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PHYSICAL AND CHEMICAL ANALYSIS OF COMPOST TO CHECK ITS MATURITY AND STABILITY

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ABSTRACT

The composting process is the most environmentally safe method of recycling the organic waste. Composting is a natural process and it takes many months to give a quality mature compost which can be used as a bio fertilizer. The composting process can be speed up by the addition of some biological inoculants e.g. bacteria and fungi or a consortium of both to get the mature compost early. The present study was designed to check the stability and maturity of compost prepared with the addition of inoculants on organic waste and without inoculants. The maturity of compost samples were evaluated after 2.5 months of composting process by performing different physical and chemical tests.

KEYWORD: biological inoculants e.g. bacteria and fungi.

INTRODUCTION

The nutrients of plants are key and significant component of sustainable agriculture (Ryckeboer et al., 2003). However, the use of chemical fertilizers now a days to improve the fertility of soil and crop production usually results in unexpected unsafe environmental effects and cause severe environmental pollution. Alternatively the microbes in soil play a vital role in complementary the dynamics of organic waste breakdown and availability of plant nutrients. Therefore bio fertilizer made by composting process has been identified as an alternative to chemical fertilizer to improve soil fertility and crop production (Michael et al., 1995).

The mature compost can be investigated for Physical, chemical and biological parameters to check its maturity and stability. The maturity, stability and changes due to the presence of microbial inoculants and without microbial inoculants on compost were evaluated. The compost windrow consists of 50 tons of organic waste and it was divided into parts so that the comparison of control and experimental can be examined. The heaps of the compost with different treatments were evaluated after 2.5 months of composting process.

The most important physical and chemical parameters of compost were inspected with importance on the parameters such as pH, C: N, moisture content, organic Carbon, Cation exchange capacity, electrical conductivity and organic matter (Vargas et al., 2005).

Methodology

The experimental heaps were treated with microbial inoculants and control was without any type of inoculation. The treatment A, B and C was experimental and Treatment D was control.

Determination of Moisture percentage of compost

The china dish was weight with 10g of compost sample. The china dish was placed in an oven at 120^{o} C for minimum 4 hours. The china dish was taken out after 4 hours of heating and cooled in desiccator. The sample was weight again after heating. Moisture content was calculated by dividing the reduction in weight by initial weight. (Richard et al., 2002).

Particle size, smell and color

The pore size, texture, smell and color of the mature compost made by different treatments was observed.

Determination of pH

The compost solution was made by adding distilled water in 1:10 and for dissolving the maximum salts, it was placed for 2 hours. The pH meter electrode was dip in the compost solution. Reading was noted on pH meter when it was stabilized. The electrode was washed with distilled water and dried with tissue paper (Monedero et al., 2001)

Determination of electrical conductivity of compost

The solution of compost was made by adding distilled water in compost sample in 1:5. The conductance cell was washed with distilled water. The cell was dipped

into solution of compost the reading was noted on EC meter. Conductivity was displayed in mS $Cm^{-1.}$ (Arnold, 2004).

Determination of organic matter

The empty crucible was weight (W1). The crucible was weight again when 5 g of compost sample was added in it (W2). The crucible having compost in it was placed in an oven at 105^{o} C for 4 hours. After drying the sample, the crucibles were placed in muffle furnace at 800^{o} C for 2 hours. The crucibles contain ash was weight (W3) (Yeomans and Bremner, 1988).The percentage of organic matter was determined by subtracting W1 from W2 and W1 fromW3.

Determination of C: N

The 0.5g of compost sample was taken and transferred in digestion tube. 1.0g of digestion mixture was added in the compost sample. Then 10 to 12ml of sulphuric acid was also added in digestion tube. The digestion tube was placed in digestion block and heated for 2 hours at 400^{o} C. The contents in the tube were changed color from black to light green. The digestion tube was cooled down. The sample was distillated on distillation apparatus in the presence of boric acid and sodium hydroxide (Tandon, 2005). Carbon was divided by nitrogen to find the C: N.

Determination of CEC

The 2g of compost sample was taken in 300ml flask and 100ml of 0.1M HCL solution was added in it. The flask was shake vigorously on shaker for 2 hours. The solution was filtered after shaking and 1% silver nitrate solution was added in the filtered solution until it start precipitation. The solution was transferred in to another 300ml flask and 0.25M barium acetate was added in it. The flask was placed in shaker for 1 hour. The solution was filtered again and the filtrate was titrated with 0.1M NAOH using 5 drops of phenolphthalein.

Statistical Analysis

The data were analyzed by using ANOVA variance (SPSS version 11). Standard deviation of the mean values was calculated for each treatment. F test was applied to the data to analyze the data for significant differences. The values were also compared for significant difference using Duncan's multiple range test.

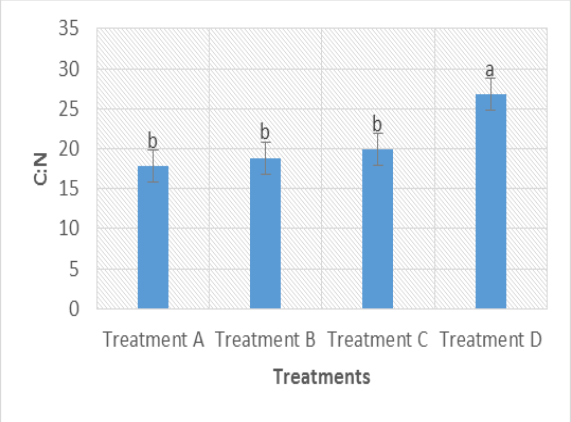
RESULTS AND DISCUSSION

The compost heaps that had some type of inoculum showed smaller pore size, no smell and smooth texture. Giusquiani et al., (1995) also reported that the larger pore size is not a positive or good sign of compost maturity.

The statistical ANOVA test was performed to find the significant difference between the mean values of treatments and compare the C: N of treatments that had inoculum with the control. The highest C: N was observed in treatment B and the all treatments that had inoculum and lowest was observed in treatment D, the control samples. The results are in the line of earlier findings of Azim et al., (2014) that the initial C: N ranging 25 to 30 produced the more mature compost.

Variance between means of C: N of mature compost formed by different treatments

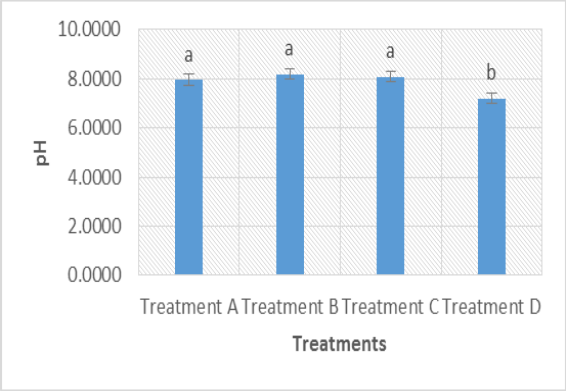
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	133.767	3	44.589	15.270	.001
Within Groups	23.360	8	2.920		
Total	157.127	11			



To check the significant difference between the mean values of pH for different treatments and compare with control, an ANOVA statistical test was performed. The pH value was recorded high in treatment C and B experimental treatments and lowest was recorded in treatment D, the control having no inoculum. The pH was increased with the time interval of composting process. Bord na Mona (2003) recommended a range of pH from 6.9-8.3 at the end of composting and the results shows this range of pH in all treatments.

Variance between means of pH of compost formed by different treatment

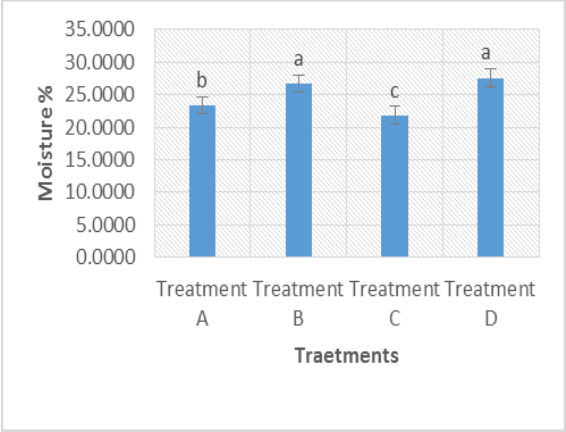
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.822	3	.607	31.849	.000
Within Groups	.153	8	.019		
Total	1.974	11			



The high values of moisture content was observed in treatment D in the mature compost form by different treatments and lowest was observed in treatment C. the moisture content must be decreased from 50 % at the end of composting. The low moisture content shows the high activity of microbes (Tiquia et al., 1996).

Variance between means of moisture % of compost formed by different treatment

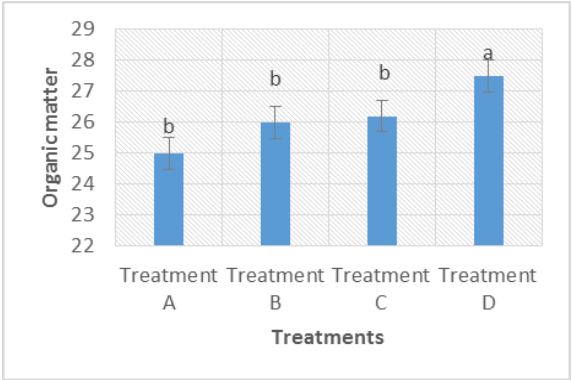
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	66.307	3	22.102	51.401	.000
Within Groups	3.440	8	.430		
Total	69.747	11			



The organic matter value was high in treatment D that had no inoculum and lowest was observed in treatment A that had inoculum and molasses. Organic matter increase with decrease in temperature (Burke et al., 1988). The organic matter content in mature compost must not exceed from 30%. The amount of organic matter must not be very high in the mature compost as it indicates that the breakdown of organic matter and humification index is slow (Haung et al., 2006).

Variance between means of organic matter of compost formed by different treatments

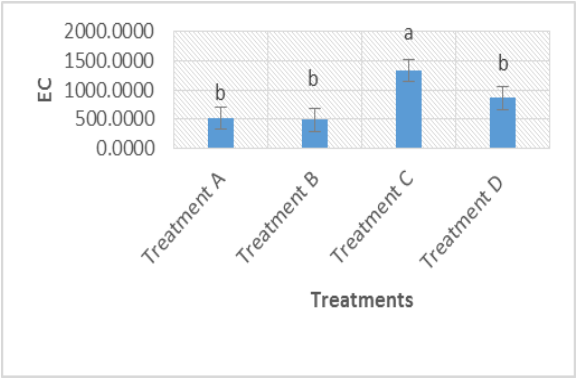
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.944	3	2.648	6.438	.016
Within Groups	3.290	8	.411		
Total	11.234	11			



The value of EC was increased in experimental and control treatments. The large EC was recorded in treatment C and lowest was recorded in treatment B. the electrical conductivity must be increased with time interval in composting process and in the mature compost its value must be high. The more alkaline pH increases the value of Ec as well (Haung et al., 2004).

ANOVA variance between means of EC of compost formed by different treatments

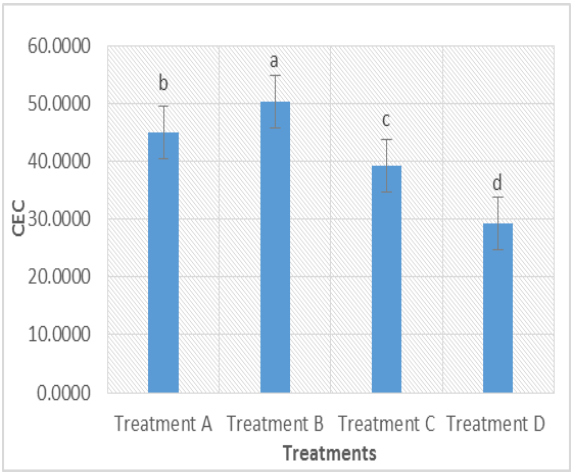
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1408139.333	3	469379.778	394.326	.000
Within Groups	9522.667	8	1190.333		
Total	1417662.000	11			



The value of CEC was increased with the time interval. The CEC was determined high in treatment B and lowest was determined in treatment D. the higher CEC value determines the more mature and stable compost (Saharinen 1998).

ANOVA variance between means of CEC of compost formed by different treatments

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	741.406	3	247.135	291.625	.000
Within Groups	6.780	8	.847		
Total	748.186	11			



CONCLUSION

This study was carried out to achieve a goal of evaluating the mature compost formed by the treatment of organic waste with microbial inoculants and without microbial inoculants. The evaluation of prepared compost by physical and chemical parameters revealed that the addition of some microorganisms gave a good quality mature compost as compared with the treatment having natural composting process.

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