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Conversion of Coir Wastes (*Cocos Nucifera*) Into Vermicompost by Utilizing *Eudrilus Eugeniae* and Its Nutritive Values

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ABSTRACT

The vermibeds were prepared by mixing the processed *Coir* waste with cured cow dung in different proportions viz., 50:50, 60:40 and they were filled in the plastic trays, individually. Simultaneously, a control for each of these concentrations was prepared and maintained. One hundred *Eudrilus eugeniae* adult worms were introduced into each of these trays excepting the control. The bioconversion ratio i.e., waste into vermicompost (52%) was found to be high in 60:40 proportion than the other. Besides, the mean number of cocoons (21), young ones (48) and quantity of chemical nutrients observed in 60:40 concentration was high when compared to 50:50 concentration. The results of the present study obviously suggest that the *Coir* waste with cured cow dung at 60:40 concentrations can very well be used for converting into value added vermicompost by utilizing *E. eugeniae*.

Key words: Vermicompost, *Coir* waste, *Cocos nucifera*, *Eudrilus eugeniae*, vermicast, Macro and Micronutrients

INTRODUCTION

Cocos nucifera is cultivated in more than 93 countries of the world in 12.05 million hectares. Among these India occupies third place with 1.89 million hectares producing 12.821 million nuts/annum (Rathinam, 2005). The *Coir*, one of the by products of coconut is used for the production of ropes, mats, bags, etc (Bhatt, 1992). In India, the annual production of coir waste is about 1.39 million tonnes and of all the states the Karnataka alone produces about 140-150 thousand tonnes. The generated waste is of great concern to the environment of our area as they are burnt. Further in order to alleviate the deleterious effects of inorganic fertilizers in the soil and environment, now-a-days Scientists advocate development of novel technologies to produce organic manures from agro-industrial wastes. In recent years, earthworms have been identified as one of the important organisms to process the biodegradable organic matter. An important feature of vermicompost is that during the processing of various organic wastes by earthworms, many of the nutrients that the wastes contain are changed into plant usable forms (Edwards, 1988). Application of vermicompost to crop fields can improve the physico-chemical and biological properties of the soil (Kale, 2006). In the present study an attempt has been made to convert *C. nucifera* (*Coir* wastes) into vermicompost, organic manure by using an epigeic earthworm, *Eudrilus eugeniae* and to assess its nutrient status.

MATERIALS AND METHODS

The present study was carried out between March 2007 and July 2007 in vermiculture unit of our college. *Eudrilus eugeniae* was selected for the present study because of its surface feeding behaviour. The selected *Coir* wastes were collected from the Vengangudi and Samayapuram Villages, Tiruchirappalli district. The *Coir* wastes were shredded into small pieces. Later, they were cured both in the open area and in a shade for 5 days. Water was sprinkled on the wastes twice in a day in order to hasten the pre-digestion process. Similar method was adopted for curing cow dung. Plastic trays of 45x15x30cm size were bought and used for the present study. At the bottom of the tray a hole was made to drain the excess water in the experimental medium. The vermibeds were prepared by mixing the processed *Coir* wastes with cured cow dung in different proportions viz., 50:50 and 60:40 as suggested by Ambika (2007) and Jaynathi (2007) and they were filled in the trays, individually. They have further stated that the conversion ratio of waste into vermicompost, production of high number of young ones and cocoons in the medium and desired level of chemical composition of nutrients in the vermicompost were comparatively better in 50:50 and 60:40 concentrations than the 70:30 concentration. A control experimental medium was also prepared with the same proportions and filled in the trays, individually. All the

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above experiments were repeated for three times. After 10 days of the preparation of the experimental media in the trays, 5 clitellate *E. eugeniae* worms were introduced into each of these trays. The worms entered into the media immediately after the inoculation. On the subsequent day 95 worms were additionally introduced into each tray, excepting the control ones. These trays were kept undisturbed in a shady place. Watering was done regularly twice in a day in order to maintain the temperature and moisture content of the medium during the entire composting period.

The produced vermicompost were collected, sieved, air dried and weighed separately from each tray. Further, after the harvest, in each tray the number of cocoons and young ones were counted and recorded. Various chemical parameters such as pH, Electrical Conductivity, organic carbon and the macro and micronutrients such as total nitrogen, total phosphorous, total potassium, total calcium, total magnesium, total sulphur and carbon : nitrogen ratio were estimated by following the method suggested by Murugesu Boopathi et al., (2005). The data were subjected to statistical analysis.

RESULTS AND DISCUSSION

The mean number of days required for bio-conversion was 35 and 39 for 50:50 and 60:40 concentrations, respectively (Table 1). The total weight of the vermicompost obtained after vermicomposting of Coir wastes were 935g (50:50) and 1040g (60:40). The percent conversion of vermicompost was 47% (50:50) and 52% (60:40) (Table 1). The mean number of cocoons and young ones produced by *E. eugeniae* was found to be 15 and 33 for 50:50 and 21 and 48 for 60:40 during the composting period. The cocoons and young ones production was found to be higher in 60:40 proportion than the other proportion. Similar observations have been made by Ambika (2007), Jayanthi (2007), Rajeswari (2008), Malarvizhi (2008), Poongodi (2009), Kavitha (2009), Viji (2009) and Dhanasekaran (2010) who used mixed leaves' litter, Korai (*Cyperus rotundus*) waste, Coir waste(*Cocos nucifera*) and Sugarcane trashes (*Saccharum officinarum*) with various microbial inoculants, respectively.

The chemical analysis of control and worm worked wastes (vermicompost) showed changes in all the parameters analyzed (Table 2).

Control vs. Vermicompost (in both concentrations)

An increase in the values was observed in the following parameters such as organic carbon, total nitrogen, total

phosphorus, total potassium, total calcium, total magnesium, total sulphur and C:N ratio. Contrary to this, a marginal decrease in the values was observed in pH and Electrical Conductivity (Table 2). The nutrient status of vermicompost depends on the type of waste materials processed by the earthworms (Uma Maheswari and Vijayalakshmi, 2004). Usually earthworm casts possess near neutral pH when compared to soil. Earthworms also contribute to several kinds of nutrients in the form of nitrogenous wastes. High solubility of nutrients in earthworm cast increases the pH of the cast (Barley, 1961). Earthworms-worked soil is close to neutral pH which is congenial for the growth of plants and microbes (Saini and Rathore, 2007). The observations of the present study corroborate the results of the earlier studies.

It is obvious that all carbon containing compounds undergoes essentially oxidation process by the action of microbes which results in the release of nutrients, CO₂ and humus. Soft plant materials are easily decomposed and deoxidized by microbes. However, tougher plant materials do not breakdown readily by soil microbes and animals. The final process of organic matter decomposition viz., mineralization and humidification although are brought out by microorganisms, these are accelerated when they pass through the guts of earthworms probably due to the presence of intestinal micro flora and enzymes in the worm's gut (Edwards and Lofty 1975; Lee, 1985). The results of the present study indicated that Coir wastes ingested by the worms underwent physical, chemical and biological degradation.

The results obviously suggest that 60:40 concentration was found to be better in terms of the following aspects viz

- (i) High rate of bioconversion,
- (ii) Production of high number of young ones and cocoons in the medium,
- (iii) Desired level of composition of nutrients in the vermicompost (when compared to control) i.e., in the chosen concentration 60:40 was comparatively better than the other concentration 50:50. Hence, it is recommended that Coir wastes with cow dung at 60:40 concentration may be used for bioconversion into a nutrients rich vermicompost. The vermicompost obtained from these wastes can also be used as a bio-organic fertilizer for crops. The mean conversion ratio of both chosen concentrations in the present study was

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Table 1: Magnitude of composition of predigested food and its bioconversion of Coir (*C. nucifera*) wastes into vermicompost by *E. eugeniae*

Particulars	Concentrations	
	50:50 ³	60:40 ³
Weight of Coir waste in each tray (g)	1000	1200
Weight of cow dung in each tray (g)	1000	800
Total weight of pre-digested mixture in each tray (g)	2000	2000
Number of adult Earthworms introduced in each tray	100	100
Mean number of days taken for bio-conversion	35	39
Mean weight of vermicompost obtained (g)	935	1040
Mean percentage of bio-conversion of vermicompost	47	52
Mean numbers of Cocoons counted	15	21
Mean numbers of Young ones observed	33	48

³Experiments were conducted in triplicates in each concentration.

Table 2: Extent of chemical constituents of control and vermicompost produced by *E. eugeniae* in various concentrations.

Parameters	50:50		60:40	
	Control	Vermicompost	Control	Vermicompost
pH	8.07	7.30	7.93	7.40
EC	4.3	3.2	4.4	3.7
Organic Carbon	7.82	18.97	7.95	19.18
Total Nitrogen (%)	1.18	2.09	1.06	2.02
Total Phosphorous (%)	0.45	1.52	0.37	1.52
Total Potassium (%)	1.58	2.19	1.54	2.18
Total Calcium (%)	4.10	4.22	4.22	4.52
Total Magnesium (%)	2.14	2.59	2.11	2.25
Total Sulphur (%)	0.14	0.19	0.14	0.15
C:N Ratio	4:1	10:1	4:1	10:1

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nearly half only i.e., 50%. Attempts should be made to digest the *coir* waste with a microbe or consortium of microbes. It is presumed that this will facilitate higher conversion rate and reduction in the number of days for bioconversion.

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