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EVALUATION OF EFFECT OF DECOMPOSED COIRPITH ON PLANT GROWTH AND COIRPITH MATURITY ASSAY

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ABSTRACT

Coir pith is a lignocellulosic substrate, decomposes very slowly in soil as it contains 30%-35% of lignin. The Basidiomycetes fungus - *Pleurotus sajor caju*, slowly degrades lignin, detoxifies phenolic compounds, produces bio-polymersing enzymes. The cellulosic compounds in the coir waste supports the initial growth of fungus and acts as a co-substrate for lignin degradation. The present study was designed to study the effect of *Pleurotus sajorcoju*, *Streptomyces violaceusniger*, Urea, Yeast sludge, *Ipomoea indica*, *Eudrilus eugeniae* on coirpith. The coirpith was mixed properly along with the different substrates and its physical, chemical properties, maturity, microbial count, germination, plant shoot and root growth was also observed. Considerable changes in physical and chemical properties, enzymes, biochemical components, minerals was identified in the coirpith mixed with different substrate after a period of 90 days, which aids the germination as well as growth of plant shoot, root. Which might be due to the increased humic acid content, CO_2 evolution, microbial count etc. The results obtained shows that it might form a better source of manure equivalent to vermicomposting.

KEYWORDS: Coir pith, substrates, physical, chemical, mineral.

INTRODUCTION

Composting as a mean of waste disposal is increasingly used by world over. This is because composting not only permits energy recovery from waste but also guarantees disposal of the

most highly polluting fractions bio-degradable organic matter. Coir waste is a byproduct of the many small scale coir industries and it is estimated that about 84,000 retting and coir extracting units are operating. It is very light, highly compressible and having high water holding capacity. Because of high lignin content and slow decomposition, coir dust has limited use in agriculture. Coir pith is a waste material from coir industry. Large quantity of coir waste about 7.5 million tone is available annually from coir industries in India. Coir pith has a high lignin (31%) and cellulose (27%) content and a carbon nitrogen (C/N) ratio of 104:1.[1] Coir dust tends to be high in both sodium and potassium compared to the other peats, but Na is leached from the material under irrigation.[2] Accumulation of the coir dust in the vicinity of coir industries lead to occupation of invaluable space, contamination of potable ground water because of percolation of residual from these dumps. If it is not removed on time the tropical rain water will percolate through it where the tannin and other harmful chemicals present in the coir pith contaminate the sources of surface and ground water. Its disposal is a big headache for industries and sometimes it is dumped on roads or burnt and disposed. Burning will not totally bring down its volume but emit smoke for several days. To solve this problem coir pith can be converted to organic manure by degradation. In agriculture, coir waste is used as soil mulching material as it has very high water holding capacity. Application of coir waste in coconut basic is one such example. It is also being used as manure after degradation by efficient lignin and cellulose degrading fungi and bacteria. In the present work *Pleurotus sajorcoju*, *Streptomyces violaceusniger*, Urea, Yeast sludge, *Ipomoea indica*, *Eudrilus eugeniae* are used for degrading coir pith. Micro-organisms multiplies well in the composed coir waste where C:N ratio is lowered and the N is available.

MATERIALS AND METHODS

Sample collection

The coir pith used for the study was collected from home coconut trees. Distillery yeast sludge was collected from Dharani sugars Vasudevanallur. *Ipomoea indica* plant was collected from Elumalaiammapatti, Madurai.

Coir pith composting

Decomposition of biological waste material containing organic nutrients under controlled condition makes a composting process. Composting of coir pith was performed in polyethylene bags. The bottom of the polyethylene bags were tied with a thread to provide flat circular bottom. Few holes were made for aeration. 1kg of coir pith was separated

uniformly into five layers and inoculated according to the study group. Water must be sprinkled after every layer of coir pith in order to maintain minimum moisture content of 60%. At the top, coir pith is to be spread and it must be allowed for biodegradation by the microorganisms for a period three months i.e 90 days. At the end of 90 days composted coir pith turns to black mass and the material can be used as organic manure is most of horticultural crops.[3]

Study groups

The study group involved 7 groups and control group. T1 consists of Coir Pith and *Pleurotus sajorcaju*, T2 consists of coir pith and *Streptomyces violaceusniger*, T3 consists of Coir Pith and *Pleurotus sajorcaju*, *Streptomyces violaceusniger*, T4 consists of Coir Pith and Urea, T5 consists of Coir Pith and Yeast sludge, T6 consists of Coir Pith and *Ipomoea indica*. The results were observed for a period of 90 days. The *Streptomyces violaceusniger* culture used for the study was grown in GYM nutrient medium. All the biochemical parameters were performed by adopting standard procedures.

Estimation of pH, Electrical conductivity

The pH, Electrical conductivity was estimated using standard procedures.

Estimation of cellulose

Cellulose undergoes acetolysis with an acetic/nitric reagent forming acetylated cellodextrins which get dissolved and hydrolysed to form glucose which on treatment with 67% H_2SO_4 forms hydroxyl methyl furfural which forms green colour product with anthrone and the colour intensity is measured at 630nm. Added 3ml of acetic/nitric reagent to a known amount of the sample in test tube and mixed vortex mixture. The tube was placed in a water bath for 30 min. Cooled and then centrifuged the contents for 15-30 min. The supernatant was discarded and the residue was washed with distilled water. 10 ml of 67%H_2SO_4 was added and allowed to stand for 1 hour. 1ml of above solution was made upto 100ml. To 1ml of this distilled solution, added 10ml of anthrone reagent and mixed well. Heated the tube in a boiling water bath for 10 minutes cooled and measured the colour at 630nm. Blank was also set. The standard was developed using cellulose.

Estimation of phenols

Total phenol estimation was carried out with the Folin-ciocalteau reagent. Gallic acid was used as a reference standard for plotting calibration curve. A volume of 0.5 mL of the plant

extract (100 µg/mL) was mixed with 2 mL of the Folin-Ciocalteu reagent (diluted 1:10 with de-ionized water) and were neutralized with 4 mL of sodium carbonate solution (7.5%, w/v). The reaction mixture was incubated at room temperature for 30 min with intermittent shaking for color development. The absorbance of the resulting blue color was measured at 765 nm. Phenols react with phosphomolybdic acid in Folin-Ciocalteau reagent in alkaline medium produces blue coloured complex (molybdenum blue).

Estimation of organic carbon

The organic carbon is oxidized by potassium dichromate in the presence of concentrated sulphuric acid. The dichromate left untreated is back titrated with ferrous ammonium sulphate solution. To the sample add 10ml of 1N potassium dichromate and mix well by swirling the flask. To this add 20ml of concentrated sulphuric acid and allow it to stand for 30min. and added 200ml of water and 10ml of orthophosphoric acid, 1ml of diphenylamine indicator and titre with 0.5N ferrous ammonium sulphate. End point is the change of light to bright green. The percent organic carbon in the sample was calculated by using the formulae 10-(10×a/b) × 0.003 ×100/W. Where, a -Volume of FAS used for sample titration, b -Volume of FAS used for blank titration, W -Weight of sample.

Estimation of total nitrogen

The sample was digested with concentrated sulphuric acid in the presence of catalyst. Under which condition the nitrogenous compounds are converted to ammonium sulphate. The ammonia of mercuric iodide and potassium iodide which is read calorimetrically at 490nm.

Different aliquots of standard ammonium sulphate was taken in a test tube and made up to 3ml with distilled water. For unknown 10mg of powdered sample, 0.5ml concentrated sulphuric acid and 50mg of catalyst (Weigh 1g of $cuso_4$, 8g potassium sulphate and 1g of selenium dioxide. Mixed and ground well, stored in black bottles. 50ml of catalyst was taken in a digestion flask and heated at 160-180°C until apple green colour was developed. Removed the flask and cooled. Added 10ml of distilled water. Now to all the test tubes added 2ml of colour reagent (Solution: A KI-4g ; Mercuric iodide 4g. Dissolved in 25ml of distilled water. Solution: B Gumghatti -5g. Ground well and dissolved in 750ml of boiled water. Add solution A and made up to 1000ml with distilled water) and 3ml of 2N NaOH. Incubated for 15 minutes at room temperature. The yellow colour developed was read at 490nm. A standard

graph was drawn with concentration of nitrogen on x-axis and OD on y-axis. The quantity of nitrogen in the sample was determined with reference to this standard graph.

Estimation of lignin

Lignin a phenolic polymer present in the cell walls of plants, woody plants consist of 30% organic matter. Lignin acts as a physical barrier against invading pathogens. 1g of coir pith and 5ml of concentrated sulphuric acid (98%) and 50ml of hydrochloric acid (37%) for 16 hours at 25°C. Then transfered to 1 litre flask with 450ml of distilled water. Boiling for 10 minutes and filtered through what man no.1 filter paper. Refluxing the material with acid mixture (98% sulphuric acid and 37% hydrochloric acid) solution removes the water soluble materials other than the fibrous component. The left out material is diluted, filtered and weighed which gives the loss of weight on ignition.

Estimation of Humic acid content

Weighed 1g of compost in to a conical flask or beaker. Added 100ml of 0.1N NaOH and kept overnight for precipitation of insoluble non humic fraction. Separate the insoluble fraction by centrifugation at 8000rpm for 10 minutes. Decant the supernatant and acidify with 2N HCL. The folic acid goes in to solution and humic acid precipitates. Centrifuged at 8000rpm for 10minutes and separated the precipitated humic acid by decantation. Dried the precipitate. Estimate the organic carbon content of the fractions. Humic acid percent =(C_{ha}/C_{af}) ×100, Humification index =(C_{ae}/C_{ha})+C_{fa}

Estimation of free carbon dioxide

After sample collection, analyze as soon as possible. 50 ml of sample was taken in a flask and added 2-3 drops of phenolphthalein indicator. Add NaOH (0.2 N) drop by drop until a faint pink color appears.. If the color turns pink, free CO_2 is absent in sample. If the sample remains colorless titrate against sodium hydroxide solution until pink color appears (end point). The free carbondioxide was calculated using the following formulae: Free CO2 (mg/l or ppm) = Vt × 1000 / Vs, Where Vt = volume of titrate (ml) and Vs = volume of sample (ml).

Measurement of dehydrogenase activity

Preparation of enzyme extract

Washed the seedlings in a tap water, cut into 1-2 cm pieces and frozen in dry ice on ice. Grinded the plant tissue to a fine paste. Suspended 10g of the paste in 50ml of MCI vanine

buffer at pH 4.8 stirred the mixture vigorously for 30 min at 4°C. Dialyzed the supernatant against several volumes of distilled water for 24 hours at 4°C changed the water at least twice used the dialyzed extract.

Pipette out 2ml of Sodium succinate into a fresh tube and added 1ml of 0.1M phosphate buffer (pH 7.0), 1ml of 0.1% of TTC and 2ml of the enzyme extract. Incubated the mixture in water bath at 33°C. Added 7ml of acetone to stop the reaction and shaken vigorously for a few seconds to pre-fix the tube. Centrifuge at 2,000g for 30 minutes to remove the precipitate. Decant the supernatant and measure the absorbance of the supernatant at 460nm in a colorimeter. Plot a standard curve and express the enzyme activity in terms of mg of dye reduced per time per g of fresh weight of plant or protein.

Plant growth hormone assay

Chemical detection of gibberellins

The extract was prepared by means of using ethanol and separated by thin layer chromatography. Presence of gibberellins in the chromate plates can be detected by means of acid sprays after examination under uv light.

The chromatogram was developed in a suitable solvent and it was dried at room temperature. Spray with Ethanol- Conc.H_2SO_4. The chromatogram was heated at 120°C for 10 minutes either in a hot air oven or on a hot plate. The plate was removed and examined under UV light (275nm) for fluorescent spots with ethanol sulfuric acid spray. Gibberellins A_1,A_3,A_5,A_6 and A_8 which posses a 7-hydroxyl group appear as blue fluorescent spot under UV light, while gibberellins A_2, A_4,A_7 and A_9 which have no 7-hydroxyl group appear as spots.

Enumeration of microbes by plate count method

The plate count technique enumerates the viable cells. Label the dilution blanks as 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}. Prepare the initial dilution by adding 1ml or 1g of the sample in to a 9ml dilution blank labeled 10^{-4} thus diluting the original sample 10 times (1/1+9=1/10 and is written 1:10 or 10-1). Mix the contents by rolling the tube back and forth between your hands to obtain uniform distribution of organisms (cells). From the first dilution transfer 1ml of suspension, to the dilution blank 10^{-2} with a sterile and fresh 1ml pipette (1/10* 1/10 =1/100 or 10^{-3}). From the 10^{-2} suspension, transfer 1ml of suspension to 10^{-3} dilution blank with a fresh sterile pipette, thus diluting the original sample to 1000 times (1:1000 or 103). Repeat this procedure till the original sample has been diluted 10,000,000 (107) times using

every time a fresh sterile pipette. From the appropriate dilution (10^5 to 10^7) transfer 0.1ml of suspension, with the respective pipettes, to sterile petridishes. Three petridishes are to be used for each dilution (if 0.1 ml is plated, the dilution is increased 10 times). Add approximately 15 ml of the nutrient medium, melted and cooled to 45°C to each petridish containing the diluted sample. Mix the contents of each dish by rotating gently to distribute the cells throughout the medium. Allow the plates to solidify. Incubate these plates in an inverted position for 24-48 hours at 37°C.

Estimation of Minerals

Dry ashing

Weighed accurately 2g of sample in a crucible. Then the sample was heated in a incinerator to completely volatilize as much of the organic matter. Transferred the crucible to a temperature control muffle furnace at 550-600°C for 5 hours. Remove the crucible from muffle furnace, allowed to cool and then the contents in the crucible was washed with 40-50ml of dilute hydrochloric acid and made up to 100ml with dilute hydrochloric acid. Then the solution was used for the estimation of minerals.

Estimation of total phosphorus

Different aliquots of working standard solutions were pipette out. 5ml of molybdate was added and mixed. Then added 2ml of ANSA reagent. The volume was made up to 50ml and the color developed was measured at 650nm. To 5ml ash solution obtained by dry ashing 5ml of molybdate reagent was added and mixed. 2ml of ANSA was added, mixed and made up to 50ml. Similarly a reagent blank was prepared using water in the place of the sample. Allowed to stand for 10 minutes and the color developed was read at 650nm. From the standard curve, the phosphorus content was calculated and expressed in mg/100g. Phosphorous reacts with molybdic acid to form a phosphomolybdate complex, then reduced with aminonaphthol sulphonic acid to molybdenum. Blue color formed was measured at 650nm.

Estimation of magnesium

Pipette out different aliquots of working solution in to a series of test tubes and made up to 5ml with distilled water. To 1ml of calcium chloride, 1ml of Gumghatti, 1ml of titan yellow and 2ml of 4N sodium hydroxide solution was added.

Diluted 1ml of sample with 5ml of distilled water. The proteins were precipitated by adding 2ml of 10% sodium tungstate and 2ml of 2/3N H_2SO_4. Centrifuged and 5ml of supernatant

was treated similarly to standard. Titan yellow solution gives red color with magnesium. The color developed was read at 520nm. A standard graph was drawn and the amount of magnesium present in the given sample was calculated.

Estimation of calcium

Calcium was estimated by the use of EDTA as a titrant and murexide as indicator. To 50 ml of sample added 2ml of NaOH and a pinch of indicator (Murexide indicator). Mixed 0.2g of ammonium purpurate with 100mg of pure sodium. It acquires a pink color. The contents were titrated against 0.01 EDTA, change of pink to purple color indicates the end point. The dye is blue in alkaline solution forms a red color complex with calcium but not with magnesium. During this titration, these metals combine with chelating agent in preference to forming ammonium purpurate complex and thus the red color changes to sky blue.

Estimation of potassium

Set the filter of flame photometer for termination of potassium in sample following the method described for the determination. Use standard potassium solutions for preparation of standard curve. Express the result in mg/g.

Estimation of sodium

In flame photometer, the relatively low energy source employed excited electrons of a few elements, mainly the alkali metals like sodium and potassium to the high energy orbits which are in a meta stable state and are prone to return to lower energy orbits ground state. In doing so, the energy previously absorbed is emitted as a portion of quanta of light in all direction is collected by a reflector and falls on a detector. The light intensity and hence the detector output is directly proportional to the concentration of the substance in the flame.

Set the filter for reading at 589nm. Start the compressor and light the burner of flame photometer. Keep the air pressure at 5lbs and adjust the gas feeder so as to have a blue sharp flame. Feed the standard sodium solution of the highest value in the range and emission on the scale. Adjust the zero value of the meter by feeding distilled water. Now feed different standard, test solutions within the range (ie, 0-1, 0-10, 1-100 mg Na/l) one by one and record the emission value for each. Plot a standard curve between concentration and emission of standard sodium solutions.

Estimation of Iron

Into a series of test tubes added different aliquots of working standard solution. The volume of each tube was made up to 7.7ml with distilled water. Then added 0.4ml of saturated potassium per sulphate, 0.3ml of concentrated sulphuric acid and 1.6ml of 3N potassium thiocyanate. 2ml of sample was treated with equal volume of 40% TCA. The proteins present in the sample was precipitated and centrifuged. The supernatant was used for the estimation of iron. The unknown solution was treated as similar to that of the standard solution. The color developed was read in a colorimeter against a reagent blank using green filter within 10 minutes or at 540nm. A standard graph was drawn by plotting the concentration of iron on x-axis and the absorbance on the y-axis. From this amount of iron present in the given unknown sample was calculated and is expressed in microgram.

RESULTS AND DISCUSSION

Microorganisms are responsible for the numerous reactions that take place in the soil. Some of the reactions brought about by the microorganisms in the soil are highly beneficial - such as destruction of various dead plant and animal residues that find way into the soil, thus becomes a suitable medium for plant and animal life.[4] The results are presented and discussed in Table.1 to Table. 12.

Table 1: Carbon (%) variation in control and experimental groups.

	Days						
Treatments	**0**	**15**	**30**	**45**	**60**	**75**	**90**
Control	48.7	48.5	48.2	47.8	47.1	46.9	46.9
T1	48.6	45.3	42.8	38.8	30.1	25.3	17.1
T2	47.3	46.9	45.1	39.7	32.8	27.1	19.8
T3	48.5	47.9	46.0	40.1	35.8	25.9	22.1
T4	47.7	46.8	46.3	39.1	31.9	26.9	20.1
T5	48.3	47.9	47.2	38.2	30.1	28.1	21.3
T6	48.9	47.5	46.9	41.3	34.1	26.7	22.3

The organic carbon decreased from 48.7 to 17.1 percent. The highest reduction was found in *Pleurotus sajorcaju*, followed by *Streptomyces violaceusniger*. This result was also supported by kadalli GG and Suseela Nair.[5] The organic carbon decreased from 48.72 % to 31,12 % and this result was supported by the view given by Nallathambi P and Marimuthu T[6] that *Pleurotus platypus* caused a great reduction in organic carbon of stalk and coirpith which has higher initial organic carbon (Table.1).

Table 2: Nitrogen (%) variation in control and experimental groups.

	Days						
Treatments	**0**	**15**	**30**	**45**	**60**	**75**	**90**
Control	0.47	0.49	0.53	0.53	0.56	0.56	0.59
T1	0.48	0.59	0.63	0.79	0.88	0.90	0.95
T2	0.43	0.53	0.61	0.75	0.82	0.88	0.91
T3	0.47	0.50	0.59	0.69	0.73	0.78	0.89
T4	0.49	0.58	0.60	0.75	0.84	0.89	0.90
T5	0.50	0.52	0.62	0.74	0.81	0.85	0.88
T6	0.51	0.53	0.59	0.62	0.75	0.79	0.81

The total nitrogen content was increased in treatments compared to the control. The high amount of nitrogen was found in *Pleurotus sajorcaju* treated coirpith, the value decreased from T2 > T4 > T3 > T5 > T6. This was also reported by solon who observed increase in nitrogen content when coirpith was treated with *Pleurotus platypus* and *polyporous* species (Table.2).

Table 3: CN ratio (%) variation in control and experimental groups.

	Days						
Treatments	**0**	**15**	**30**	**45**	**60**	**75**	**90**
Control	103.6	98.9	90.9	90.1	84.1	83.7	78.8
T1	101.6	76.7	66.3	49.1	34.2	28.1	18.0
T2	110.0	88.4	75.1	49.1	40.0	30.7	21.7
T3	103.1	95.8	77.9	58.1	49.0	33.2	24.8
T4	97.3	80.6	77.1	52.1	39.0	33.2	22.3
T5	96.6	92.1	76.1	51.6	37.1	33.0	24.2
T6	95.8	89.6	79.9	66.6	45.4	33.7	27.2

The CN ratio was brought down in treatments and control. But compared to control highest reduction was found in treatments particularly in *Pleurotus* treated coirpith and maximum reduction by urea treated coirpith and also yeast sludge treated coirpith. This result was supported by Thampan TK[7] who observed that composting reduce the CN ratio. Teradimani and Marimuthu[9,10] reports, that CN ratio was 18:1 in coirpith decomposed by *Pleurotus platupus* (Table.3).

Table 4: Cellulose (%) variation in control and experimental groups.

	Days						
Treatments	**0**	**15**	**30**	**45**	**60**	**75**	**90**
Control	35.7	35.4	35.1	34.3	34.1	33.2	32.7
T1	34.2	33.1	29.9	25.2	20.1	18.7	15.9
T2	33.6	33.2	28.1	26.2	22.7	20.1	17.2
T3	34.8	32.1	30.1	29.7	28.2	27.8	22.8

T4	32.4	31.5	30.2	29.9	28.3	27.5	25.8
T5	33.4	31.8	30.1	29.9	28.5	26.2	24.2
T6	35.3	32.1	30.4	29.2	27.7	26.5	24.5

In this, the highest reduction of cellulose was seen in *Pleurotus sajorcaju* treated coirpith. When coirpith was inoculated with *Pleurotus sajorcaju* a drastic reduction in cellulose and hemicellulose was observed and supported by Kannan K.[8] Theradimani and Marimuthu[9,10] reported that *Pleurotus platypus* show maximum cellulolytic activity (Table.4).

Table 5: Lignin (%) variation in control and experimental groups.

	Days						
Treatments	**0**	**15**	**30**	**45**	**60**	**75**	**90**
Control	49.3	49.2	49.0	48.3	48.1	48.0	47.9
T1	48.9	47.7	42.2	35.2	20.2	15.5	11.3
T2	50.3	49.8	47.5	36.1	20.5	18.5	15.1
T3	49.1	48.1	46.2	36.9	25.1	24.2	20.1
T4	49.9	48.9	47.1	36.2	30.1	26.1	20.9
T5	52.1	50.1	47.8	36.5	29.2	27.5	25.2
T6	52.5	48.9	47.2	35.3	30.5	28.5	23.3

Lignin content was decreased during the course of decomposition. Treatments show maximum reduction compared to that of control. In treatments maximum reduction followed by T1 > T2 > T3 > T6 >T5 >T4. Reports[11] say, that *P. djamor* degraded higher amount of cellulose on various substrates tested- coirpith - *P. sajorcaju* was the most effective degrader of lignin (Table.5).

Table 6: Phenol (mg/100g) variation in control and experimental groups.

	Days						
Treatments	**0**	**15**	**30**	**45**	**60**	**75**	**90**
Control	122.9	121.3	120.5	111.8	108.4	103.2	100.4
T1	118.4	104.3	93.4	60.2	40.2	30.1	28.2
T2	116.4	110.1	99.2	80.1	60.1	40.3	30.1
T3	120.7	112.2	99.9	80.5	62.1	40.8	32.5
T4	124.3	110.5	98.2	80.7	61.7	50.0	42.5
T5	120.5	116.1	100.1	80.1	72.5	50.9	40.8
T6	121.2	115.8	95.5	80.0	70.1	49.2	40.0

Phenol content was decreased in all treated coirpith, where the control shows minimum reduction in phenol. *Pleurotus sajorcaju* shows marked reduction, followed by streptomyces and T3, T5, T6 and T4 shows moderate reduction compared to *Pleurotus*. This result was

supported by previous work that total phenol was brought down from 112.9 to 44mg/g while treating with poultry wastes (Table.6).

Physico chemical properties of potting mixtures

Physical properties

The physical properties like pH, Ec, water holding capacity change due to addition of decomposed coirpith in the soil. Table.7 and Table.8 depicts the results of physic chemical properties.

pH

The coirpith incorporation in the potting medium considerably reduced the pH which could be attributed to acidic nature of the coirpith. Addition of raw coirpith alone to a saline alkaline rice soil and coir pith and 75 % NPK to alkaline soil brought down the pH from 9.0 to 8.3 and 9.1 to 8.6 respectively.

EC

The electrical conductivity was increased in the treatments when it was mixed with soil, while the Ec was increased due to high salt concentration or raw coirpith.

Water holding capacity

Water holding capacity was increased in the soil due to the addition of decomposed coirpith. The maximum water holding capacity was increased in treatment compared to that of control. Incorporation of coirpith in the potting medium improved the pore space and maximum water holding capacity which might be due to the high pore space and water holding capacity of raw coirpith.

Chemical properties

The chemical properties of soil increase due to the addition of coir pith.

Nitrogen

The addition of decomposed coirpith to the potting mixture will increase the content of nitrogen in the soil. The total N content was increased in the treatments compared to that of control. The maximum N content was observed in *Plerotus sajorcaju* treated coirpith than other treatments. The coirdust with urea provided a controlled release of mineralisable N, a significant increase in total N content from 1006 ppm to 1100 ppm in red soil cropped with maize upon addition of raw coirpith plus 150 kg/ha of N.

Phosphorous

In this phosphorous level is increased in treatments than control. The maximum amount of phosphorous was found in *Pleurotus*. The application of coirpith reduced the formation of insoluble iron phosphate and there is a possibility of increasing the availability of P in the soil.

Potassium

The potassium content was increased in the soil due to the application of coirpith. The potassium content was maximum in *Pleurotus* treated coirpith added soil and *Streptomyces*. The available K status of the soil was increased due to coirpith application upto 10^{th} level.

Carbon

The carbon content is increased in the treatments compared to that of control. The highest amount of carbon was found in *Pleurotus sajorcaju* treated coirpith added soil. This result was supported by Muthulakshmi et.al concluded that composted coirpith 12.5^{th} or with NPK plus Gypsum markedly increased the organic carbon available N, P, K, Ca, Mg and micronutrients status of soil when compared with raw coirpith.

Table 7: Physico chemical properties of initial potting mixtures.

Treatments	pH	EC dsm	N %	C %	P %	K %	Maximum water holding capacity
Control	6.2	0.824	0.49	30.2	0.08	0.58	75
T1	7.5	0.938	0.95	16.4	2.8	0.95	92
T2	7.2	0.901	0.89	18.2	2.73	0.84	85
T3	6.9	0.876	0.85	20.1	2.1	0.76	85
T4	6.8	0.893	0.84	21.4	2.09	0.62	90
T5	6.5	0.895	0.83	22.7	2.01	0.73	89
T6	6.7	0.872	0.85	20.5	1.98	0.69	92

Table 8: Physico chemical properties of potting mixtures after 20 days.

Treatments	pH	EC dsm	N %	C%	P%	K%	Maximum water holding capacity
Control	5.8	0.895	0.52	29.2	0.18	0.59	79
T1	6.9	1.001	0.99	28.5	2.81	1.90	97
T2	7.0	1.000	0.95	21.2	2.75	0.99	89
T3	6.5	0.985	0.89	23.5	2.75	0.84	88
T4	6.2	0.942	0.87	24.1	2.25	0.75	92
T5	6.0	0.976	0.85	24.4	2.1	0.62	95
T6	6.3	0.991	0.88	22.7	2.0	0.75	90

Mineral nutrients/ Other general component assessment

Mineral nutrients were increased in all the treatments compared to that of control. In treatments, the *Pleuratus sajorcaju* treated coirpith had high amount of nutrients than other treatments. This results was supplied by Nagarajan et.al[12] indicated when coirpith was inoculated with *Pleurotus sajorcaju* showed increased N, P, K, Ca, Mg and micronutrients.[5] Table.9 Shows the results of mineral nutrients and other general components assessed.

CO_2 evolution

The dynamics of CO_2 evolution from the various treatments reveal that the highest respiration activity was found in the treatment. The maximum carbon loss corresponds to maximum microbial activity. In our study high amount of CO_2 evolution found in *Pleratus sajorcaju* treated coirpith, yeast sludge treated coirpith.[13]

Humic acid content

The total humic substance and humification index resisted an increase with composting. The highest amount of humic substance found in *Pleurotus sajorcaju* treated coirpith followed by T2 > T4 > T3 > T5 > T6 than that of control. The synthesis of humic acid might have been triggered utilizing the labile fractions thereby resulting in higher humic acid percent.

Total plate count

The decomposed coirpith had higher microbial count, indicating that the coirpith had higher microbial activity resulting in the faster decomposition of lignocellulosic coirpith in to coirpith manure which is suitable for substituting the chemical fertilizer as a source of nutrients and soil amendment. This result was also supported by Maheshwarappa et.al.[14]

Dehydrogenase

The decomposed coirpith had higher activity of dehydrogenase compared to that of control. The dehydrogenase activity was stimulated by humic acid content in the coirpith. Coirpith thus prepared from decomposed coirpith was evaluated in the field of its maximal effect on germination of green gram. Decomposed coirpith was mixed in the ratio 3:1:1 with red soil and formyard manure.

Table 9: Maturity of decomposed coirpith.

Treatments	Control	T1	T2	T3	T4	T5	T6
Carbon %	46.5	17.1	19.8	22.1	20.1	21.3	22.3
Nitrogen %	0.59	0.95	0.91	0.89	0.90	0.88	0.81
C/N ratio	78.8	18.0	21.7	24.8	22.3	24.2	27.2
Phosphorous %	0.05	2.80	2.66	2.10	2.15	2.09	2.56
Potassium %	0.54	0.98	0.81	0.79	0.90	0.69	0.75
Calcium %	0.47	2.83	2.75	2.42	2.70	2.44	2.53
Magnesium %	0.35	0.54	0.50	0.52	0.46	0.48	0.48
Sodium %	-	0.058	0.023	0.035	0.046	0.012	0.012
Iron %	0.06	0.15	0.10	0.09	0.08	0.09	0.07
CO_2 evolution (mg/l)	30	89	54	64	72	89	30
Humic acid (%)	5.51	8.19	6.09	4.95	4.70	5.75	4.90
Total plate count	80.7×10	190×10	188×10	89×10	88×10	95×10	99×10
Dehydrogenase mg of dye reduce/min	0.061	0.090	0.070	0.06	0.075	0.071	0.083
Gibberlline	+++	+++	+++	+++	+++	+++	+++
pH	6.48	7.56	7.43	7.45	7.62	6.42	6.15

Effect of coirpith on germination

The results of effect of coirpith on germination was shown in Table. 10, Table.11, Table.12.

Table 10: Effect of decomposed coir pith on germination.

Treatments	Germination (%)
Control (soil)	100
Control (coir)	90
T1	100
T2	100
T3	95
T4	98
T5	100
T6	98

Highest rate of germination was found in T1, T2, T5, T6 and control soil.

Table 11: Effect of decomposed coir pith on plant shoot length.

Treatments	Plant shoot length in 20^{th} day (cm)
Control (soil)	29
Control (Coir)	25
T1	29.5
T2	27.5
T3	25.6
T4	24.5
T5	27.6
T6	26.4

The plant shoot length was highest in decomposed coirpith treated plants than control. *Pleurotus sajorcaju* treated coirpith had highest shoot length.

Table 12: Effect of decomposed coirpith on plant root length.

Treatments	Plant root length in 20th day(cm)
Control (soil)	13.3
Control (coir)	11.0
T1	15.0
T2	12.7
T3	14.4
T4	12.4
T5	9.5
T6	10.2

The plant root length was highest in decomposed coirpith treated plants than control. *Pleurotus sajorcaj*u treated coirpith had highest root length.

CONCLUSION

The results of the study confirmed that addition of coirpith changes the physical properties like pH, water holding capacity, humic acid content, CO_2 evolution and also chemical properties carbon, nitrogen, potassium, phosphorus thereby increasing the mineral properties, microbial count, dehydrogenase activity which on the whole increases the root, shoot length of the germinated plant. Thus addition of coir pith will be a better alternate and good combination will find a suitable alternate for vermicompost.

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