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Effect of Coir Pith Industry Waste Vermicompost Prepared Using *Eisenia fetida* on Growth of Vegetable Crop of Radish (*Raphanus sativus*)

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Abstract

Present study deals with the effect of coirpith industry waste vermicompost using *Eisenia fetida* for promoting the growth of Radish (*Rhapanus sativus*) preparation of coirpith waste vermicompost and its physic-chemical parameters were analyzed, enumeration of microorganisms bacteria, fungi and actinomycetes from vermicompost, preparation of vermiwash and vermicompost extract and its physic-chemical parameters were analyzed, growth parameters and biochemical characteristics also studied of Radish. The coirpith industry waste vermicompost was studied the physic-chemical parameters like pH, temperature, electrical conductivity, organic carbon, total nitrogen, total phosphorous, total potassium and C:N (ratio) were studied. The number of colony forming units of the vermicompost of bacteria, fungi and actinomycetes were also assessed. After preparation of vermicompost, vermiwash and vermicompost extract was prepared using after 45 days worked healthy earthworm. The physic-chemical parameters of vermiwash and vermicompost extract also studied. The growth parameters like seed germination, shoot length, root length, total fresh weight, total dry weight, and vigour index were studied and biochemical characteristics such as chlorophyll a & b, total chlorophyll, carotenoide and anthocyanin were estimated. Based on the results growth parameters and biochemical characteristics were higher in Radish treatments 5 and 6 using various concentration of vermicompost, vermiwash and vermicompost extract.

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Keywords

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Introduction

Coir pith is a byproduct of coconut industry. The waste of coir yarn industry (coir pith) gets accumulated in large quantities making their disposal difficult, though it is used as soil conditioner. The dust left behind after extracting long fibres from the husk of a coconut is known as coir dust. It is a fluffy and spongy material with significant water holding capacity. Coir pith will not degrade by itself and will remain over the soil years together. When it is burnt, it is not destroyed completely. It emits smoke continuously for a long time, there by pollute the environment and disposal problems (Christopher *et al.*, 2007). It is a highly lingo cellulosic waste dumped in huge piles on roadside. Because of its high lignin content and slow degradation in the natural environment, it creates environmental pollution. Hillocks of coir pith accumulate in the vicinity of coir-

fiber extraction units, of which disposal and management remain a major problem. Disposal problem of accumulated coirpith is a major problem as Coirpith gets decomposed very slowly in the natural environment because of its chemical and structural complexity. Lignin, cellulose and hemicellulose are natural chemical constituents present in all plants at variable rates (Ramalingam et al., 2004).

Composting is the natural microbial process of decomposition of organic matter by microorganisms such as Bacteria, Fungi and Actinomycetes. Biocomposting process is a viable means of converting various organic generated from the industry and the agricultural sectors into beneficial products such as biofertilizer and as a soil conditioner. Microbial degradation of coir pith is considered to be a safe, effective and environmentally friendly process. Vermicomposting has been recognized as an eco-friendly technology for converting organic wastes into high value organic manure (Kale *et al*.,1982; Senapathi, 1994). This work related to the preparation of predecompost with vermicompost, preparation of vermiwash and vermicompost extract, physico chemical parameters of vermicompost, vermiwash, and vermicompost extract, enumeration of microorganisms (Bacteria, Fungi and Actinomyces), growth parameters and biochemical characteristics of Radish (*Rhapanus sativus*) is totally wanting. Hence the present study was carried out.

Materials and methods

Coirpith industry waste are collected and dried under shade condition. To this waste add cow dung in the ratio of 1:3 (1 kg of Coirpith industry waste and 3 kg of cow dung). This set up was kept for predecomposition in tank [40 cm height × 55 cm diameter size] for 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 *Eisenia fetida* were introduced in the same tank. After 45th day, the trial tank compost were sieved and collected for coirpith 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).

The enumeration of microorganisms such as bacteria, fungi and actinomycetes using standard plate count method (Chitrapriya et al., 2013). The vermiwash and vermicompost extract were prepared using standard procedures (Gurav and Pathade 2011). 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 Avinish and Joshi (2010). Pot culture study was carried out for growth parameters were observed and biochemical characteristics were analyzed for 40 days intervals of pot culture study of radish.

Results and discussion

The physico-chemical parameters of vermicompost was given Table 1. Coirpith industry waste was studied the physico - chemical parameters such as the pH was 7.2, temperature was 36°C, electrical conductivity (dS/m) was 1.37×10^2, organic carbon was 44.25 %, total nitrogen was 2.23%, total phosphorous was 2.10%, total potassium was 2.05% and C: N (ratio) was 20.01%. Mane and Raskar Smitha (2012) reported the physico - chemical parameters of vermicompost from agricultural wastes using *Eudrilus eugeniae* kingberg and *Eisenia foetida* such as pH was 8.0, electrical conductivity (ds/m) was 3.44×10^2, organic carbon was 19.7 %, total nitrogen was 0.95%, total phosphorous was 0.8%, total potassium was 0.8% and C:N ratio was 20.40%. Hiranmai Yadav (2015) also reported the physico-chemical parameters of vermicompost such as pH was 8.52, organic carbon was 21.83 %, total nitrogen was 2.23%, total phosphorous was 0.01%, total potassium was 0.07% and C:N ratio was 9.79% from weed wastes with cow dung using *Eisenia foetida*. Avnish and Joshi (2010) reported the physico-chemical parameters of vermicompost from some toxic and dangerous weed wastes using *Eisenia foetida*.

After preparation of vermicompost, enumeration of microorganisms (bacteria, fungi and actinomycetes) were enumerated and it was given Table 2. The number of colony forming unit of vermicompost bacteria was 162×10^6, fungi was 20×10^3 and actinomycetes was 151×10^4. And compare commercial vermicompost the number of colony forming unit of the commercial vermicompost of the bacteria was 65×10^6, fungi was 15

$\times 10^3$ and actinomycetes was 103 x 10^4. Nagavallmma et al. (2006) reported the enumeration of microorganisms from organic waste vermicompost such as the number of colony forming unit of bacteria was 54 $\times 10^6$, fungi was 8 $\times 10^4$ and actinomycetes was 1 $\times 10^4$. Chhotu.D. Jadia and Fulekar (2008) also reported that the enumeration of microorganisms from organic waste vermicompost such as the number of colony forming unit of bacteria was 34 $\times 10^6$, fungi was 67 $\times 10^4$.

Table 1. Physico-chemical parameters of coir pith industry waste vermicompost.

S.No	Parameters	At 45 Days
1	pH	7.2
2	Temperature (°C)	36^0C
3	Electrical conductivity (dS/m)	1.37×10^2
4	Organic carbon (%)	44.25
5	Total nitrogen (%)	2.23
6	Total phosphorous (%)	2.10
7	Total potassium (%)	2.05
8	C: N (%)	20.0

Table 2. Enumeration of microbial populations of coir pith industry waste vermicompost.

S. No.	Microorganisms	No of Colony forming units (CFU) of commercial vermicompost	No of Colony forming units (CFU) of coir pith waste vermicompost
1	Bacteria	65×10^6	162×10^6
2	Fungi	15×10^3	20×10^3
3	Actinomyces	109×10^4	151×10^4

Vermiwash and vermicompost extract was prepared after 45 days worked healthy earthworm. The Physico-chemical parameters of vermiwash and vermicompost extract was given Table 3. The Physico-chemical parameters of vermiwash and vermicompost extract such as pH of the vermiwash was 6.8, temperature was 30^0C, electrical conductivity (ds//m) was $1.27x10^2$, organic carbon was 48.09 %, total nitrogen was 2.61%, total phosphorous was 2.10%, total potassium was 2.05% and C: N (Ratio) was 18.42% and vermicompost extract pH was 6.7, temperature was 29^0C, electrical conductivity (dS/m) was $1.28x10^2$, organic carbon was 48.20 %, total nitrogen was 2.31%, total phosphorous was 1.85%, total potassium was 2.10% and C: N (Ratio) was 21.0%. Kaur et al. (2015) also reported the physico chemical parameters of vermiwash such as organic carbon was 0.001%. Marlin Cynthiya and Rajeshkumar (2012) studied the physico chemical parameters of vermiwash such as total nitrogen was 0.47%, total phosphorous was 0.61% and total potassium was 0.36%.

Table 3. Physicochemical parameters of *Eisenia foetida* vermiwash and vermicompost extract.

S. No.	Parameters	Vermiwash	Vermicompost extract
1	pH	6.8	6.7
2	Temperature (^{0}C)	30°C	29°C
3	Electrical conductivity (dS/m)	$1.27x10^2$	$1.28x10^2$
4	Organic Carbon (%)	48.09	48.20
5	Total Nitrogen (%)	2.61	2.31
6	Total Phosphorous (%)	2.10	1.85
7	Total Potassium (%)	2.05	2.10
8	C: N (%)	18.42	21.0

Vermicompost, vermiwash and vermicompost extract was using various concentrations of pot culture studies. The growth parameters of radish were given Table 4. The germination efficiency was higher in T_6 (99%) and lower in T_0 (94%), the root length was higher in T_6 (15.19) and lower in T_0 (11.30), the total fresh weight was higher in T_6 (30.16 g) and lower in T_1 (20.26 g), the total dry weight was higher in T_6 (16.09 g) and lower in T_1 (10.35 g), the vigour index was higher in T_6 (1432.8 cm^2) and lower in T_1 (1247 cm^2) for 40 days among different concentration of triplicate treatments. Hruda Ranjan *et al.* (2013) reported the growth parameters of brinjal and chilli plants such as shoot height and leaf number. Naikwade *et al.* (2012) reported the growth

parameters of maize crop such as plant height, no. of leaves, root length, shoot length, no. of leaves and leaf length for different waste composts. Mamta *et al.*, (2012) reported the growth parameters of brinjal (*Solanum melongena*) such as plant height, no. of leaves, leaf length and leaf width. Jaya Nair et al. (2006) also reported the growth parameters such as root length, number of leaves and plant height of Bendi plant.

The biochemical characteristics of Radish were given Table 5. The chlorophyll a was higher in T_6 (5.3) and lower in T_0 (2.27), the chlorophyll b was higher in T_6 (5.3) and lower in T_1 (3.20), the total chlorophyll was higher in T_6 (10.6) and lower in T_0 (5.74), carotenoids was higher in T_5 (13.18) and lower in T_0 (12.14) for 40 days, anthocyanin was higher in T_6 (0.1215) and lower in T_0 (0.1135) for 40 days among different concentration of triplicate treatments. Mohamad Oma Albasha *et al.*, (2015) also reported the biochemical characteristics like chlorophyll a and chlorophyll b using brinjal plant. Siva Kumar and Rajan (2014) also reported the biochemical characteristics of cluster bean such as chlorophyll a, chlorophyll b, Total chlorophyll and carotenoid content.

Table 4. The growth parameters of radish after 40 days.

Growth parameters	T0	T1	T2	T3	T4	T5	T6
Germination efficiency	94	94	96	98	98	99	99
Root length (cm)	11.38 ± 0.79	12.06 ± 0.65	11.38 ±0.79	11.38 ±0.79	14.02 ±0.30	14.02±0.30	15.19±0.63
Total fresh weight (g)	20.26±0.25	21.40 ±0.72	21.40 ±0.72	24.16 ±0.15	26.16 ±0.15	28.2±0.26	30.16 ±0.13
Total dry weight (g)	12.35 ±0.06	10.35 ±0.03	11.38 ±0.79	12.85±0.06	14.12±0.07	15.45±0.04	16.09±0.35
Vigour index	1270.1	1247.4	1346.4	1293.6	1381.8	1381.8	1432.8

Table 5. The biochemical characteristics (mg/g) of radish after 40 days.

Biochemical characteristics	T0	T1	T2	T3	T4	T5	T6
Chlorophyll (a)	2.27± 0.01	3.14±0.16	3.74±0.39	4.0±0.10	4.3±0.57	4.7±0.76	5.3 ±0.57
Chlorophyll (b)	3.47±0.01	3.20±0.00	3.65±0.26	4.5±1.32	4.7±0.76	5.0±1.01	5.3±0.28
Total Chlorophyll	5.74±0.02	6.34±0.20	7.39±0.03	8.5±0.03	9.4± 0.02	9.7±0.01	10.6± 0.02
Carotenoide	12.14	12.65	12.73	12.85	12.98	13.18	13.12
Anthocyanin	0.1135	0.1147	0.1148	0.1165	0.1186	0.1190	0.1215

Conclusion

The present study was concluded that the earthworm *Eisenia foetida* is more efficient in bioconversion of coir pith industry wastes vermicompost, vermiwash and vermicompost extract were using various concentration of pot culture study of Radish (40 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 is being a natural means of soil fertility management strategy for sustainable agriculture.

Conflict of interest statement

Authors declare that they have no conflict of interest.

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