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Short Communication

Impact of effective microorganism on the decomposition of coir pith

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Abstract

Nowadays, environmental pollution is a serious threat and some of the pollutants can be used as an organic manure after biodegradation. And so, an attempt was made to degrade the organic waste, coir pith using EM (Effective Microorganism). The sample was inoculated with EM at different concentrations (T_1 – Control (uninoculated), T_2 – EM (Undiluted), T_3 – 1:10 dilution, T_4 - 1:50 dilution). At 30, 60, 90 days of time intervals, the biochemical parameters like lignin, cellulose, organic carbon, total nitrogen, C:N ratio, phenol and reducing sugars were determined. Among the treatments coir pith with undiluted EM (T_2) showed a very good decreasing trend in all the biochemical parameters than the other concentrations of EM. The present investigation suggests that coir pith waste can be converted into a value added, nutrient enriched organic manure.

Keywords: Coir pith, biodegradation, EM (effective microorganisms), biochemical parameters.

Introduction

Coconut Coir pith or coir waste is an elastic, soft spongy, highly hygroscopic, cork like pith material forming the non-fibrous tissue of husk and is a renewable agro waste resource that accumulates in huge quantities. As the coir industries of Tamil Nadu accumulate about 0.2 million tones of coir pith every year, an accumulated stock of 10×10^{-6} metric tons is produced in the southern states of India and their disposal problem leads to environmental disharmony[1].

During extraction of 1Kg coir fibre, 2Kg of coir pith is produced as a waste. Problems concerning the global environment have created much attention in developing eco-friendly products[2]. Conversion of coir pith into organic manure would solve the waste disposal problem. More significantly, it would also decrease the usage of chemical fertilizers. It is estimated that, the Coir pith contains 74% of organic matter, 42.9% organic carbon, 0.24% nitrogen and 13% of ash content[3,4].

Organic residues are actual resources for building soil fertility and composting is one of the best recycling methods for converting organic residues into inputs for growing food crops.

Effective Microorganism (EM) is a liquid concentrate and consists of common and aerobic and anaerobic mixed culture of beneficial microorganisms like photosynthetic bacteria, lactobacillus, streptomyces, actinomycetes, etc. It is known from sources, that EM (Effective Microorganism) can be applied as an inoculants to increase the microbial diversity of soils. This in turn can improve soil quality and soil health which enhances the growth, yield and quality of crops[5]. The aim of the present study is to investigate the efficacy of Effective Microorganism in converting the coir pith into value added, nutrient enriched organic manure.

Methodology

The industrial waste, coir pith was collected from coir industry in Kinnathukadavu area near Pollachi (Coimbatore district). Weighed sterile coir pith was inoculated with EM at different concentrations (T_1–Control (uninoculated), T_2–EM (Undiluted), T_3–1:10 dilution, T_4-1:50 dilution). The biochemical parameters like cellulose, lignin, organic carbon, total nitrogen, total phenol. C:N ratio and reducing sugear were analysed in fresh and decomposed samples at an interval of 30 days for 90 days using the following parameters: Lignin content[6], Cellulose[7], Organic Carbon[8], Total Nitrogen[9] , Total Phenol[10], Reducing sugers[11].

Results and discussion

Cellulose and lignin content: Among the four treatments, T_2 (Undiluted-EM) treatment was found to be significant in reducing the cellulose and lignin content to 18.17% and 20.79% from 28.61% and 32.14% (raw coir pith) after 90 days of inoculation with EM compared to other treatments. Raw coir pith contained 27% cellulose and after 20days of decomposition with *Pleurotus sajour-caju* inoculation, it was reduced to 8%[12]. Similar reduction in cellulose content from 34.71% to 10.93% was also observed[13] during biodegradation of solid waste by EM.

The present finding is on par as they observed 20 % after 30 days of decomposition of coir pith with *Pleurotus sajor-caju* against the control (32 %)[14].

Table-1: Biochemical parameters of Raw and decomposed coir pith at different concentrations of inoculation of EM (Effective Microorganisms) after 30, 60 and 90 days.

Biochemical parameters	Raw coir pith	30 days				60 days				90 days			
		T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4
Cellulose (%)	28.61	26.73	24.59	25.43	25.07	25.77	22.56	24.01	24.80	24.82	18.17	20.16	23.82
Lignin (%)	32.14	30.47	28.03	28.64	29.28	29.06	23.65	24.25	27.58	28.56	20.79	22.57	25.46
Organic Carbon (%)	31.12	30.84	28.08	29.11	29.92	29.26	25.24	26.15	26.72	27.76	22.29	24.84	25.59
Total Nitrogen (%)	0.24	0.30	0.66	0.52	0.49	0.43	0.91	0.73	0.67	0.46	1.24	0.97	0.78
C:N ratio	130:1	103:1	43:1	67:1	61:1	68:1	28:1	36:1	40:1	60:1	18:1	26:1	33:1
Total Phenol (mg g^{-1})	5.41	4.23	3.06	3.63	3.74	4.21	2.60	2.81	3.02	3.95	0.73	0.91	1.82
Reducing sugar (mg g^{-1})	0.84	0.79	0.60	0.64	0.67	0.68	0.52	0.55	0.57	0.65	0.41	0.47	0.52

T_1 – Control, T_2 – Undiluted EM, T_3 – 1:10 dilution, T_4 - 1:50 dilution.

Organic carbon content: Organic carbon content in the raw coir pith waste was 31.12%. And after 90 days of biodegradation, it was gradually reduced to 22.29% in T_2 treatment (EM undiluted) against the control T_1 treatment (27.76%) after 90 days of decomposition with EM.

A reduction in organic carbon content from 30.6 to 20.9 percent during composting of solid waste by Effective Microorganisms[13] and using *Pleurotus sajor-caju* in coir-pith the reduction was observed from 26.28 to 20.18 percent after 30 days of inoculation[14].

Total Nitrogen content: There was a gradual increase in total nitrogen content in all EM treatments (T_3 and T_4) than the raw coir pith. The total nitrogen content in the raw coir pith was observed to be 0.24% and as decomposition proceeded, it was increased to 1.24% in T_2 treatment (EM-Undiluted). Nitrogen content in raw coir pith was 0.46%[15]. EM-vermicomposted solid waste showed an increase in total nitrogen content from 0.38% to 1.21%[16].

C:N ratio: C: N ratio of raw coir pith was estimated to be 130:l and after 90 days of decomposition it was drastically narrowed down to 18:1 in T_2 (EM-Undiluted) treatment. C:N ratio of other treatments (T_3 and T_4) were 26:1 and 33:1 compared to control (60:1) after 90 days of decomposition.

Simillar reduction of C:N ratio was observed in cocopeat inoculated by selected fungi viz. *Aspergillus niger*, *Penicillium citrinum*, *Trichoderma* sp., *Humicola* sp. and *Chaetomium globosum*[17] and while using EM to compost areca nut waste[18]. Inoculation of *Trichoderma harzianum* along with coir pith has narrowed down the C:N ratio from 103:1 to 24:1[19]. C:N ratio is the most important index for assessing the compost maturity[20].

Total Phenolic content and reducing sugar: The total phenolic content and reducing sugar in raw coir pith were estimated to be 5.41mg g^{-1} and 0.84mg g^{-1}. The Phenolic content was found to be decreased in all the four samples (T_1, T_2, T_3 and T_4) to 3.95mg g^{-1}, 0.73mg g^{-1}, 0.91mg g^{-1}, 1.82mg g^{-1} respectively on 90 days of decomposition. Composting of coir pith helps in detoxifying phenolic compounds[21].

The present finding is on par with the findings of Padmaja and Adlene Sangeetha[13]. They also reported a reduction in total phenolic content and reducing sugar from 1.83 to 0.67mg g^{-1} to 0.37 mg g^{-1} during the degradation of solid waste by EM.

The amount of reducing sugar present in raw coir waste found to be 0.71mg g^{-1}. After 90 days of decomposition with T_1, T_2, T_3 and T_4 treatments, decreased to 0.65mg g^{-1}, 0.41mg g^{-1}, 0.47 mg g^{-1} and 0.52mg g^{-1} respectively. Reduction in reducing sugar was found when coir pith was decomposed using *Phanerocheate chrysosporium* and *Rhizopus stolonifer*[22].

Conclusion

Among the concentrations used for decomposing coirpith, EM-undiluted proved to be more efficient in reducing cellulose, lignin, organic carbon, C:N ratio, total phenol and reducing sugar contents and increasing the total nitrogen content. From the above evidences, it can be concluded that there exists a tremendous potential for the biodegradation of coir waste by EM technology.

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