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Comparative study on moisture content required for composting process

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Abstract: *The present investigation is to assess and compare the moisture content of two organic raw materials coir pith and water hyacinth and predict their compatibility in compost making. The different parts (leaf, stem, root) of Water Hyacinth plant (both young and old) and cow dung as an inoculums in compost beds were also scrutinized for this study.*

Key Words: *WaterHyacinth, moisture content,coir pith, cow dung, compost bed.*

1. INTRODUCTION:

Composting is the controlled biological decomposition and conversion of solid organic material into humus like substance called compost. The process uses various microorganisms such as bacteria, actinomyces and fungi to break down the organic compounds into simpler substances. By properly managing air, moisture and nutrients, the composting process can transform large quantities of organic material into compost in are relatively short time.

During composting, the microorganisms consume oxygen while feeding on organic matter. Active composting generates a considerable amount of heat, and large quantities of carbon dioxide and water vapour are released into the air. The carbon dioxide and water losses can amount to half the weight of the initial organic materials, so composting reduces both the volume and mass of the raw materials while transforming them into beneficial humus like material. Composting is most efficient when the major parameters -- oxygen, nitrogen, carbon, moisture and temperature -- which affect the composting process are properly managed.

The advantage of using compost for fertilizing is that it improves soil fertility in the long run, by improving the soil structure. Organic matter is the key factor in improving the soil structure. Organic matter contains a lot of micro-elements important for plant growth and it improves the water retention capacity of the soil. So this study aims towards analysing the moisture content of the different parts (leaf, stem, root) of Water Hyacinth [1] plant (both young and old), coir pith [2] and cow dung [3].

2. MATERIALS AND METHODS:

Water hyacinth, cattle (Cow) dung, and coir pith were taken as such in their original raw forms as samples for raw materials for compost making. Fresh water hyacinth plants were collected from the ponds situated near the Tamil Nadu Rice Research Institute Aduthurai, in Thanjavur district and processed for chemical analysis without drying and loss of moisture. Two sets of water hyacinth plants of young and old (1 and 2) were collected and separated into different parts with a stainless steel blade and separately analysed. Young and old plants were also sampled to judge nutrient accumulation with the age of the plant. Cow dung was obtained a fresh from the farm yard of Tamil Nadu Rice Research Institute, Aduthurai and analysed. Coir pith was transported from a nearby coir fiber processing mill at Vazhkai a village about 20 km from Aduthurai and used in the analysis to express the composition on dry weight basis, parts of the same samples were separately subjected to moisture estimation.

2.2. Estimation of Moisture content

A weighing bottle with its stopper separately placed in an electric oven at 105^0C for about 15 minutes. Then by replacing, the stopper, moisture bottle is removed, cooled it in a desiccator and recorded its weight. Then, about 5 g of the sample is transferred to this bottle, fix the stopper and weighed quickly. After removed the weighing bottle stopper, it is kept in the oven at 70^0c for 8 hours [4]. Then by replacing the stopper, the weighing bottle from the oven is removed, cooled in a desiccator and weighed. That would express the loss in weight as percentage.

Calculation

Weight of moisture bottle alone = A gm

Weight of moisture bottle and sample = B gm
Weight of sample alone = (B-A) gm
Weight of moisture bottle and sample after drying in the oven = C gm
Weight of moisture in the sample = (B-C) gm

$$\text{Percentage of moisture in the sample} = \frac{(B-C)}{(B-A)} \times 100$$

3. RESULTS AND DISCUSSION:

The moisture content between 50 & 70 % (average 60%) is most suitable for composting and should be maintained during the periods of active bacterial reaction such as mesophilic and thermophilic growth. In our experiment the percentage of moisture content is higher in younger water hyacinth especially in stem-1 (95.89 %), while young leaf-1, older leaf-2, older stem-2 and young root-1, and older root-2 of water hyacinth plants registered 90.09 %, 88.82 %, 95.76 %, 92.16 % and 93.10 % as moisture contents (Table-1). Overall results of the different parts of the fresh water hyacinth plants indicated that stems (95%) held the highest moisture followed by roots (around 92%) and leaves (around 90%) as in graph-1.

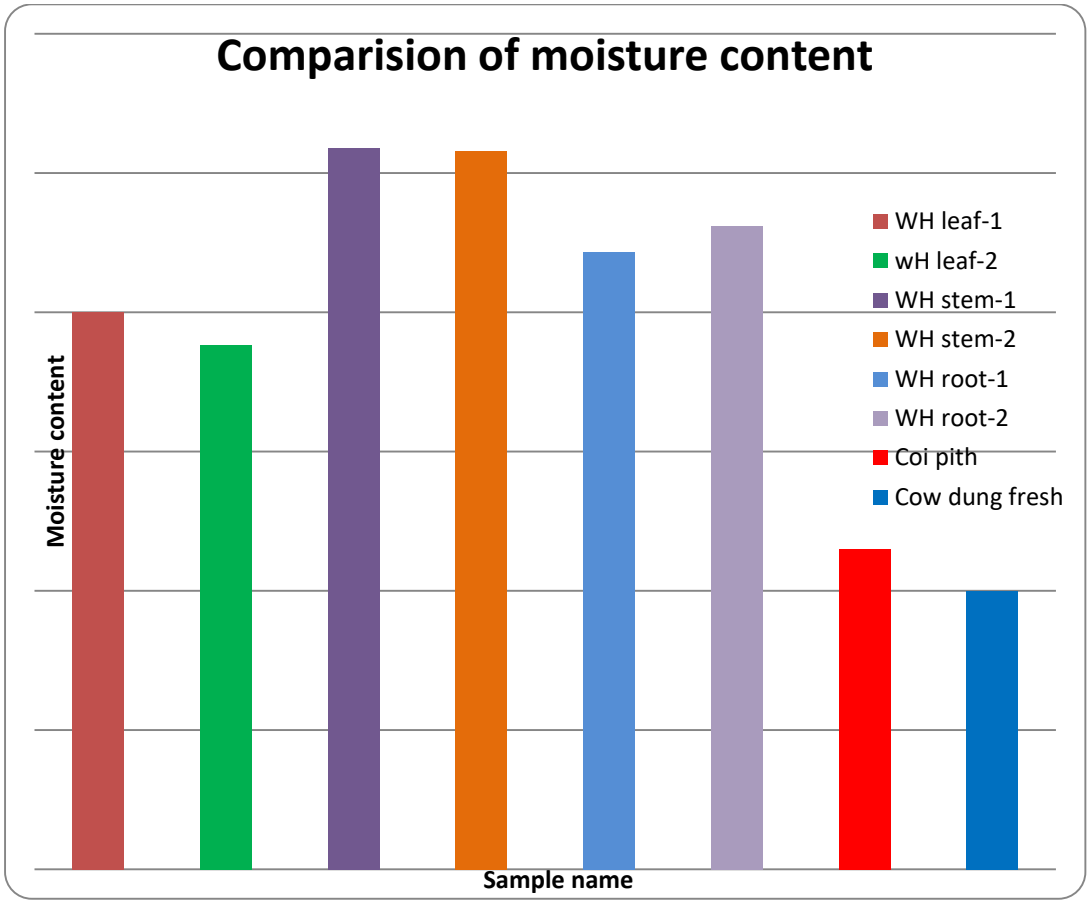
The moisture content observed for the coir pith sample and fresh cow dung were less than water hyacinth recording 81.4 % and 80 % respectively. But this much of moisture is not generally found in dried coir pith heaps. Much lower moisture (< 30%) is usually reported [5] in dry coir pith heaps which are not exposed to recent rains. A greater affinity of coir pith to water coupled with its greater moisture retention characteristics probably contributed a higher moisture around 80% in the samples analysed here which could be due to the recent rain falling over the uncovered coir pith heap. A moisture around 80% in fresh cow dung [6] is normally expected and can also aid cow dung to remain biologically very active supporting a great deal of microbial load in it.

As the moisture content is generally lower for coir pith, addition of fresh water hyacinth with higher moisture can help to increase the moisture content of the compost bed comprising a mixer of coir pith and water hyacinth to a certain desirable degree. Hence frequent watering during the composting process which is labour intensive may not be necessary in such a combination.

Comparing the leaf, stem and root of younger plants (numbered as 1) with older plants of Water Hyacinth (numbered as 2), younger Water Hyacinth parts had higher moisture content with setm-2 registering the highest.

Table 1. Chemical composition of various raw materials suitable for compost making

S.NO.	Sample	Fresh Weight (g)	Dry Weight (g)	MC (%)
1.	WH leaf -1 (young)	10.8	1.07	90.09
2.	WH leaf – 2 (older)	17.45	1.95	88.82
3.	WH stem – 1 (young)	27.5	1.13	95.89
4.	WH stem -2 (older)	51.94	2.2	95.76
5.	WH root – 1 (young)	15.69	1.23	92.16
6.	WH root -2 (older)	40.18	2.27	93.10
7.	Coir pith	10	1.86	81.4
8.	Fresh Cow dung	10	2	80



Graph-1. Moisture content percentage of various samples

4. CONCLUSION:

The analysis of raw materials chosen in this investigation for compost making clearly brought out that water hyacinth had more than 90% moisture content. Among the different parts of the water hyacinth plant, the stem, which actually makes the bulk of the plant, was found to be richest in terms of moisture. Coir pith had less moisture compared to water hyacinth and fresh cow dung. Hence, combining a dry cum brown substrate like coir pith with a wet cum green substrate like water hyacinth in addition to fresh cow dung as a microbial inoculum could be ideal for compost making.

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