Management of Kitchen Waste by Vermicomposting Using Earthworm, *Eudrilus Eugeniae*

Mohamed Omer Albasha[1*], P.Gupta[2], and P.W. Ramteke[3]

***Abstract*—**The use of earthworms in the degradation of various types of wastes from the past so many years. Present study examines the potential of the African night crawler *Eudrilus eugeniae* in the vermicomposting of Kitchen waste. As Kitchen waste is rich inorganic material while deficient in nitrogen cow dung was mixed with it to make it suitable for earthworms. A mixture of Kitchen waste and cow dung in the ratio of 1:1 was found to be the best ratio than 2 (Kitchen waste): 1 (cow dung) and 3 (Kitchen waste): 1 (cow dung). In 60 days time good quality compost was prepared by earthworms. Physical and biochemical parameters were analyzed during this period of 60 days. Pre decomposition of 15 days and subsequent vermicomposting of 60 days indicates the role of this species in vermitechnology. Increase was found in all the parameters like, Total nitrogen (%), Available phosphorus (%) and Exchangeable potassium (%) while a decrease was found in pH and C:N ratio as the timing of vermicomposting increased from o days to 6 days.

***Keywords*—**cow dung, *Eudrilus eugeniae.* vermin- composting; kitchen waste.

I. Introduction

EARTHWORMS are one of the most important organisms among soil invertebrates owing to their beneficial effects on soil environment such as modification of soil physical properties and impact on decomposition of soil organic matter. They depend on soil for all of their activities hence they are called geobionts. Earthworms are also known as rain worms, as they are seen in large numbers during rains, manure worms, as some varieties flourish well in manures. Earthworms play a significant eco-functional role in soil ecosystem by affecting physical, chemical and biological properties of the soil. Earthworms have dynamic potentials and can do wonderful jobs for man and biosphere. The potentials of earthworms have been proved in decomposition of waste materials. Many organic by-products of agricultural production and processing industries are currently seen as waste and thus become potential environmental hazards. Due to ill effects of modern technologies and un-sustainable developments, the importance of eco-friendly technologies is now stressed upon.

The potential of earthworms in soil processing due to their burrowing nature and composting of organic matter has been realized and simple appropriate vermiculture biotechnology has been developed which may solve the problems of waste processing and management to a large extent.

Applied use of earthworms in the breakdown of a wide range of organic residues, including sewage sludge, animal wastes, crop residues, Kitchen waste and industrial refuse to produce vermicompost, has been recommended Hartenstein and Bisesi, [1]; Van Gestel*et al*., [2]; Dominguez and Edwards, [3]. The importance of the earthworms in waste management, environmental conservation, organic farming and sustainable agriculture has been highlighted by several workers [4 -7].

The worms actually enhance microbial activity and diversity [8] and lead to rapid degradation of waste and recovery of nutrients. World waste industry has been registering a growth rate of 2.8% per annum. The microflora in the intestine of worms and gut enzymes, as well as microflora present in the waste, are involved in decomposition [9]. Enhanced organic matter decomposition in the presence of earthworms has been reported, Suriyanayanam *et al*., [10] carried out a study and reported that kitchen waste can be used as a good bulking agent or good source of carbon in composting

II. Materials And Methods

A. Collection Of Material

The cattle dung (20 days old) was procured from nearby dairy farm of Sam Higging bottom Institute of Agricultural Technology & Science(SHIATS). The moisture content of the medium was maintained at about 50%.-70% and the Kitchen waste was procured from the SHIATS teacher campus & Student Mess. The kitchen waste was shredded before using by means of a kitchen waste shredder.

B. Collection Of Earthworms

Earthworms (Eudrilus eugeniae) were procured from vermicomposting center, located in Dadri Village in Chaka Block, Allahabad. For the present study, separate vermibed was made using Twenty days (20 days) old cattle dung for mass culture of Eudrilus eugeniae. The culture was constantly monitored throughout the period of study with time by time

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spraying of water. Mature worms for experimental purpose were taken from this stock culture.

C. Experimental Setup

Two sets of experiments were conducted in the present study.

D. Pre-Decomposition Experiment

A ceramic tank of 45x30x15 cm measurement was filled with a mixture (5 kg) of dung and kitchen waste , it was daily sprinkled with water so that it gets decomposed. Also this waste was turned up and down for proper aeration and decomposition. This experiment continued for 15 days.

E. Composting Experiment

In this study plastic container was filled with the pre-decomposed mixture of cow dung and kitchen waste 25 adult, mature, worms were taken from the stock culture and were uniformly released on the top of the containers of all the three experimental containers. The experiments were conducted inside the vermicompost shade located in Department of Biological Science (SHIATS), Allahabad.

The containers were covered by mesh garden cloth and were observed daily in order to check the various parameters necessary for the survival and reproduction of earthworms. This whole setup was maintained for 60 days till the finely granular vermicompost was prepared.

During the composting process the material was analysed for different physico-chemical attributes such as pH, total Nitrogen, available Phosphorus, exchangeable Potassium, as per the methods suggested by other workers [11-13] as well as for earthworm number, cocoon production and weight loss of organic substrate [14-15]. During the course of investigation, the samples were examined at periodic intervals after 30 and 60 days of vermicomposting.

II. Results And Discussion

Scientific investigations have established the viability of using earthworms as a treatment technique for numerous waste streams besides producing organic fertilizers. Vermicomposting results in the bioconversion of the waste stream into two useful products, earthworm biomass and vermicompost [16]. kitchen waste material is characterized with high values of pH, organic carbon. However, other nutrient such as total nitrogen available phosphorus and exchangeable potassium were found in very trace amounts. The process of vermicomposting activity significantly modified the physical and chemical properties of kitchen waste material that can be an important tool for organic farming. It is indicated in Table.1 that during vermicomposting the pH declines (from 7.9 to 7.1) with the advancement of vermicomposting period (from 0 to 60 days) (Figure. 1). Other researchers [17, 18 & 19] have shown higher reduction in pH in the polyculture reactors. It might be on account of high mineralization of nitrogen and phosphorus into nitrates/nitrites and ortho-phosphate

TABLE I
EFFECT OF VERMICOMPOST ON DIFFERENT PHYSICO-CHEMICAL PARAMETERS OF KITCHEN WASTE

Parameters	Duration of Vermicomposting		
	0 day	30 day	60 day
pH	7.9	7.5	7.1
Total nitrogen (%)	0.14	0.22	0.35
Available phosphorus (%)	0.76	0.92	1.21
Exchangeable potassium (%)	0.091	0.134	0.39
C : N ratio	30.8	16.41	5.45

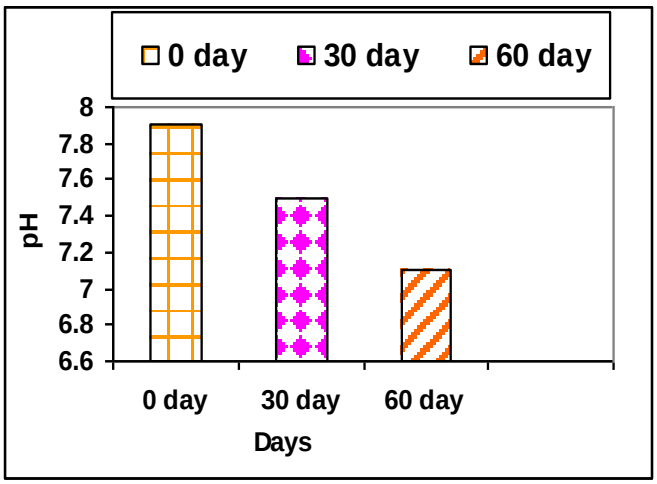

Fig .1 Effect Of Vermicompost On PH Of Kitchen Waste

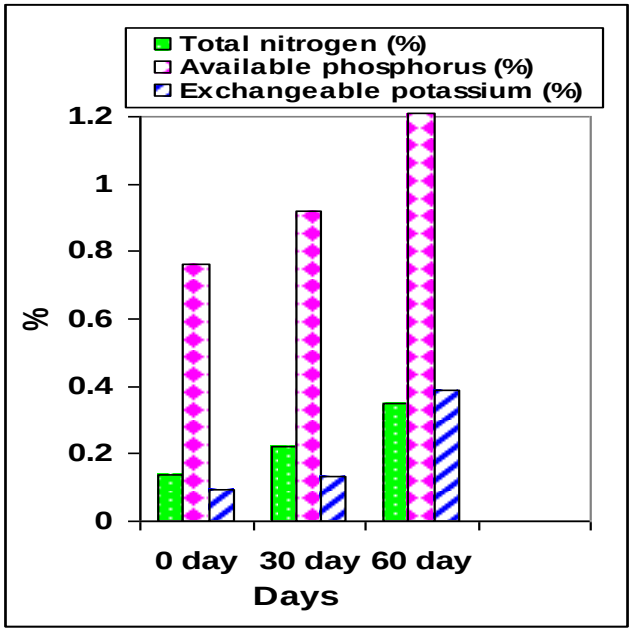

Fig.2 Effect Of Vermicompost On Total Nitrogen, Available Phosphorus And Exchangeable Potassium Of Kitchen Waste

TABLE II
IMPACT OF COMPOSTING PERIOD ON EARTHWORM NUMBER, BIOMASS AND COCOON PRODUCTION

Type of Waste	Earthworm Number			Body Weight (gm)			Cocoon Production		
	0 Days	30 Days	60 Days	0 Days	30 Days	60 Days	0 Days	30 Days	60 Days
Kitchen waste	28	32	45	35	39	57	Nil	21	45

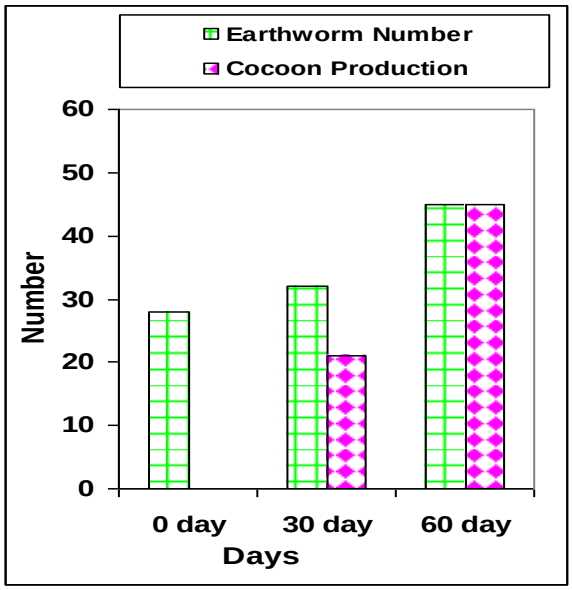

Fig.3 Impact Of Composting Period On Earthworm Number And Cocoon Production

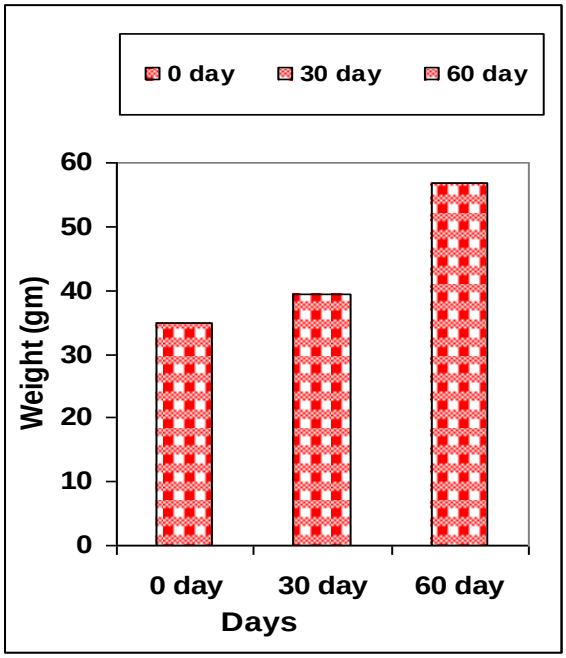

Fig.4 Impact Of Composting Period On Earthworm Biomass

TABLE III
IMPACT OF VERMICOMPOSTING ON WEIGHT LOSS OF ORGANIC SUBSTRATE

Type of Waste	Initial weight of Substrate (gm)	Final weight of Vermicompost (gm)	Loss % during vermicompost
Kitchen waste	5000gm	2180gm	56.4

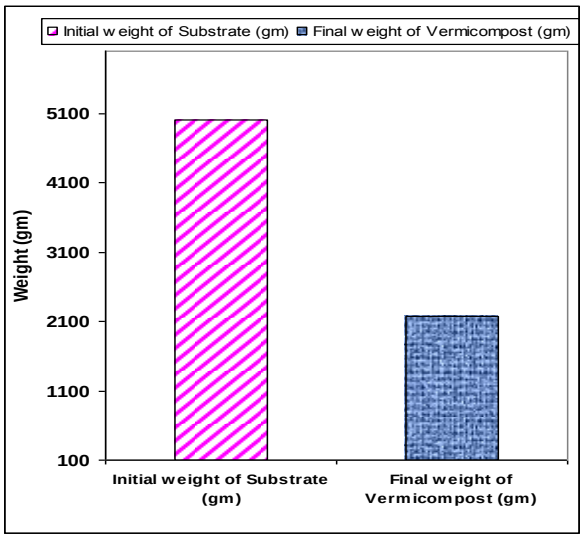

Fig.5 Impact Of Vermicomposting On Weight Loss Of Organic Substrate

It is clearly evident from the result of Table 1 that the values of total nitrogen, available phosphorus and exchangeable potassium increased over 60 days of vermicomposting. Lowest values of total nitrogen (0.14%), available phosphorus (0.76%) and exchangeable potassium (0.091%) were found in control (0day). Moreover, as the time period increases during vermicomposting, these parameters also increases and their maximum values i.e. total nitrogen (0.35%), available phosphorus (1.21%) and exchangeable potassium (0.39%) were obtained after 60 days of vermicomposting (Figure. 2). Gunadi and Edwards, [20] also carried out a study and demonstrated that after six months of vermicomposting, the nitrogen content in the end product was high. The data shown in table 2 and figures 3& 4 clearly indicates that there was no mortality of worms in the predecomposed kitchen waste.Garget et al., [21] while working growth and reproduction of E. foetida in animal wastes also opined that precomposting is very essential to avoid the mortality of worms. the changes in biomass and cocoon production were also noted by Suthar , [22] and attributed the cause of difference in substrate composting quality.

Table.3 clearly indicates that vermitechnology reduces the amount of waste and also improves the nutrient content of the product (vermicompost) to be used as a biofertilizer in agricultural practices. Weight loss in case of kitchen waste was found to be 56.4% (Figure.5)

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