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Managmentof Fly Ash by Macro-Decomposer Earthworm *Pheretima posthuma* (Annelida: Megascolecidae)

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Abstract: In the present study, an attempt was made for proper management of solid waste fly ash by Earthworm *P. posthuma*. In our observation, the earthworm species *P.posthuma* degrade fly ash when it combined in various combinations with soil and Natural fertilizers. Results showed thatlocal earthworm species *P. posthuma* degrade the fly ash and grow in all experimental sets was prepaired by various proportions of mixing cow dung, Plant residues and soil namely A, B, C and Dconverted it in the compost after 60 days. But *P. posthuma*cannot survive in only fly ash experimental set E. The fly ash, soil and natural fertilizer convert in vermicompost. Chemical properties of compost is Organic carbon ranging bet ween 1.27 to 2.33. pH 6.52 to 6.63, Nitrogen 240.36 to 373.18, Phosphorous 10.32 to 19.45, Potassium 445.77 to 600.72, Cu 1.630 to 1.600, Mn 0.904 to 6.978, Zn 0.474 to 2.562, Fe 0.126 to 1.390 dsm^{-1} 0.69 to 1.03.

Key words: Management · Fly ash · Earthworm

INTRODUCTION

Fly ash is a resultant of combustion of coal at high temperature, has been regarded as a problematic solid waste all over the world. It is generated in huge amounts and cause serious hazards to the environment. Disposal and management of fly ash is a major problem in coal-fired thermal power plants. Fly ash emissions from a variety of coal combustion units show a wide range of composition [1]. Fly ash is an amorphous ferroalumino silicate, solid waste around thermal power plants. It creates problems due to improper utilization and disposal. Fly ash can be disposed-off in a dry or wet state. Studies show that wet disposal of this waste does not protect the environment from migration of metal into the soil [3]. The disposal, management and proper utilization of waste products has become a concern for the scientists and environmentalists. Proper management of solid-waste fly ash from thermal power plants is necessary to safeguard our environment [4].

Coal combustion product generated each year in India is more than 100 million tonnes per annum of which 4 million tones is released into the atmosphere. According to the data provided by Govt. of India 110 million tones of this kind of waste is produced in India during 2005-2006. Nearly 50-60 % of the fly ash is being stored at plant dump sites and other sites intended for this purpose [5]. Coal-based thermal power plants have been a major source of power generation in India, where 75% of the total power obtained is from coal-based thermal power plants [6].

Generated Fly Ash is being disposed to open ash pond in thin slurry form. More than 65,000 acre of land in India is occupied for storage of this massively generated quantity of Fly ash. Dumping of Fly ash in open ash pond causes serious adverse environmental impacts owing to its elevated trace element contents, in particular the arsenic which causes ecological problems. Recently, India has been charged for being a “dumping hub for arsenic” [7]. Few workers studied the effect of mixed application fly ash and organic compost on soil and availability and uptake of elements by various plant species [8].

Through the ingestion of organic matter earthworms are important to the initial breakdown as well as to subsequent decomposition of organic matter [9]. In fact,

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earthworms may consume more surface organic matter than all other soil animals together recycling of wastes through vermitechnology reduces the problems of non-utilization of agro-wastes. The earthworms that are employed in organic wastes mixed with soil, to a certain extent accumulate toxic metals and after vermicomposting they can be re-employed for the same purpose [10].

The present outlets of fly ash disposal are using cement, concrete and brick industries but such use only accounted for 38% of fly ash produced by thermal power stations, the repeated exposure of fly ash causes irritation in eyes, skin, nose and results in arsenic poisoning around the Thermal power plants [11]. Coal based thermal power plants are located at Parli (vai). It is located at the18°52'08N 76°31'34E keeping this view in mind the present study was aimed proper management of solid-waste fly ash by earthworm species *P. posthuma*and finds a new way for safe disposal and utilization of Fly ash for cleaner environment.

MATERIALS AND METHODS

Earthworms were collected from the soil of Late Ramesh Warpudkar college campus Sonpeth. Fly ash collected from the thermal power plant of Parli (Vai) 20 km away from Sonpeth which is located at the18°52'08N 76°31'34E. The natural fertilizerand soil was collected from the nearest farm next to the college.

Experimental Combinations: Natural Fertilizer was prepaired mixing cow dung, Plant residues. Twenty earthworms *P. posthuma* were cultivated in each set offive different combinations of Fly ash, soil and Natural Fertilizer. The combinations were: as in Table 1.1 .

Table 1.1

Experimental set no.	Composition	Proportion (in kg)
A	Fly ash + Soil + Natural Fertilizer	6:9:5
B	Fly ash + Soil + Natural Fertilizer	8:8:4
C	Fly ash + Soil + Natural Fertilizer	10:7:3
D	Fly ash + Soil + Natural Fertilizer	12: 6: 2
E	Fly ash	

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RESULTS AND DISCUSSION

Coal combustion by-products mainly Fly ash is an undesirable waste whose interaction with air, soil and water has created effects on human health, agriculture and natural ecosystems. Fly ash is an amorphous ferroalumino silicate, solid waste around thermal power plants, *i.e*. pH 7.9, EC 1.0 dSm^{-1}, Organic carbon 1.2gkg^{-1}, CaO 18 gkg^{-1}, total N,P,K were 0.035, 0.085 and 0.164 percent respectively. However total Fe,Zn, Mn, Cu and B were 0.35%, 101.20, 175.08, 75 and 250 mg kg^{-1} respectively [2]. Hence, fly ash safe disposal and utilization is an important concern to safeguard the cleaner environment. We got similar results [12] about the growth and reproduction of earthworms.

The potential of earthworms as waste processors has been well documented by various authors [13]. Nutrition is an essential factor to determine the maximum growth of an organism. Earthworms derive their nutrition from Natural Fertilizers, living bacteria, fungi, diatoms, algae, protozoa, nematodes and decomposing animals [14].

In our observation, the earthworm species *P. posthuma* degrade fly ash when it combined in various combination with soil and Natural fertilizers *P. posthuma*tolerate Fly ash + Soil + Natural Fertilizer (12: 6: 2) combination and converted it in the compost after 60 days. The chemical analysis shows that it is good fertilizerorganic carbon ranging between 1.27% to 2.33%, pH 6.81 to 6.52,N 240 to 373.18, P 10.32 to 19.45, K445.77 to 600.72, Cu 1.600 to 3.158, Mn 0.904 to 7.528, Zn 0.47 to 2.52, Fe 0.126 to 1.836, dSm^{-1} 0.69 to 1.03. *P. posthuma* didn't survive in only fly ash.

CONCLUSION

The outcome of the present investigation provides an alternative way for the utilization of fly ash apart from the conventional cement, concrete, brick making, land filling etc. in future forestry will attract more Fly ash utilization for growing economically and socio-ecologically important trees. So, using Fly ash for Fertilizers production will be one of the important strategies to protect environmental degradation as well as economical importance.

Table 1.2.Growth of Earthworms in numbers.

	Day				
Box No.	0	15	30	45	60
A	20	28	60	78	112
B	20	31	57	72	108
C	20	27	42	56	77
D	20	25	35	49	67
E	20	0	0	0	0

Table 1.3: Physical and chemical properties of various combinations after 60 days

Contents	Box No. A	Box No. B	Box No. C	Box No. D
Organic Carbon	2.33%	2.19%	1.52%	1.27%
pH	6.63	6.81	6.56	6.52
Nitrogen	373.18	305.5	260.29	240.36
Phosphorous	19.45	17.88	10.86	10.32
potassium	600.72	560.85	470.80	445.77
Cu	1.600	3.158	1.674	1.630
Mn	6.978	7.528	0.114	0.904
Zn	2.562	2.520	0.592	o.474
Fe	0.126	1.836	1.020	1.390
dSm^{-1}	1.03	0.94	0.71	0.69

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