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CARBON TO NITROGEN RATIO OF THE COMBINATION OF FEEDSTOCKS PREPARED FOR COMPOSTING OF *PARTHENIUM HYSTEROPHORUS* WEED

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ABSTRACT

Many parameters play an important role in composting process such as moisture, aeration, type of raw material used, temperature, C/N ratio, etc. A desired C/N ratio of feedstock is required for getting good quality compost in comparatively limited time and therefore, a right combination of the raw material should be blended for preparing a perfect recipe for composting. Different combinations were prepared using different organic wastes such as *Parthenium*, cow dung, wheat straw, charcoal powder, sawdust, etc. in different proportions. C/N ratio of the different organic wastes such as *Parthenium* as well as different combinations has been reported. The results of this study are helpful in maintaining the desired C/N ratio of the feedstock while preparing the compost.

Key words: Carbon, Compost, Microorganisms, Nitrogen, Parthenium.

INTRODUCTION

The C/N ratio or carbon-to-nitrogen ratio is the ratio of the mass of carbon to the mass of nitrogen in a substance. It can be used in analysing sediments and compost. The relative proportion of carbon and nitrogen is a major controlling factor in the composting process[1,2]. Carbon is the basic building block of life and it is a source of energy for microorganisms, where as nitrogen is necessary for proteins, genetic material, and cell structure. Microorganisms digesting the compost need about 30 parts of carbon for every part of nitrogen, they consume. That is a balanced diet for them. They need more carbon than nitrogen. In aerobic decomposition, part of the carbon is released as CO_2 while the rest is combined with nitrogen in the bodies of microorganisms. As a result, the carbon content

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of a compost pile is continuously decreasing. Nitrogen is used for the synthesis of cellular material, amino acids, and proteins and is continuously recycled through the microbe's bodies. Any nitrogen that is incorporated into the cells becomes available again on the death of microorganism.

Microbial activity utilizes a C/N ratio of 30-35:1 in composting. Higher ratio will result in lowering the composting rates[3]. This depends on an assumption that carbon is completely consumed, which is often not the case. Thus, for practical agricultural purposes, compost should have an initial C/N ratio of 20-30:1. If there is too much nitrogen, then the microorganisms can not use it and the excess of nitrogen is lost in the form of ammonia gas. Nitrogen is too valuable for plants to allow it to escape into the atmosphere. In general, the combination of feedstock quality and compost management will determine the quality of the finished product. Their ratio can be measured by CHN analyzer and the continuous-flow isotope ratio mass spectrometer (CF-IRMS)[4].

However, for most of the practical applications, desired C/N ratios can be achieved by blending commonly used substrates of known C/N contents, which are readily available and easy to use. One may be able to measure the carbon and nitrogen contents of the materials and then calculate the ratio directly.

Plant cellulose is a carbon-based material and therefore, plant by-products such as hay, straw, weeds, paper products, etc. will provide the needed carbon. Sawmill sawdust has a moisture content of 40-65%, which is good for compost[5]. For this purpose, the materials containing high amounts of carbon are considered as browns, and materials containing high amounts of nitrogen are considered as greens. It is recommended that two to three volumes of browns be mixed with one volume of greens in order to produce a mix with appropriate C/N ratio for composting[6]. Microbial systems, especially bacteria, respond primarily to readily available nutrients. The mix of raw materials not only needs the proper C/N ratio, but the nutrients need to be in suitable forms so that it can be consumed. Material containing simple sugars, such as fruit waste, decomposes rapidly, while woody material bound by decay-resistant lignin is more difficult to degrade. Most of the nitrogen sources decay easily except for keratin (horns, hair, wool, and feathers). If necessary, the availability of the carbon and nitrogen in compost feedstock should be maximized by mixing thoroughly and grinding material into smaller pieces.

As C/N ratio is one of the most important factors affecting the quality of compost and the process; generally, composting could be carried out under a wide range of initial C/N ratios of 11 to 105, depending on the starting materials[7,8]. However, it was recommended that composting of recalcitrant raw materials should be conducted under low

ranges of C/N ratios. Recent studies have shown that composting can be carried out effectively at a lower C/N ratio of 15 also[9]. Composts can be made from most organic byproducts. Common feedstock are poultry, hog and cattle manures, food processing wastes, sewage sludge, municipal leaves, brush and grass clippings, sawdust, and other by-products of wood processing. Ideally, several raw materials should be mixed together to create the ideal range of conditions. Composting is a process that can occur over a wide range of conditions, and if materials have an acceptable moisture content and carbon-to-nitrogen ratio, good compost can be produced with good management practices.

EXPERIMENTAL

Materials and methods

Different organic wastes such as *Parthenium,* fresh cow dung, wheat straw, charcoal powder, ash (Wood), sawdust, etc. were collected and their percent ratio in each recipe was taken on the basis of volume (not by weight).

The desired compositions were meshed in grinder and a homogeneous mixture of all the necessary materials was prepared. The detail of the feedstock used in each combination is reported in Table 1.

Table 1:

Sample No.	Wheat straw (%)	*Parthenium* (%)	Cow dung (%)	Charcoal powder (%)	Ash (Wood) (%)	Sawdust (%)
1	50	50	-	-	-	-
2	50	45	5	-	-	-
3	50	40	10	-	-	-
4	50	35	15	-	-	-
5	50	30	20	-	-	-
6	50	25	25	-	-	-
7	-	100	-	-	-	-
8	-	50	50	-	-	-
9	-	80	+10*	20	-	-

Cont…

Sample No.	Wheat straw (%)	*Parthenium* (%)	Cow dung (%)	Charcoal powder (%)	Ash (Wood) (%)	Sawdust (%)
10	-	70	+10*	30	-	-
11	-	60	+10*	40	-	-
12	-	66	+10*	33	-	-
13	-	33	+10*	-	66	-
14	-	90	+10*	-	-	10

*Extra cow dung was added to make mixture homogeneous (10% of total quantity)

The total organic carbon and nitrogen contents were determined in each combination using the method[10].

RESULTS AND DISCUSSION

C/N ratio of different combinations was determined and interesting results were found, which may be useful in developing good recipes, while composting weed *Parthenium*.

The results are reported in Table 2.

Table 2: Analysis on dry basis

Sample No.	C (%) Method (TMECC 04.01-A)	N (%) Method (TMECC 04.02-A)	C/N ratio
1	13.20	1.30	10.20
2	10.60	0.96	11.00
3	13.20	1.20	11.0
4	9.20	1.30	7.10
5	13.50	1.40	9.60
6	15.60	1.40	11.10
7	16.00	1.60	10.00
8	15.40	1.30	11.80

Cont…

Sample No.	C (%) Method (TMECC 04.01-A)	N (%) Method (TMECC 04.02-A)	C/N ratio
9	15.12	1.90	7.96
10	16.12	1.60	10.08
11	15.96	2.01	7.94
12	17.01	1.80	9.45
13	13.21	1.20	11.01
14	12.80	1.70	7.50

CONCLUSION

C/N ratios for all the recipes were determined using standard methods. Carbon to nitrogen ratio of *Parthenium hysterophorus* weed found in this locality was 10:1, while other combinations gave results ranging from 7.1 to 11.8. Because both; carbon and nitrogen are available in organic wastes and hence, one can not distinguish any waste as a source of single material alone e.g. Carbon or nitrogen.

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