The Andhra Agric. J 65 (3): 582-585, 2018

Characteristics of Textile Sludge Obtained from Nuziveedu Seeds Limited, Guntur District of Andhra Pradesh

K Anand Kumar, P Prabhu Prasadini, G Ramachandra Rao and G Kishore Babu
Department of Environmental Science, Advanced Post Graduate Centre, Lam, Guntur.

ABSTRCT

An experiment was conducted to study the characteristics of textile sludge obtained from Nuziveedu Seeds Limited, Chandole of Guntur district of Andhra Pradesh. The textile sludge was collected and shade dried for physico-chemical and chemical analysis in department of Environmental Science. Analytical data showed that the textile sludge was neutral in reaction (pH of 7.18) with EC of 1.93 dS m^{-1} and organic carbon content of 13.41percent. The textile sludge was found to have high organic carbon percent. N, P and K contents of textile sludge were 2.6, 0.2, and 2.8%, respectively. Micronutrients namely Zn, Fe, Mn and Cu were found to be 19.5, 468.1, 32.0 and 24.3 ppm were within permissible limits. Whereas in case of heavy metals Cd content has exceeded SEPA limits. However Cr content was found to be higher than Municipal Solid Waste Rules and all others was within permissible limits. This indicates that various other options can be explored for its suitable management other than the conventionally used options like landfilling.

Keywords: *Characteristics, Physic-chemical, Textile sludge.*

India has several industrial sectors, among that textile industry is the oldest. There are about 21076 textile units in India, out of which Tamilnadu has the highest, 5285 units followed by Maharashtra. And more than 700 large textile mills are mainly concentrated in Ahmadabad, Bombay, Tirpur, Erode, Coimbatore, Kanpur and Delhi. The suspended and dissolved solids along with those added during the wastewater treatment process, are separated in the form of settleable solids called sludge. A textile unit processing 3-4 tons of yarn or fabric is liable to generate 50 kg of sludge per day (Ansari and Thakur, 2001). Large volumes of organic waste is generated by the textile industry and released into the environment. Sludge can become a problem if it is improperly managed or disposed off. Concerns about environmental quality have led to the introduction of alternative disposal methods such as the use as nutrient source to plants and as soil conditioners. The use of textile sludge in agricultural lands can be justified as an appropriate destination for waste recycling as it normally contains high organic matter, N, P, K and micronutrients contents as reported by Balan and Monteiro (2001).

MATERIAL AND METHODS

Sludge collection

Textile sludge was collected from NSL textiles, Guntur, Andhra Pradesh

Sludge analysis

The pH was determined in 1:5 sludge water suspension *i.e*., 20 g of sludge in 100 mL of distilled water using combined glass electrode pH meter. EC of sludge was measured in the supernatant of 1:5 ratio sludge water suspension with EC bridge (Jackson, 1973). Organic carbon content of the sludge was estimated by the wet digestion method (Walkley and Black, 1934). Available Nitrogen content estimated by Bremner (1965) method and was expressed in kg ha^{-1}. Sludge digested with diacid mixture (9:4) was used for determination of P, K, micronutrients and heavy metals (Lindsay and Norvell, 1978).

RESULTS AND DISCUSSION

The results of analysis of textile sludge of NSL, Guntur presented in table 1 showed its physico-chemical & chemical properties. The analytical data of sludge revealed that it was neutral in reaction with a pH of 7.18 had EC of 1.93 dS m^{-1} and organic carbon content of 13.41percent. These results were in conformity with the results of Araujo *et al*. (2007) and Hammadi *et al.* (2007) who reported a pH of 6.8 and 7.05 for textile sludge, respectively. Parameswari and Udayasoorian (2013) reported high EC value of 4.53 dS m^{-1}. Patel and Pandey (2008) and Pandey *et al*. (2011) also reported high organic carbon values in the sludge generated in CETPs of Rajasthan and Tamilnadu.

The major nutrients namely N, P and K contents of textile sludge were 2.6, 0.2 and 2.8%, respectively. Similar values were reported by Krishnamoorthy *et al.* (2015). The examination of the data on total heavy metals showed the order of Fe > Cr > Ni > Mn > Cu > Pb > Zn > Cd. Micronutrients *viz.,* Zn, Fe, Mn and Cu

were recorded as 19.5, 468.1, 32.0 and 24.3 ppm, respectively. Rosa *et al*. (2007) reported micronutrients in textile sludge to the extent of 937.70, 3942, 30.64 and 40.14 ppm of Zn, Fe, Mn and Cu, respectively. The permissible level given by different nations is presented in the Table 3. Well documented studies disclosed that heavy metals such as Zinc (Zn) and Copper (Cu) are principal elements restricting the use of sludge for agricultural purposes (Udom *et al*., 2004; Dai *et al*., 2007). But in the textile sludge studied, the Cu content was 24.3 mg kg^{-1} and Zn content was 19.5 mg kg^{-1} which was lower than permissible limits set for China and India. Sludge contained heavy metals namely Pb, Ni, Cd and Cr to the extent of 22.6, 37.6, 4.5 and 106.6 ppm, respectively. Similar ranges of values were reported by Patel and Pandey (2008) and Islam *et al.* (2009). Maddumapatsbandi *et al.* (2014) and Pandey *et al.* (2011) also reported presence of heavy metals in textile sludge.

The heavy metals content was compared with different standards as shown in Table 2 and 3. The content of Pb, Cr, Zn, Cu and Mn in textile sludge were below the permissible limits as prescribed by Awashthi (2000) and *State environmental protection Administration* (1995) as shown in Table 2, whereas Cd was found to be higher than the SEPA limit.

Table1: Characteristics of Textile sludge used in the study

S.No.	Character	Value
1	pH	7.18
2	EC (dS m^{-1})	1.93
3	Organic carbon (%)	13.41
4	Nitrogen (%)	2.60
5	Phosphorus (%)	0.20
6	Potassium (%)	2.80
7	Zinc (ppm)	19.50
8	Iron (ppm)	468.10
9	Manganese (ppm)	32.00
10	Copper (ppm)	24.30
11	Lead (ppm)	22.60
12	Nickel (ppm)	37.60
13	Cadmium (ppm)	4.50
14	Chromium (ppm)	106.60

Comparison of the heavy metal content in the sludge studied with the allowable limits for heavy metals of biosolids for land application as shown in table 3, indicated that the heavy metals *viz.*, Pb, Ni, Cr, Cd, Cu and Zn present in textile sludge were below the permissible limits prescribed by USEPA – 503 rules (1993), Commission of European Communities (1980) and Ministry of Environment & Forests (2000). However, Ni, Cr and Cd were close to the limit as prescribed by Ministry of Environment & Forests indicating that its continuous application to soil might be hazardous. In order to ensure safe application of compost, the standards laid down in the notification on Municipal Solid Wastes (Management & Handling) Rules, 1999 notified on 27th September, 2000 by the Ministry of Environment and Forests, Government of India, for Production of compost are given in the table 3. The comparison revealed that the content of Cr in sludge was higher than permissible limit, Cd was on par and Ni was close to the permissible limit. Contents of Pb, Zn and Cu were well within the limits.

The textile sludge was obtained after physico-chemical treatment from textile wastewater treatment plant in the NSL, textiles. It was characterized for different physico-chemical parameters and heavy metals. The characterization data indicates the neutral nature of textile sludge having high conductivity and also having high organic carbon, N, P and K contents. Micronutrients and heavy metals present in textile sludge were within the permissible limits. Whereas Cd was higher than the *State Environmental Protection Administration* permissible limit and Cr was also higher than the Municipal Solid Waste rules. Sludge is generated in huge quantity which is being labelled as hazardous sludge as per the Hazardous Waste and Management and Handling (Amendment rules, 2003), which makes the sludge management process further important. Therefore, an economically sound and environmental-friendly solution like composting the sludge using microbial consortium may be tested for its safe disposal for productive purposes.

Table 2: A comparison of heavy metal content (mg kg^{-1}) in sludge with permissible limits

Metal	Present study	Permissible limit in India[a]	SEPA limit in China[b]
Pb	22.6	250-500	350
Cd	4.5	6-Mar	0.6
Cr	106.6	NA	250
Zn	19.5	300-600	300
Cu	24.3	135-600	100
Mn	32.0	NA	NA

Table 3: Allowable limits for pollutant concentration (ppm) for land application

Metal	Present study	Commission of European Communities (1980)	USEPA–503 rules (1993)	MSW Rules (1999)	MoEF (2000)
Cu	24.3	1000-1750	4300	300	150
Zn	19.5	2500-4000	7500	100	500
Pb	22.6	750-1200	840	100	100
Ni	37.6	300-400	420	50	50
Cr	106.6	-	3000	50	150
Cd	4.5	20-40	85	5	5

CONCLUSION

The application of textile sludge showed improvement in soil properties, and microbial load in soil. Hence, textile sludge can be advocated as a soil conditioner wherever appropriate safety and application regulations are respected. Although sludge is sometimes criticised for containing potentially high levels of metals or contaminants, sludge can serve as a valuable and often much needed source of nutrients, application of which on land may be less expensive and highly effective than inappropriate disposal. However, it needs strategies or promising composting techniques for its use in agriculture without environmental risk.

LITERATURE CITED

Ansari A A and Thakur B D 2001 Sludge management in textile industry; disposal, recycling and reuse of primary sludge. *Asian Textile Journal,* 10(7): 55-60

Araujo A S F, Monteiro R T R and Cardoso P F 2007 Effect of composted textile sludge on growth, nodulation and nitrogen fixation of soybean and cowpea. *Bioresoure Technol*ogy, 98:1028-1032

Awasthi S K 2000 Prevention of Food Adulteration Act no 37 of 1954.Central *and State Rules as Amended for 1999. 3rd Edition*, Ashoka Law House, New Delhi

Balan D S and Monteiro RT 2001 Decolorization of textile indigo dye by lignino-lytic fungi. *Journal of Biotechnology*, 89:141–145

Bremner J M 1965 Inorganic forms of nitrogen. *In Black C.A (ed.),* 1179-1237

Commission of European Communities 1980 Council directive C86/278/EEC/on the projection of the environment and in particular of the soil, when sewage sludge is used in agriculture. *European Community, L181 Annex* IA: 6-12

Dai J Y, Xu M Q, Chen J P, Yang X P and Ke Z S 2007 PCDD/F, PAH and heavy metals in the sewage sludge from six wastewater treatment plants in Beijing, China. *Chemosphere*. 66:353-361

Hammadi El M A, Melika T and Hanchi B 2007 Composition of detergent and chloride in Tunisian textile sludge and produced composts as a function of sludge ratio. *Research Journal Environmental Sciences,* 1 (6):317-323

Islam M M, Halim M A, Saiful Islam M, Safiqual Islam M and Biswas C K 2009 Analysis the plant nutrients and organic matter in textile sludge in Ganzipur, Bangladesh. *Journal of Environmental Science and Technology,* 2 (1):63-67

Jackson M L 1973 Soil Chemical Analysis. *Prentice Hall of India Private Limited, New Delhi*, 498

Krishnamoorthy R, Kannadasan N and Renuga D 2015 Bioconversion of textile sludge employing the earthworm Eisenia fetida and its impact on the growth of Cajanus cajan. *International Journal of Nano Corrosion Science and Engineering,* 2(5):422-428

Lindsay W L and Norvell W A 1978 Development of DTPA soil tests for zinc, iron, manganese and copper. *Soil Science Society of America Journal*, 42: 421-428

Maddumapatabandi T D, De Silva W R M and De Silva K M N 2014 Analysis of textile sludge to develop a slow releasing organic fertilizer. *Research Symposium on Engineering Advancements* (*SAITM – RSEA),* 79-82

MoEF 2000 Report of Ministry of Environment and Forest, Governament of India.

Municipal Solid Wastes (Management and Handling) Rules 1999 *S.O.908 (E*).

Pandey S, Patel H and Johri R 2011 Potential Reuse of Chemical Sludge from Textile Dyeing Processes. *The Energy and Resources Institute*, India Habitat Centre.

Parameswari M and Udayasoorian C 2013 Influence of textile and dye effluent irrigation and amendments on micronutrients Iron and Copper status in soil under Maize crop. *International Journal of Current Trends in Research,* 2 (1): 163-167

Patel H and Pandey S 2008 Physico-chemical characterization of textile chemical sludge generated from various Cetps in India. *Journal of Environmental Research and Development,* 2 (3):329-339

Rosa E V C, Giuradelli T M, Corrêa A X R, Rörig L R, Sshwingel P R, Resgalla-Jr C and Radetski C M 2007 Ecotoxicological evaluation of the short term effects of fresh and stabilized textile sludges before application in forest soil restoration. *Environment Pollution*, 146:463-469

SEPA 1995 Environmental quality standard for soils. *Environmental Protection Administration, China*.GB15618.

U S Environmental Protection Agency 1993 Standards for the use for disposal of sewage sludge. *Fed. Fegist*. 58, 32, 40, Part 503.

Udom B E, Mbagwu J S C, Adesodum J K and Agbim N N 2004 Distributions of zinc, copper, cadmium and lead in a tropical ultisol after long-term disposal of sewage sewage. Environ. Int. 30:467-470

Walkley A J and Black C A 1934 An examination of Digtijareff methods for determining soil organic matter and a proposed modification of the chromic acid titration method. *Soil Science*, 37: 29-38

Received on 27.09.2017 and revised on 18.07.2018