



**EFFICIENCY OF VERMICOMPOST PRODUCTION FROM POULTRY DROPPINGS
AND PRESSMUD BY USING *EUDRILUS EUGENIAE***

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ABSTRACT

Bioconversion of industrial wastes in to beneficial vermicompost not only solves solid waste accumulation but also yield highly nutritive organic manure. Enhancing the efficiency of earthworm that is involved in process of converting sugar mill filter press mud in to vermicompost, will be highly economical. An African earthworm *Eudrilus eugeniae* was used to convert the sugar mill filter press mud into nutritive vermicompost. To enhance vermicomposting efficiency, an organic nutrient Poultry droppings, an effective microbial suspension was supplemented. **Results:** The vermicompost yielded in Poultry droppings vermibed had a significantly high nitrogen, phosphorus and micronutrient value. In the poultry droppings supplemented vermicompost C/N ratio was 55.5% higher than that was present in the cowdung added vermicompost. In Pressmud-poultry droppings, vermibed the mean egg production by a single worm at 45 days of growth was 12 ± 2.6 (33.33%). Poltry droppings had influenced the egg production. When compared to Pressmud-cowdung vermibed reared worm, (77.4%) the hatchability of eggs in filtermud jeevamirtham vermibed was high (85.8%). This indicates that the Poultry droppings supplementation strengthens viability of the eggs. **Conclusion:** The present study recommends utilization of effective microorganism suspension, Poultry droppings pressmud for vermicomposting to enhance the functioning of the earthworm and to increase fertilizer value of vermicompost. In the present study also macronutrient and micronutrient content increased significantly in vermicompost prepared from pressmud waste due to the supplementation of Poultry droppings. This is practical significance if adopted by urban farmers as a result of soil health and in turn the productivity of soil can be maintained for further agriculture.

KEYWORDS: Poultry droppings, Press mud, Vermicomposting, *Eudrilus eugeniae*.

INTRODUCTION

Vermitechnology has been proposed globally as potential tool to stabilize the natural and anthropogenic wastes, such as sewage sludge, industrial sludge, plant-derived wastes, agro-industrial solid waste, household waste, animal dung, etc. Vermicompost get better the soil structure, increasing the water holding capacity and porosity which make easy the root respiration and growth (Lee, 1992). The favourable effects of vermicompost on crops like maize (Gutierrez-Miceli *et al.*, 2008), wheat (Sharma and Madan, 1988), strawberry (Singh *et al.*, 2008), petunias (Arancon *et al.*, 2004), marigold, pepper, cornflower, tomato (Bachman and Metzger, 2008), blackgram and pepper (Arancon *et al.*, 2004).

Recycling of wastes through vermicomposting reduces trouble of discarding of agricultural as well as industrial wastes without adversely impacting the environment (Prakash and Karmegam, 2010) Filter cake or Pressmud

as it is commonly known is one of the important by-products of the sugar industry.

Pressmud is a squashy, spongyamorphous and dark brown to brownish white material containing sugar, fibre coagulated colloids including cane wax, albuminoids, inorganic salts and soil particles. It is readily converted to a storehouse of macro and micro nutrients besides being a very effectual soil amendment thorough vermicomposting. Pressmud mounts as it is accumulated at a stocking point, it undergoes self ignition and adds to pollution of the environment besides causing an eyes sore (Lakshmi and Vijayalakshmi, 2000). According to curing of Pressmud for 4-6 weeks is required before application to the soils. So, the present investigation was undertaken to convert fresh Pressmud into nutrient rich manure by using African Earthworm *Eudrilus eugeniae* (Kinberg). According to proximately 12 million tones of press mud is produced in India annually. Due to the prohibitive cost of sludge throwing away, it is either

discarded in open or along roadsides or railway tracks or stored in the sugar mill premises where it causes adverse impacts on the ambient environment (Parthasarathi, 2008). Conventional composting of press mud takes about 6 months and also does not remove the foul odour completely. Hence, suitable press mud management technology is considered necessary which not only guard and conserve the environment and land resources but also to recover the nutrients present in it.

Poultry droppings are the excretory products of poultry birds, which contain enormous amount of nutrients. However, they are not suitable for direct application into the field and Scientists have therefore tried to utilize these wastes in different ways. Turan (1999) utilized poultry litter along with natural zeolite as an ingredient during the composting process and concluded that the addition of natural zeolite to poultry litter compost was found to have a beneficial effect on the characteristics of the end product. Whereas, the studies conducted by Guerra-Rodríguez *et al.* (2000 and 2001) report the utilization of solid poultry manure along with chestnut burr and leaf litter mix, and barley wastes, respectively by the process of co-composting. The co-compost was matured in 103 days from a biological point of view, and the percentage of germination obtained using the co-compost varied with the seeds used. It was 186% for ryegrass seeds, 85.74% for wheat seeds and 103% for barley seeds. Garg and Kaushik (2005) investigated the potential of an epigeic earthworm *E. fetida* to transform textile mill sludge spiked with poultry droppings into value added product- that is vermicompost. Yadav and Garg (2011) also tried vermicomposting of poultry droppings and food industry sludge along with cow dung, employing earthworms (*E. fetida*). These studies clearly show the possible utilization of poultry litter with suitable combination of bulking agents and the method.

The present work deals with the vermicomposting of pressmud waste using a natural nutrient preparation, Poultry droppings into nutrient rich manure by using the earthworm *Eudrilus eugeniae*.

MATERIALS AND METHODS

Stock culture of Earthworms

E. eugeniae was obtained from a vermicomposting unit of Shakthi in Madurai, Tamilnadu (India). The stock culture of the earthworm was maintained in plastic containers using partially decomposed bio-waste and cowdung as growth medium in laboratory condition. This was further used in the vermicomposting experiment.

Collection of Pressmud: The filter mud was collected from the National Sugar Factory near Madurai. Fresh filter mud was kept in shade for 2-3 weeks before using for the vermicomposting process (Sangwan *et al.*, 2008). The shade dried pressmud was then blended with organic growth promoter Poultry droppings rich in microbes and used as a bulking agent to increase the C/N ratio. The mixture was prepared by mixing 200 mL of 200g cow

and 1000kg filter mud, the raw material for the vermicomposting process. Before starting of the experiment, pressmud wastes (PM) and the pressmud wastes with Poultry droppings (PM+PD) and pressmud with cowdung mixture (PM+CD) were pre-composted for 15 days so that it becomes palatable to the earthworms.

Design of the work: The vermibeds were prepared using pressmud in plastic containers and watering was done regularly to moist the medium. Three treatments were taken for vermicomposting of PM materials; one with cowdung alone; while the other two with a mixture of Pressmud and Poultry droppings and Pressmud and cow dung. The plastic containers were filled with 1.5 cm thick sterilized soil layer at the bottom as soil is considered as an important supporting material for vermicomposting (Yadav *et al.*, 2010), Control and treatments were triplicate.

To each plastic container, 10 adult 40 days old earthworms *Eudrilus eugeniae* were introduced from the stock culture after pre-composting of the raw materials. The experiment was conducted in dark room in ambient temperature. The moisture levels in the experimental containers were maintained at 70±10% (Yadav and Garg, 2009).

The vermicompost was harvested after the appearance of black granular structure on the surface of the composting medium. Watering of the composting medium was discontinued four days before the harvesting. Vermicompost output from each treatment was calculated on dry weight basis. Population of earthworm and their biomass as well as cocoons were measured at the end of the experiment as per the method given by Gupta and Garg (2008).

After an undisturbed 7 days of composting period, the content in the triplicates was mixed and moisture content was checked together with earth worm's activity. Every 15 days over a period of 45 days the worms were hand sorted and weighed. The weight of 10 worms were taken together (mg) and calculated to percent of single worm weight. The Cocoons production by earthworm was measured in each worm worked compost containers. Separated cocoons were counted and introduced into separate bedding containing the same material in which their parents were reared. On the basis of the obtained data about the biomass and cocoon numbers, other parameters of earthworm such as biomass increase rate (mg day⁻¹), maximum weight achieved and reproduction rate (cocoon/worm/day) were calculated with the help of the recorded data for different worm.

After 45 days, worms were removed from the Worm-worked compost (WC). Samples of Worm-worked compost (WC) and control compost were sun dried and analyzed for pH (1:2.5 soil water suspension), electrical

conductivity (EC) (1:2.5 soil water suspension filtrate), organic carbon (OC).

Statistical analysis: Paired sample t-test was used to analyze the differences in vermicompost production in different treatments. The same test was used to compare the mean values of different chemical parameters of the compost (control) and vermicompost generated in the two treatments. Finally, one-way ANOVA was employed to compare the effects of the different amendments effects within the control and experimental compost.

RESULTS

Pressmud is a sugar factory wastes which can't be directly applied to farms. Filter is converted into a nutrient rich vermicompost by employing the earthworm *Eudrilus eugeniae*. To enhance the bioconversion efficiencies of the earthworm an organic nutrient enriched with effective microbial suspension, poultry droppings and cow dung were used.

Development of earthworms: In the present experiments the African earthworm *Eudrilus eugeniae* was used to convert Pressmud into vermicompost. To rear the worm's two types of vermibeds were used. In the both the vermibeds Pressmud was used but nutrient supplementation was different. In the Pressmud-cowdung and Pressmud-Poultry droppings vermibeds the growth of earthworm different. After 45 days the mean weight increase of the earthworm in the Pressmudcowdung vermibed was 704.22±59.62 mg (94.26% but in Pressmud-Poultry droppings vermibed the mean weight increase was 803.32±91.40 (145.18%) (Table 1). Significant difference was noticed in the weight of the earthworm reared in Pressmud poultry droppings vermibed when compared to Pressmud-cowdung vermibed. The influence of poultry droppings to enhance the growth of worm is evident.

Reproduction factor: Cocoon production and their hatchability are influenced by the type of vermibed in which the worms are reared. In the Pressmud-cowdung vermibed the mean number of eggs produced by a worm after 45 days of growth was 9±3. However in Pressmud-Poultry droppings, vermibed the mean egg production by a single worm at 45 days of growth was 12±2.6 (33.33%). Poultry droppings had influenced the egg production. When compared to Pressmud-cowdung vermibed reared worm, (77.4%) the hatchability of eggs in the Pressmud poultry droppings vermibed was high (85.8%). This indicates that the poultry droppings

supplementation strengthens the viability of the eggs (Table 2). Poultry droppings mixed vermibed both the cocoons production and hatchling numbers were significantly higher than the vermibed in which cowdung was applied (Table 2).

In the present experiment, the influence of organic nutrient supplement, Poultry droppings to convert sugar factory Pressmud into high quality vermicompost was studied. Further, whether the Poultry droppings addition with Pressmud can influence the economic characteristics of the earthworm was also studied. The efficacy of Poultry droppings on the vermicomposting efficiency of the earthworm *Eudrilus eugeniae* was compared with Pressmud that was converted into vermicompost by mixing cowdung. The influence of Poultry droppings on the physicochemical characteristics of vermicompost was analyzed and compared with vermin bed where cowdung was alone used. The characteristics like pH, EC, N, P, K, Ca, Mg, S and C/N ratio in raw filter pressmud, vermicompost made from filter pressmud by supplementing Poultry droppings and cowdung showed that the various physico-chemical characteristics, in the Poultry droppings used vermicompost was significantly greater when compared cowdung used vermibed and raw filter pressmud. N, P, K and micronutrients like Ca, Mg and S were found at an elevated level in Poultry droppings mixed vermicompost (Table 3).

Also the pH of the vermicompost prepared using Poultry droppings increased from its original value towards neutral. The vermicasts are more neutral in which the worms live and this may be due to the fact that the earthworms neutralize soil as it passes through them by secretions of the calciferous glands secretions from the intestine and also due to ammonia which is excreted. Suthar (2008) reported that there is significant increase in conductivity and K content in bed soil by the end of vermicomposting process, which might be due to leaching of K during vermicomposting process, Macronutrients such as nitrogen, phosphorus and also increased significantly in pressmud vermicompost.

In the present study also macronutrient and micronutrient content increased significantly in the vermicompost prepared from pressmud waste due to the supplementation of Poultry droppings. In the Pressmud supplemented vermicompost C/N ratio was 55.5% higher than that was present in the cowdung added vermicompost.

Table 1: Influence of Poultry droppings on the growth of the earthworm *Eudrilus eugeniae* in different vermibeds.

Types of vermibeds	Initial weight (mg) of the earthworm (Mean ± SD of 10 worms)	Weight of the earthworm (mg) after of 10 worms (Mean ± SD of 10 worms)
Pressmud + poultry droppings	311.04±0.34	704.22±59.62 (94.26%)
Pressmud + cowdung	327.64±44.59	803.32±91.40 (145.18%)

Table 2: Influence of poultry droppings on cocoon, hatchability and Natality of the earthworm *Eudrilus eugeniae* employed in the vermicomposting process of Pressmud.

Types of vermibeds	Total number of egg (n=30)	Number of eggs produced per worm	Total number of egg hatched	Hatching percentage (%)
Pressmud + cowdung	270	9±3.0	209	77.4
Pressmud + poultry droppings	360	12±2.6	302	85.8

Table 3: Physio-chemical changes in filtermud mixed with jeevamirtham and cowdung treated with earthworm *eudrilus eugeniae* (Mean±SDTukey's test, p<0.05).

Treatments	pH	EC ds/m	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)	C/N ratio
Pressmud	7.42±0.005	2.50±0.057	2.45±0.012	1.97±0.008	0.53±0.005	4.26±0.015	1.04±0.003	0.84±0.005	8.58±0.005
Pressmud+cowdung Vermicompost (wc-j1)	7.52±0.003*	1.91±0.008*	3.47±0.006*	2.34±0.008*	0.87±0.003*	4.92±0.003*	1.82±0.003*	1.05±0.046*	9.13±0.008*
Pressmud+Poultry droppings Vermicompost (wc-j1)	7.49±0.016*	2.55±0.028 ^{NA}	4.07±0.003*	2.66±0.015*	0.98±0.003*	5.13±0.003*	1.87±0.003*	1.34±0.003*	14.04±0.010*

p = 0.05; *: 0.04 < 0.05 -Significant;Na: 0.423>0.05 - Non Significant.

DISCUSSION

Comparatively the higher level of organic content in non worm-worked composts may be due to the increase in their microbial load, which is expected to be less in worm-worked composts (Garg and Kaushik, 2005; Parvaresh *et al.*, 2004; Suthar, 2009). As far as interaction effects concerned, in compost and vermicompost highest nitrogen content was recorded in T5 which was on par with rest of the treatments. This is because may be due to higher amount of nitrogen in parthenium and cassia (Sharma *et al.*, 2004). The observed increase in the EC, N, P, K and micronutrients (Cu, Zn, Mg and Fe) in all worm worked composts (except in the case of N in neem leaves compost) showed that the activity of earthworm *E. eugeniae* along with microorganisms promoted mineralization process and brought the nutrients to ready to use form for plant growth. Pressmud has significant fertilizer value but due to prohibitive cost of sludge disposal, it is dumped in open, where it adversely affects the ambient environment. Apart from this, such practices entail wastage of organic and inorganic nutrients present in the Pressmud that might be put to good use. The management and nutrient recovery from filter mud carried out in the present work by mixing with Poultry droppings was very effective. The results showed that during the supplementation of poultry droppings the nutrient load viz; nitrogen, phosphorus and content was enhanced. The product so obtained can be used in agricultural fields as manure. This study provides a platform for the utilization of Filter mud amended with Poultry droppings for the process of productive and value added vermicompost manufacture.

CONCLUSION

Pressmud with Poultry droppings composted using employing *Eudrilus eugeniae*, showed high manorial value. Hence vermicomposting can be a potential ecological engineering process to convert noxious industrial wastes into value-added materials for sustainable agriculture.

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