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Comparison of Chemical Analysis of Compost Leachate and Commercial Fertilizer to check the quantity of heavy metals

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ABSTRACT--*Leachate can be defined as a liquid that can probably pollute environment. This leachate is produced during aerobic composting of organic waste that may lead to many harmful effects on soil, surrounding villages, aquatic life and groundwater resources. Solid waste Compost Leachate is a liquid that produced during organic solid waste composting and brings out heterogeneous materials of and contains a complex diversity of organic compounds and materials such as heavy metals, fatty acids, humic acid substances, and many toxic compounds. This study was designed to compare the concentration of heavy metals present in compost leachate prepared during composing of municipal solid waste and commercial fertilizer. Municipal solid waste compost leachate and commercial fertilizer were properly evaluated for the physico-chemical parameters. Samples of leachate prepared from municipal solid waste composting were collected from Lahore Compost Company. Samples were digested and analysed in duplicates for pH, Temperature, BOD, EC, TDS and COD. The metals such as Ni, Cr, Zn, and Cu quantity in the leachate was also determined using the Atomic Absorption. It was concluded from this study that the quantity of heavy metals (Cu, Ni, Zn, and Cr) present in leachate was within acceptable amount that is also not harmful for plan and crop growth. On comparison with commercial fertilizer this amount of heavy metals is also lower than the commercial fertilizer. It was concluded from this study that the use compost leachate for plants and other crops is safe.*

Keywords*-- Compost, Leachate, Fertilizer, Organic Waste*

I. INTRODUCTION

Compost leachate can be used as a source of water and nutrients [1]. The composition of leachate is categorised by several parameters in high concentrations such as boron, carbon, phosphorous, potassium, zinc, calcium, magnesium and nitrogen. These elements are required by plant as micro- and macronutrients. It provides the evidence for the reuse of leachate as fertilizer for the growth of plants [2]. Leachate produced from aerobic composting give high amount of plant nutrients. Leachate could be use as fertilizer for plants growth. To prevent any damage to growing plants leachate amount must be diluted [3]. There is also a sufficient amount of organic matter is present that can increase fertility of soil. Organic matter of soil is the key parameter to evaluate soil quality.

In Lahore Pakistan, Lahore Waste Management Company (LWMC) is accountable for the collection and proper treatment municipal solid waste. City District Government Lahore had assigned this duty to LWMC [4]. LWMC is producing compost from proper fractions of municipal solid waste by using a technique called aerobic composting. In Pakistan there will be an increase in the dumping sites and more plants will be make function for

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decomposition of waste. Municipal waste compost leachate is considered as one of the problems of compost production. Leachate is the main concern during the production of compost. Leachate contains many heavy metals that could be toxic and it needs to be treated properly before exposing it to water body. No further processing or treatment is required if we use leachate as a fertilizer in the production of crops and plants by simply diluting it.

II. MATERIAL AND METHODS

Municipal solid waste samples were collected from composting plant sites. Te samples were taken from compost leachate tank. The samples were saved in bottles and transported to lab and stored for further studies.

Commercial fertilizer used in routine plant growth is also taken from certified company. These samples were also taken to laboratory for further chemical studies.

Important features required for the fertilizer and its quality. pH of both municipal solid waste compost leachate and commercial fertilizer were analyzed by using 510 EU Tech Company portable pH meter, electrical conductivity (EC) . The BOD_5 was analyzed through BOD incubator and COD reactor was used for the determination of COD. For heavy metal analysis samples of leachate were treated with acid, 1.5 ml of nitric acid concentrated was added to avoid any growth of algae and other microbes. This concentrated acid also precipitated metals in the leachate sample. The sample of leachate was digested , 70ml sample was added into the beaker and heated below the boiling temperature until the volume was reducec up to 20ml. Another 10mL of concentrated acid was poured in beaker and then heated again for 25 minutes. The heated sample was also treated with 10ml of concentrated HCL and left at medium heating for 35 minutes. The prepared solutions were allowed to cool at room temperature. Any insoluble particles were removed by simple filtration. These processed solution were transferred in to 150ml beaker[5]. Fertilizer sample was digested as follows: 4.5g fertilizer dissolved in 10ml concentrated HCl and boiled at hot plate for approximately 35min in 150mL flask. 18mL of 0.24M HCl was added after gently cooling the solution. After filtration the volume was raised to 140ml with 0.1M HCl solution [6].

The Samples of treated leachate and commercial fertilizer were processed and analyzed in duplicates. Following Ni, Cr, Zn, and Cu metals from the samples were analyzed using Atomic Absorption.

III. RESULTS AND DISCUSSION

. The samples were analysed for the following metals Ni, Cr, Zn, and Cu using Atomic Absorption technique. Below table 1 shows comparison of parameters of compost and FEPA standards.

Table 1: Comparison of Analysis of physico-chemical parameters of leachate with FEPA standards

Parameters	**Leachate**	**FEPA Standards**	**NEQs for Effluents**
Temperature	17± 0.222	35	41 °C Max

(°C)			
pH	7.18± 0.228	5	7-10
DO (ppm)	5.40± 0.44	5	-
TDS (mg/L)	2877 ± 0.459		3400
TSS (mg/L)	544.5± 0.347	500	148
EC (mS/cm)	24.99± 0.23	125	-
COD (mg/L)	895 ± 0.515	75	149
BOD (mg/L)	195 ± 10.0	30	78

Chloride (mg/L)	78± 0.422	100	9500
Salinity (ppm)	17.5 ± 0.123	-	-
Hardness (mg/L)	389± 0.172	200	-
Chloride (mg/L)	78± 0.422	100	9500
Nitrate (mg/L)	94± 0.141	20	-
Phosphate (mg/L)	99± 0.513	50	-

Sulphate	218± 0.142	100	500
Turbidity (NTU)	17.66 ± 0.178	5	-

3.1: Comparison of Heavy Metal Analysis of Leachate and Fertilizer:

Leachate and fertilizer samples were analysed for heavy metal Ni, Zn, Cu andCr.

Table 2: Heavy metal analysis of leachate and fertilizer

Metals	**Leachate**	**Fertilizer**	**FEPA Standards**	**NEQs for Effluents**
Zn (ppm)	0.55	32.15	-	1.0
Cu (ppm)	0.45	1.7	0.5	5.0
Cr (ppm)	1.18	13.95	0.2	1.0
Ni (ppm)	0.56	4.5	0.01	1.0

Heavy metal analysis for Ni, Cr, Zn and Cu of fertilizer and leachate is shown in table 2. On comparison of leachate with fertilizer, It was observed in this study that the commercial fertilizer showed quite high amount of four heavy metals as compared with standards set. Some chemical fertilizers comprise of toxic substances like heavy metals and organic pollutant as by components [7]. Results in this study wasn't surprising considering the fact that trace metal content of commercial fertilizers is highly variable, mainly depends on the fertilizer source and its production process. The dilution of commercial fertilizer is a necessity to avoid any toxicity in crops during growth. It has to be diluted before use so this dilution also results in heavy metal dilution. In leachate the concentrations of heavy metals were observed at minimum levels below the tolerable limits. Concentrations of heavy metals in leachate depend on processed waste composition. The leachate was taken from composting plant where organic waste was converting in to compost by natural decomposition optimizing various parameters. Due to the origin of leacahte from organic source it contains less heavy metals comparatively with landfill leachate. Landfill leachate had higher amount of metals because of the variations in waste sources and composition such as

hospital waste and electronic [8]. Heavy metal toxicity is also causing many ecological health problems [9]. Especially seed germination is highly affected by heavy metals toxicity. As proved by this study that leachate contains low levels of heavy metals and it is not causing issuing in early germination of seeds and plant health. After proper dilution of commercial fertilizer which also dilute the amount of heavy metals. It is also not harmful for crops and plant growth.

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