace elements in a silt loam soil following long-term applications of sewage sludge Sci Total Environ. 227: 13-28.

Branom, J.R. and Sarkar, D. 2004. Phosphorus availability in sediments of a sludge disposal lake. Environmental Geosciences, 11(1): 42-52.

Chefetz, B., Hatcher, P.G., Hedar, Y., Chen, Y. 1996. Chemical and Biological Characterization of Organic Matter during composting of Municipal Solid Waste. *J. Environ.Qual.,* 25: 776 p.

European Commission. 2001. Disposal and recycling routes for sewage sludge Part 3 – Scientific and technical report. Luxembourg.

Moreno, J.L., Hernandez, T., Garcia, C. 1999. Effects of Cadmium - contaminated sewage sludge sompost on dynamics of organic matter and microbial activity in an aird soil. *Biol. Fertil. Soils,* 28: 230 p.

Seleem E. Gaber, Mahmoud S. Rizk and Mohamed M. Yehia. 2011. Extraction of certain heavy metals from sewage sludge using different types of acids. *Biokemistri*. 23 (1), 41-48.

Salt, D.E., Blaylock, M., Kumar, PBAN, Dushenkov, V., Ensley B.D., Chet, I., Raskin, I. 1995. Phytoremediation: a novel strategy for the removal of toxic metals from the environment using plants. *Bio-Technology,* 13: 468–474.