International Journal of Biology Research
ISSN: 2455-6548
Impact Factor: RJIF 5.22
www.biologyjournal.in
Volume 3; Issue 3; July 2018; Page No. 30-32

Vermicomposting of saw dust mixed with cow dung using *Eudrilus eugeniae*

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Abstract
India and many other developing countries are suffering from the disposal of solid wastes due to urbanization and population density. Saw dust is a waste product of timber industries, produced by wood working machinery, portable power tools or by use of hand tools. In some manufacturing industries, it can be a significant fire hazard and source of dust pollution. It is composed of fine particles of wood and is the main component of particleboard. Research on saw dust health hazards comes within the field of occupational health science, and study of saw dust control comes within the field of indoor air quality engineering. Vermicomposting is a simple biotechnological process of composting, in which earthworms are used to enhance the process of waste conversion into useful end product. In this study, the role of earthworm in converting the saw dust into a valuable product is assessed. The saw dust was mixed with cow dung and earthworm *Eudrilus eugeniae* and left for vermicomposting for 30 days. After 30 days, the vermicompost was collected and the physico-chemical parameters were analyzed by using the standard methods. The reduction in pH and organic carbon were noticed at 30-day. The result indicated that vermicomposting with *Eudrilus eugeniae* is better for converting saw dust into nutrient rich vermicasting in a short period of time. Thus, the recycling of wastes through vermitechnology reduces the problem of accumulation of timber industry wastes. Vermicompost slowly releases N, K, Ca, Mg and P to plants.

Keywords: vermicompost, saw dust, cow dung, *Eudrilus eugeniae*

1. Introduction
India is very rich in forest resources. Forests provide wide range of products ranging from paper to paints, chemicals, housing and furniture. Indian forest industry broadly divided into two major areas: the paper and pulp industry and the wood industry. Wood is of great demand in the areas of furniture and laminates. Wood is also required in the fields of railways, defense, and construction. Bamboo products, which are similar to wood, are also in demand. Wood processing industries primarily include sawmilling, plywood, wood panel, furniture, building component, flooring, particle board, moulding, jointing and craft industries. Wood wastes generally are concentrated at the processing factories, e.g. plywood mills and sawmills. The amount of waste generated from wood processing industries varies from one type industry to another depending on the form of raw material and finished product. In general, processing of 1,000 kilos of wood in the furniture industries will lead to waste generation of almost half (45%), i.e. 450 kilos of wood. Similarly, when processing 1,000 kilos of wood in sawmill, the waste will amount to more than half (52%), i.e. 520 kilo of wood. The biomass wastes generated from wood processing industries include sawdust, off-cuts and bark [1]. Exposure to saw dust has long been associated with a variety of adverse healtheffects, including dermatitis, allergic respiratory effects, mucosal and nonallergic respiratory effects, and cancer [2]. Recycling of wood wastes is not done by all wood industries, particularly small to medium scale wood industries. Bark and sawdust are usually burned and thereby leads to environmental pollution.
Vermicomposting is the safest and cheapest way for the proper disposal of the agro waste without doing any harm to the environment. The recycling of waste through vermitechnology reduces the problem of non-utilization of agro wastes [3]. Nutrients of vermicomposting are readily available to the earthworms and thereby increase their population. Vermicomposting is a bio-oxidation process in which, earthworm interacts with microorganisms and other soil fauna, accelerating the decomposition process and thereby stabilizes the organic matter. Vermicompost is a method of enriching compost with the use of earthworms. Earthworms consume raw materials and excrete it in digested form called "worm cast", which is rich in nutrients, growth promoting substances, beneficial soil micro flora. Vermicompost is popularly called as "black gold", due to its colour and quality in supplying nutrient to plants, enriching soils by improving physico-chemical and biological properties. Vermicompost as gaining popularity and become a major component of organic farming system [4]. Vermicomposting is a simple biotechnological process of composting, in which, certain species of earthworms are used to enhance the process of waste conversion and produce a better end product. Earthworms consume various organic wastes and reduce the volume by 40-60%. Earthworm weighs about 0.5 to 0.6g, eats waste equivalent to its body weight, and produce cast about 50% of the wastes, it consumes in a day. The worm castings contain higher percentage of both macro and micronutrients

than the garden compost [4].

The present study has been taken up to recycle the saw dust by using both cow dung and earthworm. The earthworm species chosen for this study, *Eudrilus eugeniae*, commonly referred as the African Night Crawler, occurs all over the World but mostly in the waste management of Southeast-Asian regions. This worm species can breakdown cellulose material without as much help from the soil bacteria and when they eat, they leave behind worm casting that can be used as organic fertilizer [5].

2. Materials and methods

The healthy adult African red earthworms (*Eudrilus eugeniae*) were purchased from Thanthai Han's Roever Agricultural College, Perambalur were used in this present study. Cow dung was procured from the dairy farm situated in the Kurumbalur village, Kurumbalur. Cow dung was spread for 10 days for shadow air drying, so that unwanted gases and heat were removed, which may harm the earthworms. Saw dust was collected from the wood industries of Ariyalur, District.

3. Experimental design

The experiment was carried out in a plastic bin of size 48 X 45 X 21cm were filled with mixture of cow dung and saw dust. The plastic bin was spread with non-oven cloth to avoid spillage of compost as well as to avoid escape of earthworms. The bottom of the bin was uniformly spread with pure sand for about 1 inch height. Above this, the thoroughly mixed saw dust and cow dung was filled in the ratio of 1:1. Then 250g of earthworms were introduced into the substrate for vermicomposting. Then the vermicomposting bin was placed in the plastic tray to collect the vermin wash. The entire setup was maintained in a cool area for about 30 days. The substrate moisture content was maintained to 60-80% by sprinkling water every day. Once in 3 days, the surface of the substrate was ploughed well for better aeration with the help of wooden stick to speed up the vermicomposting and to eliminate volatile toxic gases. At the end of the experiment, worms, hatchlings and cocoons were removed. The vermicompost was sieved, air dried and stored in plastic bags for physico-chemical analysis.

4. Physico-chemical analysis

5g of air dried sample was dissolved in 50 ml of distilled water (1:10 ratio) and shaken well for 40 min. Then the supernatant was collected, filtered and the pH and EC of the filtrate was tested by using pH and EC meter. The porosity, water holding capacity, bulk density, organic carbon content (%), C:N ratio were determined as per standard protocols. The K, Ca, Mg, Cu, Fe, Zn were determined by using Atomic Absorption Spectrophotometer (Perkin Elmer analyst -100, New Jersey, USA). Total nitrogen and phosphorous contents were quantified by the standard methods.

5. Results and discussion

The physico-chemical parameters of vermicompost at different time intervals (0-30 days) are presented in Table 1. The pH of the vermicompost is decreased from 7.4 to 6.9; whereas the EC significantly increased (72% over control). The increment in the EC was probably due to the degradation of organic matter and thereby releasing minerals such as calcium, magnesium, potassium and phosphorous. Vermicomposting converts saw dust into compost in 30 days, reduces the C: N ratio and increases N, P and K. Vermicomposting has improved the porosity and water holding capacity, whereas decreased the bulk density due to the high humus content [6-8]. The major and micronutrients were also increased significantly indicating that the degradation of organic materials releasing minerals such as exchangeable calcium, magnesium, phosphorous, potassium, nitrogen, copper and zinc [1, 2, 5, 7, 9]. To sum up, vermicomposting of saw dust and cow dung is a natural, ecofriendly, cost-benefited, less laboured and speedy process where, earthworms are ingested the organic material and produced humus like vermicastings, known as "Black Gold". Vermicastings are rich in nutrient and thereby enriched the physico-chemical parameters of the soil. In addition, the reduced pH solubilizes the macro and micronutrients, which make them readily available to the plant kingdom. This is in consonance with the findings of Sakthivel, *et al*. (2017) [10, 11].

Table 1: Physico-chemical parameters of vermicompost at different time intervals. The Data are mean values of three different experiments. (Data in parenthesis indicates% over control)

S. NO	Parameters	0 - day	30 - day
1	pH	7.4	6.9 (93)
2	EC (mS/cm)	6.10	10.50 (172)
3	Water holding capacity (%)	39.5	51.6 (130)
4	Bulk density (Kg m-3)	545	362 (66)
5	Porosity (%)	41.55	79.62 (191)
6	Organic carbon (%)	21.5	12.8 (59)
7	C:N ratio	39.5	17.6 (45)
8	Nitrogen (%)	0.90	1.78 (198)
9	Phosphorous (%)	0.45	0.82 (182)
10	Potassium (%)	0.5	0.81 (162)
11	Calcium (%)	1.40	2.15 (154)
12	Magnesium (%)	0.30	0.45 (150)
13	Copper (ppm)	103	168 (163)
14	Iron (ppm)	141	163 (116)
15	Zinc (ppm)	127	196 (154)

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