



Vermiconversion of paper industry waste for recycling the nutrients using earthworm *Eudrilus eugeniae* kingberg on growth of cluster bean (*Cymopsis tetragonoloba*)

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Abstract

Objective: To preparation of vermicompost from paper industry waste for recycling the nutrients using earthworm *Eudrilus eugeniae* kingberg. To analyze the physico chemical parameters of vermicompost, vermiwash and vermicompost extract, enumeration of microorganism from vermicompost, growth parameters and biochemical characteristics of Cluster bean (*Cymopsis tetragonoloba*) were studied.

Methods: The paper industry wastes washed for two times with preparing the predecompost and it kept in 30 days. For preparing the vermicompost, the predecomposition was directly mixed with cowdung in the ratio of 1:2 on dry weight basis in same tank. Seventy number of healthy, clitellate *Eudrilus eugeniae* kingberg were introduced in the same tank. After 45 days the trial tank compost were sieved and collected for paper industry waste vermicompost.

Results: The physico chemical parameters of vermicompost vermiwash and vermicompost extract were studied, the growth parameters and biochemical characteristics were higher in treatments 5 and 6 of Cluster bean were using various concentration of vermicompost, vermiwash and vermicompost extract.

Conclusion: Present study was concluded that the *Eudrilus eugeniae* kingberg is more efficient in bioconversion of paper industry waste vermicompost, vermiwash and vermicompost extract were using various concentration of pot culture study of brinjal was higher growth and high yield and vermicompost act as an excellent biofertilizer of crop plants.

Keywords: Vermicompost; Vermi Wash; Vermicompost Extract; Physico Chemical Parameters; Growth and Biochemical Parameters.

1. Introduction

Presently many cities are facing the problem of disposal of solid waste generated within the cities. Solid waste arising out of domestic, commercial industrial and agriculture products comprises biodegradable (organic) and non-biodegradable material. Paper industry of India is the 15th largest industry in the world and contributes 5 million dollars to the government's coffer annually. This will not only severely pollute land and ground water of that area but there will also be a waste of rich carbon resource (Nirmala Natarajan and Gajendran 2014). Disposal and environmental friendly management of these industrial wastes has become a serious global problem. Contamination of ground water, soils, as well as, food resources are some of the problems which have resulted from land filling practices of dumped waste materials.

The safe treatment and recycling of solid pulp and paper mill sludge (SPPMS) emerging out of effluent treatment plants mixed with cow dung (CD) and food processing waste (FPW) to produce good quality compost using vermitechnology (Nogales et al., 2005). The use of earthworms in the degradation of various types of wastes is continuing from the past so many years. These wastes include industrial, agricultural and domestic wastes etc. This study examines the potential of the African night crawler *Eudrilus eugeniae* in the vermicomposting of waste paper (Muddasir Basheer and Agrawal 2013). Vermicompost is rich in NKP (nitrogen 2-3%, potassium 1.85- 2.25% and phosphorus 1.55-2.25%), micronutrients, and beneficial Soil microbes and also contain 'plant growth

hormones & enzymes'. It is scientifically proving as 'miracle growth promoter & also plant protector' from pests and diseases. (Gajalakshmi et al., 2002). The work related to the preparation of predecompost with vermicompost, preparation of vermiwash and vermicompost extract, physico chemical parameters, growth parameters and biochemical characteristics of cluster bean is total wanting. Hence the present study was carried out.

2. materials and methods

The paper waste sample was washed with water for two times. For the first wash, one kilogram of paper waste was washed with two liters of water and for the second wash, one liter of water was used and the paper waste was shade dried for a day, for preparing the predecompost the paper industry waste was directly mixed with cow dung in 1:3 (1 kg of sample and 3 kg of cow dung) ratio on dry weight basis in tank 40 cm height × 50 cm diameter size. *Bacillus* species [100 ml] was inoculated to the predecompost tank. The predecomposition tank set up was kept in 30 days. Water was regularly sprinkled and the substrate was regularly turned for 30 days. For preparing the vermicompost, the predecomposition was directly mixed with cow dung in 1:2 (1 kg of predecompost and 2 kg of cow dung) ratio on dry weight basis in same tank. The substrates were hold 60-80 percentage of moisture content and kept for 24 hrs stabilization. Seventy number of healthy, clitellate Earth worm *Eudrilus eugeniae* kingberg were introduced in the same tank. After 45th day, the trial tank compost were sieved and col-

lected for paper industry waste vermicompost. The vermicompost extracts were analyzed for various physico chemical parameters such as pH, electric conductivity, total nitrogen, total phosphorous and total potassium using standard procedures (Mane and Raskar Smitha 2012).

Table 1: The Physico Chemical Parameters of Paper Industry Waste Vermicompost

SNO	Parameters	At 45 days
1.	pH	8.2
2.	Temperature	34°C
3.	Electrical conductivity	0.2
4.	Nitrogen	0.36
5.	Phosphorous	1.18
6.	Potassium	2.65
7.	Carbon	46
8.	C:N (ratio)	1.27

Table 2: Enumeration of Microbial Populations of Vermicomposts

S.NO	Microorganisms	No of Colony forming units (CFU) of Commercial vermicompost	No of Colony forming units (CFU) paper industry waste vermicompost
1.	Bacteria	59.5x10 ⁶	85x10 ⁶
2.	Fungi	9x10 ³	15x10 ³
3.	Actinomyces	102.5x10 ⁴	148x10 ⁴

Table 3: Physico Chemical Parameters of Paper Industry Waste Vermiwash and Vermicompost Extract

S.NO	Parameters	Vermiwash	Vermicompost extract
1.	pH	7.48	6.8
2.	Electrical conductivity	1.2	0.5
3.	Temperature	29°C	30°C
4.	Nitrogen	1.65	2.38
5.	Phosphorous	1.15	1.95
6.	Potassium	2.21	2.19
7.	Carbon (%)	46	53.73
8.	C:N (ratio)	0.03	0.04

Table 4: The Growth Parameters of Cluster Bean for 60 Days Pot Culture Study

Growth parameters	T0	T1	T2	T3	T4	T5	T6
Germination efficiency	53	77	80	70	70	93	97
Shoot length	13.8±6.1	14.3±6.4	15.1±6.8	17.1±7.6	20.1±8.9	22.4±11.6	24.7±12.4
Root length	4.9±1.8	5.4±2.8	6.1±3.2	7.9±4.6	8.1±5.6	9.4±6.6	10.2±7.2
Total fresh weight	3.1±0.2	4.1±0.1	5.2±0.2	6.1±0.3	6.4±0.2	6.6±0.4	6.2±0.2
Total dry weight	1.5±0.2	2.6±0.1	2.8±0.1	3.9±0.1	3.1±0.1	3.5±0.1	3.3±0.1
Vigour index	3289	4325	4220	5428	5392	6863	6689

Table 5: The Biochemical Characteristics of Cluster Bean for 60 Days Pot Culture Study

Biochemical characteristics	T0	T1	T2	T3	T4	T5	T6
Chlorophyll (a)	0.4±0.1	1.1±0.2	1.2±0.1	1.4±0.1	1.6±0.2	1.7±0.2	1.9±0.3
Chlorophyll (b)	0.3±0.1	0.4±0.2	0.2±0.5	0.4±0.3	1.6±0.2	1.6±0.1	1.9±0.2
Total Chlorophyll	1.4±0.3	1.6±0.4	1.9±1.4	2.1±0.2	2.3±0.5	2.6±0.5	2.9±0.1
Carotenoids	7.7±2.2	10.8±3.2	13.5±4.1	16.1±5.0	19.0±6.0	22.7±7.2	25.7±8.4
Anthocyanin	0.21	0.13	0.22	0.21	0.16	0.11	0.91

The enumeration of microorganisms such as bacteria, fungi and actinomycetes using standard plate count method (Karthika Arumugam et al., 2013). The vermiwash and vermicompost extract were prepared using standard procedures (Seetha Devi et al., 2012). The vermiwash and vermicompost extract were analyzed for various physico chemical parameter such as pH, electrical conductivity, total nitrogen, total phosphorous and total potassium using standard procedures (Ankur Rajpal et al., 2011). Pot culture study was carried out for growth parameters were observed and biochemical characteristics were analyzed for 30 days and 60days intervals of pot culture study of Cluster bean.

3. Results and discussion

The physico chemical parameters of vermicompost were given table 1. The pH of the vermicompost 8.2, the temperature was 34°C, the electrical conductivity was 0.2, the organic carbon was 46, the total nitrogen was 0.36, the total phosphorous was 1.18, total potassium was 2.65 and the total C:N (Ratio) of the vermicompost 1.27. Antony et al., (2015) reported the vermicompost of paper waste using *Eudrilus eugeniae* were the physico chemical parameters such as pH (7.7), Phosphorous (0.06), Potassium

(0.39) and Moisture was (5%) (Muddasir Basheer and Agrawal 2013) also reported the vermicompost of paper waste using *Eudrilus eugeniae* were the physico chemical parameter pH (7.6.).

The enumeration of microorganisms (Bacteria, Fungi, and Actinomycetes) from 45 days worked vermicompost using *Eudrilus eugeniae*. The organisms such as Bacteria was (85 × 10⁶) Fungi (15 × 10³) and Actinomycetes (148 × 10⁴). Karthika Arumugam et al., (2013) studied the enumeration of microorganisms vermicomposting using after 45 days worked was such as Bacteria, Fungi, and Actinomycetes were analyzed. The physico chemical parameters of vermiwash such as pH was (7.48), Electrical conductivity (1.2), Temperature (29°C), Nitrogen (1.65), Phosphorous (1.15), Potassium (2.21), carbon (46) and C: N (ratio) was (0.03). Jayanthi and Jayanthi (2014) reported the physico chemical parameters of vermiwash such as Nitrogen (1.94), Phosphorous (3.40) and Potassium (0.96) were analysed. Tangavel et al., (2003) also reported the organic waste vermicompost using *Eudrilus eugeniae* vermiwash physico chemical parameters such as pH, Nitrogen, and phosphorous were analyzed.

The growth parameters of Cluster bean, germination efficiency was higher in T₆ (97%) Lower in T₀ (control) (53%). The shoot length was higher in T₆ (10.2) lower in T₀ (control) (13.8). Root length was higher in T₆ (9.4) lower in T₀ (control) (4.9). Total

fresh weight was higher in T₆ (1.9) lower in T₀ (control) (0.3). Total dry weight was higher in T₆ (1.6) lower in T₀ (control) (0.1). Leaf area index was higher in T₆ (3.9) lower in T₀ (control) (0.1). Vigour index of Cluster bean was higher in T₆ (6989) lower in T₀ (control) (3289). Allah Bakhsh Gulshan et al., (2013) Reported the growth parameters of okra plant using Root length (38.6) and Shoot length was (24.8) using various concentration of vermicomposting compared to inorganic fertilizer. Balbhim et al., (2015) also reported the growth parameters of Cluster bean (*Cyamopsis tetragonoloba*) using fresh weight (2.6), and dry weight (0.44) was using various concentration of vermicomposting compared to inorganic fertilizer.

The bio chemical characteristics of cluster bean chlorophyll a content was higher in T₆ (1.9) lower in T₀ (control) (0.4). Chlorophyll b content was higher in T₆ (1.9) lower in T₀ (Control) (0.3). Total chlorophyll content was higher in T₆ (2.7) lower in T₀ (control) (1.4 ± 0.9). Carotenoid content was higher in T₆ (25.7) lower in T₀ (control) (7.7). Anthocyanin content was higher in T₆ (0.2) lower in T₀ (control) (0.9). Mohamad Oma Albasha et al., (2015) reported the biochemical characteristics of chlorophyll a, chlorophyll b and total chlorophyll were estimated the brinjal plant. Kamal Lochan Barmer et al., (2013) also reported the biochemical parameters of using Chlorophyll a (1.2), Chlorophyll b (1.9), Carotenoids (11), Anthocyanine (2.7). Sivakumar and Rajan (2014) reported the bio chemical parameters of cluster bean such as chlorophyll a, chlorophyll b, total chlorophyll carotenoids and anthocyanin.

4. Conclusions

The present study was concluded that the earthworm *Eudrilus eugeniae* kingberg is more efficient in bioconversion of paper industry wastes vermicompost, vermiwash and vermicompost extract were using various concentration of pot culture study of Brinjal (60 days) was higher in growth parameters and it is acts as an excellent base for the establishment and multiplication of beneficial and symbiotic microbes. It being a natural means of soil fertility management strategy for sustainable agriculture.

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