Evaluation of the effect of Organic Waste on Nutrient Quality of Compost

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Abstract- The technique of composting is the degradation of organic matter and production of valuable nutrient rich compost that can improve soil fertility. The use of appropriate type of organic waste for composting can give better result when compost is applied on soil. It will improve in proper recycling of organic waste into a value added soil amendment. So, the presented study is to evaluate the nutrient contents and physiochemical parameters of compost prepared from different types of organic waste. The study was done by taking 4 types of wastes (A=fruits waste, B =vegetable waste, C=farm waste, D= cooked leftover food). The analysis of compost showed that nutrient content and physiochemical parameters considerably affected by the type of organic waste used for composting. Waste from the cooked leftover food contains more nutrient content as compare to other waste (N=.42%, P=.19%, K=.36%). Organic matter was also higher in cooked food waste (8.18%). The C/N ratio for fruits and vegetable waste was same, 11:1 and highest for cooked food waste, 13:1. The result of experiment shows that nutrient contents and physiochemical parameters of compost prepared from cooked leftover food was better than the other wastes that were used for study. All the compost prepared matched the standards of Indian Fertilizer Control Order. So these compost are suitable for the use on soil.

Index Terms- Compost, Food waste, nutrient, quality

I. INTRODUCTION

Food waste has become a serious issue in all around the world. Globally, 33.3% of food produced is likely to be converted in food waste because of which the loss is estimated about 1.6 billion tons of food per year [1]. Its proper management is the only solution concerning its fast generation. The solution should be based on environment friendly manner because food waste generation cause many problems like odor, leaching of toxics in ground and greenhouse gas emission [2]. Organic wastes mainly contain the biodegradable compounds and nutrients like nitrogen, potassium and phosphorus which are required by plants. So recycling of these nutrients is a sustainable method [3]. Composting of organic waste is a traditional method for managing the organic waste. All biodegradable waste can be managed by composting [4]. It is well known that the composting technique is a sustainable way of recycling the nutrients in agriculture and also controlling the environment pollution. Previous research has already proved that using composting for the organic waste management and use of compost in agriculture is a sustainable method [5]. Its use on land is directly related to the nutrients that it contains. Basically nitrogen phosphorus and potassium are the macro nutrients present in compost which plants are required to uptake from the soil [6]. Compost prepared from different types of organic waste produce different types of compost on the basis of presence of the nutrients [7]. Compost containing high quantity of macro nutrients is more useful for plants than the low quantity nutrients compost. Compost with more nutrients improve soil health and enhance plant growth. A compost nutrients quantity depends on the chemical composition of the organic waste that is used for composting [8]. The quality of compost can be improved by incorporating different types of organic waste and monitoring of its physical and chemical properties [9]. So it is useful to study which type of organic waste produce compost containing more nutrients in it. There is little knowledge available about the nutrient content relationship the type of organic waste used for composting. More study on different types of compost can make composting more in use. Its use in agriculture also reduce the use of chemical fertilizers which shows long term harm to soil as well as to plants [10]. The purpose of research is to determine that which type of organic waste, which is generally household waste, produce compost with more nutrients as well as study of physical and chemical parameters of composts. This study can be useful in identifying the type of waste which gives compost with better nutrient quantity and physico-chemical properties.

II. METHODOLOGY

A. Preparatiion of Composting Piles

For the research four windrow composting piles were prepared for comparative study. Four types of waste used for study were leftover cooked food- including rice, gram and chapatti, farm waste, raw vegetable waste and fruits waste. The cooked leftover food was collected from the hostel mess of Bhartiya skill Development University, Jaipur. Farm waste was collected from the campus ground of Bhartiya skill Development University. The waste of raw fruits and vegetables were collected from the local muhana mandi market at jaipur. All these four types of waste were put into piles separately. The amount of all four types of waste for the analysis was taken same which is 30kg each type of waste. For proper composting it is necessary to provide adequate conditions for the process. Temperature, moisture, C/N

ratio and microorganisms are the main factors which effect composting [11]. All these factors which effect composting where kept same for all piles so that comparative study can be done

B. Monitoring and observation of Piles

Temperature was maintained same by regular monitoring and turning over the piles. Average temperature in our study was noted 25^0C – 45^0C. Previous studies suggested that this temperature range is suitable for composting [12]. To maintain the moisture about 40-60% as reviewed in literature [13] water was poured in each pile as per the requirement. The ideal C/N ratio for active composting is 30:1 [14]. We put dry leaves in each composting pile to make the C/N ratio 30:1 so that the process of composting proceeds actively. Regular monitoring and maintaining of conditions produced well matured and stable composts in all four piles after completion of three months.

C. Analysis of Compost

Each composting pile produced compost by taking time duration of 3 months. Compost use in agriculture as soil amendment, depends on its stability and maturity as well as the nutrients quality. To analysis stability and maturity two parameters are useful that are physical and chemical parameters.

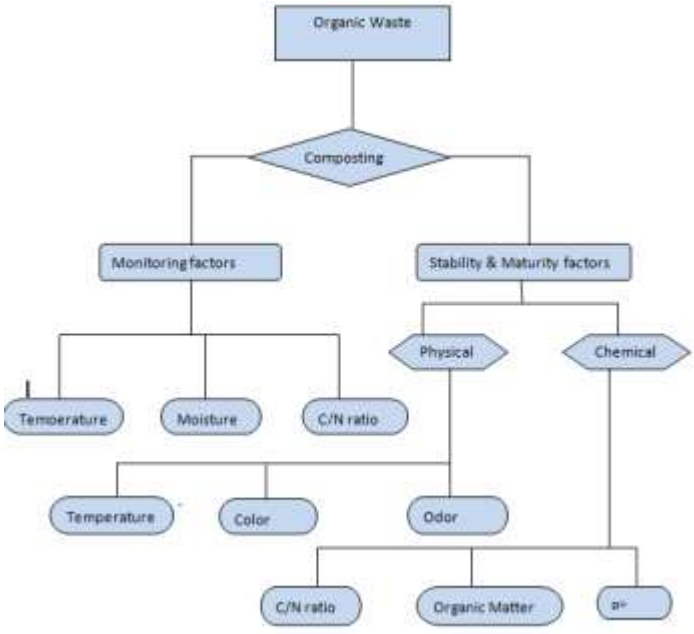

Figure 1: Showing factors responsible in composting

Physically well matured and stable compost do not show flipping in its temperature [15]. As at the end of 3 months composts produced in all four piles do not show any further changes. A stable temperature was noted for all piles which are in range of 20-25^{0}C at the end of 3 months. There was change in color of organic waste in each pile. All the compost produced are dark to light grayish in color which indicates maturity according to the literature [16]. All compost smell like earthy and dusky, no more smell of rotten waste observed in any pile. This is also a sign of maturity and stability of all four composts [17].

In composting process there is a steady decrease in C/N ratio of organic waste. A well mature compost C/N ratio is expected to be less than 20:1 [18]. There is overall degradation of organic matter by the microorganism. Activity of microorganisms vary on compounds to compounds because it is easy for the microbes to break the sugar molecule but difficult to break complex molecule like cellulose or lignin. So cellulose and lignin are not completely degradable in composting. In the end product there is reduction in organic matter of compost [19]. The estimation of C/N ratio was done dividing the value of organic carbon with the total nitrogen value. When the process of composting starts P^H is acidic due to the degradation of organic matter but with time P^H start increasing and at the end of composting P^H becomes neutral or slightly alkaline [20]. In current study P^H was calculated by making suspension of 25gm compost into 50ml of distilled water and shakes it for 2 hours on rotary shaker. After 2 hours, filter it with whatman filter paper and estimate the P^H by P^H meter. The chemical parameters of our study are shown in the table.

Compost	C/N ratio	P^H	Organic matter
Fruits waste	11:1	8.41	6.18%
Vegetable waste	11:1	8.17	6.56%
Farm waste	12:1	7.2	5.96%
Cooked leftover	13:1	7.93	8.18%

Table 1: Showing chemical parameters of compost

Compost is used on soil because it increase soil organic matter, P^H and its nutrient content that is essential for plants growth [21]. The major macro nutrient that improve soil quality and plant growth are the nitrogen, phosphorus and potassium [22].

Analysis of all the major nutrients was done according to the Indian fertilizer control order. Amount of total nitrogen was calculated according to kjeldahl method. Phosphorus is present in the form of phosphate in compost which was calculated in presented study. For this 10gm of sample was put into a 50gm crucible. Heat it about 650º- 700ºC for 6hours. Then cool it in a dessicator. Took the content into a 100ml beaker and add 30ml 25% HCl. Through this process the total phosphorus was estimated by gravimetric quinoline molybdate method. Estimation of potassium was done by flame photometry method. Our study of different compost shows variation in nutrients quantity which is shown in the table below.

Compost	Total nitrogen	P_2O_5	K_2O
Fruits waste	.32%	.14%	.26%
Vegetable waste	.34%	.18%	.32%
Farm waste	.28%	.12%	.24%
Cooked leftover	.42%	.19%	.36%

Table 2: Showing macro nutrients of compost

III. RESULT AND DISCUSSION

During the research on composting and its end product compost, two types of factors were studied. These are monitoring factors and the stability as well as maturity factors. Monitoring factors are those which were observed during the process of composting. Temperature, moisture and C/N ratio are the factors that were controlled and observed in each pile during the process so that composting proceed actively. At the end of the process, four composts were produced in four piles. There physical and chemical parameters were analyzed. Physical analysis shows that all four composts were well stabled and matured with respect to temperature, odor and color. Analysis of chemical properties shows that the C/N ratio of all composts is below 20 which indicate maturity. Out of four, the compost from leftover cooked food show high C/N ratio of 13:1. The percentage of organic matter in compost is also highest in compost from cooked food. This is due to the presence of lignin and hemicelluloses which are difficult to completely degrade by the microorganisms. P^H of all compost was in range of 7-8 that is acceptable for well matured compost. After analysis of the stability and maturity it is necessary to analyze the macro nutrient content of compost before applying it on soil. Macro nutrients are the content which plants take up from soil for their growth [23]. Our study shows that all the four type of compost were appropriate in macro nutrient quantity for the use. Comparative analysis shows that waste from the cooked leftover food contain more NPK than the other wastes.

IV. CONCLUSION

Composting is one of the best methods for the proper and sustainable management of organic waste. Compost obtain in this process contain the nutrients which plants are required for their healthy growth. So it is necessary to study the nutrients quantity of compost. To know which type of organic waste produce better nutrients quantity in compost, comparative study of different organic waste can give the idea for choosing the organic waste for producing better compost in its nutrient quantity. Study of four different types of waste composting was conducted. Windrow type of composting was used and four piles were prepared to produce four types of composts. All composting piles were monitored throughout the process. Temperature, moisture and C/N ratio were monitored and kept same for all piles. At the end of 3 months composts were produced in all piles. Physical stability and maturity was analyzed by temperature, odor and color assessment. Chemical maturity was checked by C/N ratio, organic matter and P^H. All the four types of compost produced are suitable for the use on soil and as an organic fertilizer. There quality matched with the standards of Indian fertilizer control order. Doing comparative analysis shows that compost from leftover cooked food contain quit more nutrients quantity than the others.

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There is no data availability statement is applicable for the current research.

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