Available online at www.sciencedirect.com

ScienceDirect

Procedia Environmental Sciences 35 (2016) 425 – 434

Procedia Environmental Sciences

International Conference on Solid Waste Management, 5IconSWM 2015

Effect on Growth of Earthworm and Chemical Parameters during Vermicomposting of Pressmud Sludge Mixed with Cattle Dung Mixture

Sartaj Ahmad Bhat[a], Jaswinder Singh[b], Adarsh Pal Vig[a,*]

[a] *Department of Botanical and Environmental Science, Guru Nanak Dev University, Amritsar, India*
[b] *Department of Zoology, Khalsa College Amritsar, India*

Abstract

The aim of present work was to assess the growth of earthworm Eisenia fetida during vermicomposting of pressmud (PM) sludge. It was mixed with cattle dung (CD) at different ratios (PM: CD) of 0:100 (PM_0) 25:75 (PM_{25}), 50:50 (PM_{50}), 75:25 (PM_{75}) and 100:0 (PM_{100}) under different varying weight 8.76 (PM_0), 7.63 (PM_{25}), 9.93 (PM_{50}), 9.90 (PM_{75}) and 10.23 g (PM_{100}). Co-composting with cattle dung helped to improve their acceptability for E. fetida and also improved physico-chemical characteristics. Best suitable mixture for highest survival, maximum weight and highest population buildup of E. fetida was determined by observing growth rate, weight, mortality, rate of cocoon production and population buildup. Minimum mortality and highest weight (77 g) of worms were observed in 25:75 (PM_{25}) mixture of PM. However, increasing percentages of wastes significantly affected the number and weight of worms. Nitrogen, phosphorus, sodium, increased from initial feed mixture to final products, while organic carbon, C:N ratio and Potassium showed an opposite trend. Heavy metals (Copper, Chromium, Iron) decreased significantly from initial except Zinc and manganese which accumulate significantly.

Peer-review under responsibility of the organizing committee of 5IconSWM 2015

Keywords: Vermicomposting, Pressmud, Eisenia fetida, Cattle dung, Physico-chemical;

1. Introduction

Pressmud (PM) is the solid residue obtained in the sugarcane juice clarification process. The clarification

* Corresponding author.
E-mail address: dr.adarshpalvig@gmail.com

Peer-review under responsibility of the organizing committee of 5IconSWM 2015
doi:10.1016/j.proenv.2016.07.025

process separates the juice into a clear juice that rises to the top and a mud that collects at the bottom in a sugar industry. About 0.03 ton of pressmud is produced per ton of sugarcane processed (Yadav and Solomon, 2006). There is a major disposal problem for the pressmud although it is fairly rich in organic nutrients, it finds little use as agricultural fertilizer. The primary reason for this is the insoluble and imbalanced nature of the nutrient content in it. It generates intense heat (65 °C), foul odor and takes long time for natural decomposition (Sen and Chandra, 2007). Due to the prohibitive cost of PM disposal, most of the mills in India store the sludge in open field which imbalance the micro and macro fauna of land and water of that area. Vermicomposting is the efficient method of converting organic wastes into environment friendly products. It is a non-thermophilic process involving the joint action of earthworms and their intestinal microbiota. (Aira et al., 2000). Microorganisms cause the biochemical decomposition of organic matter, but earthworms are involved in the indirect stimulation of microbial populations through fragmentation and ingestion of fresh organic matter, which resulted in a greater surface area available for microbial colonization. Vermicomposting accelerate the decomposition process by 2-5 times, thereby hastens the conversion of wastes into valuable biofertilizer and produces much more homogenous materials compared to anaerobic composting (Atiyeh et al., 2000).

Keeping in view the above facts, the present work was conducted to assess the growth of earthworm *Eisenia fetida* during vermicomposting of pressmud sludge in 135 days. Co-composting with other organic material (cattle dung) improved physico-chemical parameters and also acceptability for *E. fetida*. Number, fecundity and biomass of *E. fetida* were taken as parameters of the suitability of feed mixtures. Efficiency of *E. fetida* for recovering nutrients was evaluated by physico-chemical parameters in the waste and vermicompost initially and after bioconversion.

2. Materials and methods

The experiment was conducted with *Eisenia fetida* which is capable of converting PM sludge to stabilized material. Young non-clitellated *E. fetida* were randomly picked from a stock culture maintained in the vermicomposting unit of the Department of Botanical and Environmental Sciences, Guru Nanak Dev University, Amritsar, Punjab, India. Fresh pressmud (PM) was obtained from Rana Sugars Limited, Amritsar, Punjab, India. Cattle dung (CD) was obtained from a dairy farm situated in the vicinity of the university. The initial physico-chemical parameters of PM and CD are given in Table 1.

2.2 Experimental protocol

The PM was mixed with CD in the ratios of 0:100 (PM_0), 25:75 (PM_{25}), 50:50 (PM_{50}), 75:25 (PM_{75}) and 100:0 (PM_{100}) (PM: CD). The experiment was run in plastic trays of volume 3834 cc in triplicates and the mixtures were manually turned every 24 hours for 15 days, so as to eliminate possible volatile toxic gases. The total weight of each tray was kept at 2 kg. After 15 days, 50 young non-clitellated *E. fetida* with initial average body weight 8.76 (PM_0), 7.63 (PM_{25}), 9.93 (PM_{50}), 9.90 (PM_{75}) and 10.23 g (PM_{100}) were added to the feed mixtures. The trays were covered with a jute mat to prevent birds from picking the earthworms. The moisture content was maintained to 50-60% throughout the study period by regularly sprinkling of adequate quantity of water. Earthworm average weight, cocoons and hatchlings were weighed, sorted and counted manually at the interval of 15 days. At the end of the experiment (135 days), worms, cocoons and hatchlings were removed. The vermicompost (end product) was sieved, air dried and physico-chemical parameters were analysed.

2.3 Physico-chemical parameters

Physico-chemical analysis was done to determine the extent of stabilization. pH and electrical conductivity (EC) were determined in double distilled water suspension of each concentration in the ratio of 1:10 (W/V) using Systronics µ pH system 362 and Systronics conductivity meter-304, respectively. Micro-Kjeldhal method of AOAC (2000) was used for measuring nitrogen after digestion. Total organic carbon (TOC) was measured after igniting the 0.5 g of sample in a muffle furnace at 550°c for 60 minutes as described by Nelson and Sommers (1996). The method described by John (1970) was used for measuring total phosphorus (TP) using Systronics spectrophotometer 2202, total potassium (TK) and sodium (TNa) was measured by using a Systonics flame photometer-128 after digesting the samples in diacid mixture ($HClO_4$:HNO_3 in 4:1 ratio). Heavy metals were