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Water Hyacinth In to Nutrient Rich Fertilizer By Rotary Drum Composter Method

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Abstract - Water Hyacinth invaded many tropical and subtropical bodies of water. It grows so quickly that one plant can produce 248 off springs every 90 days in ideal conditions. It also causes many problems to aquatic life and also blocking irrigation canals. Every year large amount of money spent on removing Water Hyacinth. So, recycling them can generate income and contribute cost economics. Composting of water hyacinth can be one option. For making compost in 1st trial after shredding and drying of Water Hyacinth it was mixed with cow dung and rice straw also quick aerobic culture was added to enhance the process. In 2nd trial half amount of previous sample mixed with same amount of kitchen and garden waste. Bio clean compost was added to enhance the process. Physiochemical parameters like temperature, moisture content, pH were analyzed in both trials.

Key Words: Eichhornia Crassipes, Reformer Rotary Drum Composter, Quick Aerobic Culture, Bio Clean Compost, Cow Dung, Rice Straw

Abbreviations: MC – Moisture Content, T – temperature, WH – Water Hyacinth, CD – Cow Dung, RS – Rice Straw, WM – Waste Mixture, KGW - Kitchen and Garden Waste

1. INTRODUCTION

Water Hyacinth (Eichhornia Crassipes) which is called as 'Jalpareeni' in Marathi. It is a water weed which is native to Pune region. It is a floating plant which grows in stagnant water bodies having sewage water dumped into it. It is a water weed which is commonly found in tropical and sub-tropical climates. In Pune, water hyacinth has created a lot of problems to people. It causes blockage of irrigation canal, fishing problems and causes harm to aquatic life, it causes obstruction to water ways. Our prime focus is to study the characteristics of water hyacinth its beneficial uses and disposal techniques. Water Hyacinth is used as fertilizer, ropes, baskets, and for biogas production.

In PCMC a lot of money is spent every year for the removal of Water Hyacinth but which finally causes a disposal problem. So a treatment method can be introduced to generate a compost from the waste. The Water Hyacinth as a raw material has great potential to convert into a compost. A comparative analysis of the Water Hyacinth compost, Green waste compost and farm yard manure showed that the presence of organic Carbon with Nitrogen, Phosphorus and Potassium was comparatively higher in the Water Hyacinth compost. Not only improved the health of aquatic ecosystems by removing this prolific species from the water bodies but also improve the soil health and productivity of the agricultural land through the application of prepared compost from the collected Water Hyacinth

Water Hyacinth compost can be best suited in a country like India where the livelihood of most of the people depends on agriculture. Aerobic composting method can be incorporated as Water Hyacinth is green organic waste rich in nitrogen content and aerobic composting is best suited for organic waste. Fast composting can be done by rotary drum composter which provides proper mixing and aeration to the waste mixture. Composting of water hyacinth can be enhanced by using bulking agents to balance the excess moisture content produced by water hyacinth and addition of bio culture speeds up the composting process.

2. MATERIALS AND METHODS

The materials used: The different waste mixture was prepared using Water Hyacinth, cow dung and rice straw. Water Hyacinth was brought from the Pawana River of Old Sangvi. Fresh cow dung was procured from Akurdi gaon. Rice straw was available from the college campus. The 6:3:1 proportion was decided for making the compost.

Reformers Rotary Drum composter: The capacity of drum was 100 L and it was decided by analyzing the market available composter and the easily available drum in the market. The composter comprises of the plastic drum which is a regular drum generally used for storage of water. Its length and diameter is 0.82 and 0.45 m respectively. The drum from inner side is provided with anti-corrosive coating. The entire assembly of drum is kept on a stand (made of metal). For proper aeration and mixing the drum is provided with manually operated handle. rum is mounted on metal stand, and is rotated manually by its handle. 5 mm holes are provided on the drum for proper aeration. In addition, 1^0 slope is provided to the stand for leachate collection. Manual rotation was given after every 24 hrs. The drum was provided with doors to maintain the aerobic condition.

Specifications for different components of Composter

Metal: Metal i.e steel required for preparing 0.9m metal stand with rectangular shape base and 2 triangle face. 10mm diameter with 0.16m length blades connected alternately. L shape 0.2m length metal handle is connected to rod.

Fixtures: Fixtures i.e hinges and nut bolt was required to fix door to drum.

Anti-corrosive coating Anti-corrosive coating was applied to the surface of the drum to prevent it from the rusting action.

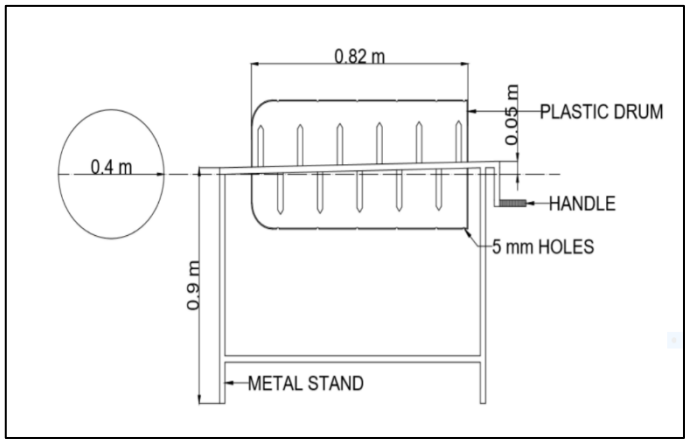


Figure 1 *Cross section of Reformers Rotary Drum Composter*

Figure 2 *Reformers Rotary Drum Composter*

Sampling and Parameter Analysis: During the composting process the temperature, moisture content and pH was recorded after every 24 hrs. using digital thermometer, moisture and pH meter respectively. Nitrogen, phosphorous, potassium content of water hyacinth was determined at the agriculture college laboratory.

Table 1 *Trial 1 in Rotary Drum Composter*

Trial 1	WH	CD	RS
Proportion Of WM	60%	30%	10%
Bio-culture	5 g/ kg of waste (Quick aerobic composter)		

Table 2 *Trial 2 In Rotary Drum Composter*

Trial 2	WH+CD+RH	KGW
Proportion Of WM	50%	50%
Bio-culture	5 g/ kg of waste (Bio-clean compost)	

3. RESULTS AND DISCUSSION

Trial 1 in Reformers Rotary Drum Composter

The Composting of Trial 1 was performed in the Reformers Rotary Drum Composter. We took proportion of Trial as 6:3:1 i.e Water Hyacinth 60%, Cow Dung 30%, Rice straw 10% respectively.

Quantity of Sample Intake:

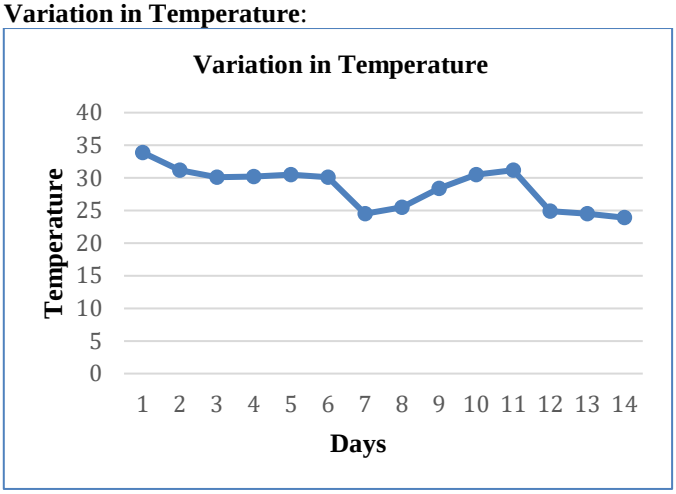
Water Hyacinth: 14.4 kg, Cow Dung: 7.2 kg , Rice straw: 2.4 kg , Bio-Culture: 40 g of Quick Aerobic Culture .

Table 3 *Trial 1 Readings in Reformers Rotary Drum Composter*

Days	Trial 1		
	MC(%)	T(ºC)	pH
1	75	33.9	6.5
2	75	31.2	7
3	Excess	30.1	5
4	75	30.2	4.5
5	70	30.5	6.1
6	70	30.1	6.5
7	70	24.5	5
8	Excess	25.5	4.5
9	Excess	28.4	7
10	Excess	30.5	7.5
11	Excess	31.2	7.3
12	Excess	24.9	7.4
13	Excess	24.5	7.1
14	Excess	23.9	7.2

The observed Composting Performance analysis results during its Composting Trial 1 is presented parameter wise for better interpretation and comparisons of results

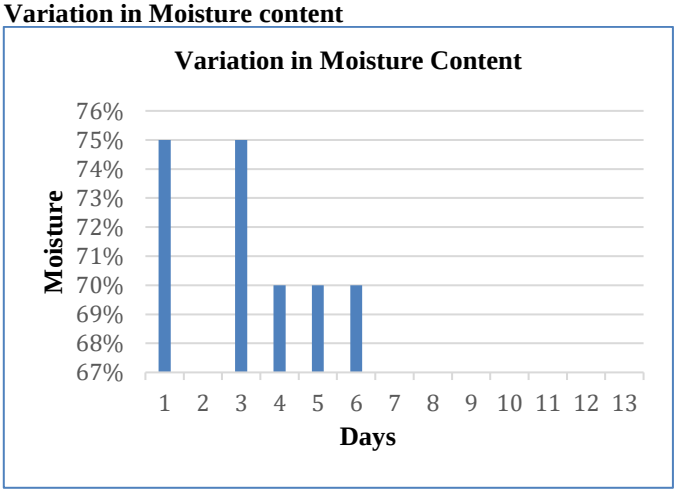
Variation in Temperature:



Graph 1 *Graph of Temperature Vs Days*

At the start of composting process temperature increases gradually it might be the result pf mesophilic stage (20-40°C). The temperature increases due to higher microbial activity at the initial stage of trial 1 the temperature observed higher up to 33.9°C. Then it decreases and remains constant up to 6 days up to 30°C. Again decreased by 5°C at the 6th day and remains constant for 7th day. Then it increases gradually up to 30°C and again at 12th day it decreases up to 25°C.

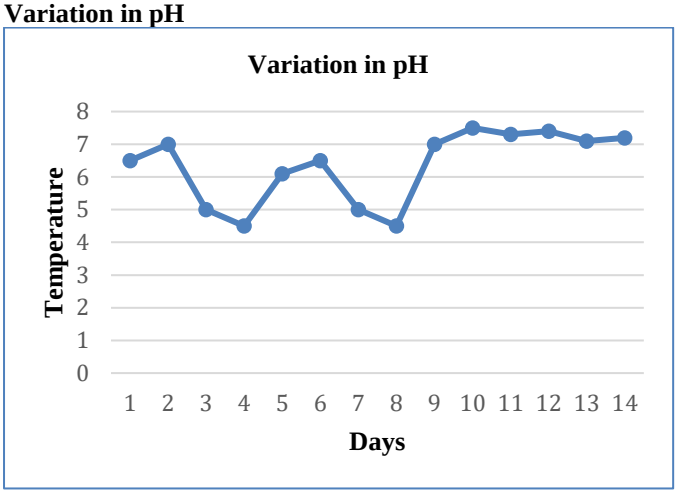
Variation in Moisture content



Graph 2 *Graph of Moisture Vs Days*

From initial stage of these trial the moisture content of sample was observed at higher side in the range 65% to 70 %. After 8th day the moisture suddenly increased, excess moisture content recorded during those days. Microorganisms need sufficient moisture content to survive. if moisture content increases then it can stop the composting process. According to the handbook of composting ideal moisture content should be 45 -55 %.

Variation in pH



Graph 3 *Graph of pH vs Days*

The pH was observed from the range 4 to 8. At final stage of these trial in last 5 days pH observed in the range 6 to 8. It was observed in optimum stage

Mass Balancing of Trial 1 in Reformer Rotary Drum Composter

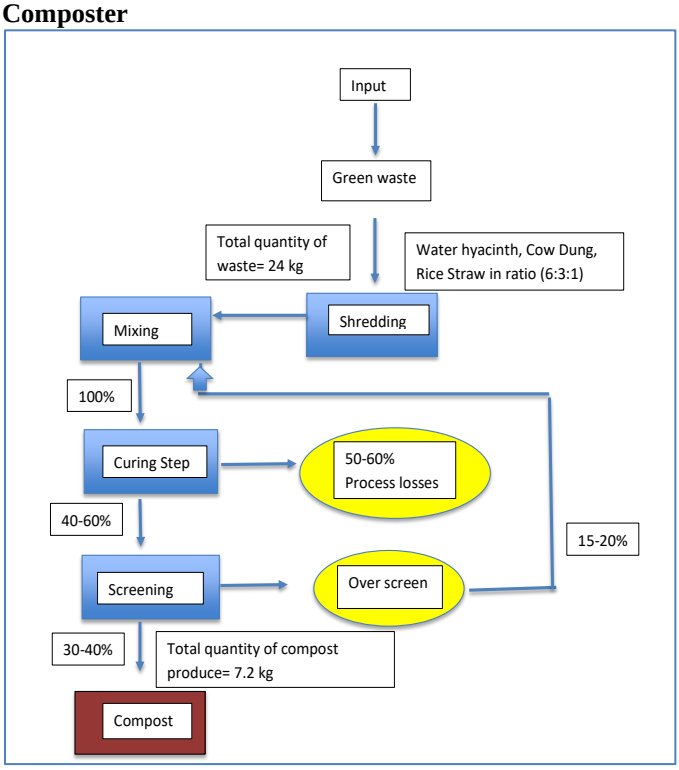


Figure 3 *Mass Balancing of Trial 1 in Reformers Rotary Drum Composter*

- The total input of waste i.e combination of water hyacinth, Cow Dung and Rice Straw in the proportion (6:3:1) 24 kg.
- At the end of curing step there is (50-60%) process loss (12 kg).
- The compost produced is (30-40%) i.e, (7.2 kg).

Trial 2 in Reformers Rotary Drum Composter

After the failure of trial 1 in Reformers Rotary Drum Composter. we mixed that previous sample with kitchen & garden waste for better results. as the moisture content of previous sample was observed excess so that wet sample was dried and then used in the process of composting. Kitchen & garden waste together and previous sample was taken in proportion 5:5. both were taken 10 kg each i.e. Pervious sample 50%, Kitchen and garden waste 50%.

Intake Quantity of sample:

Water Hyacinth, Cow Dung, Rice Straw :10 kg

Kitchen & garden waste: 10kg

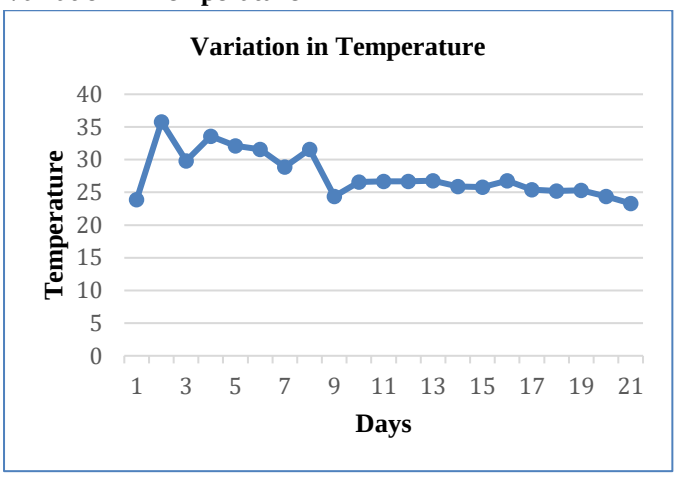
Bio clean Aerobic Bio culture: 40 g

For these trial temperature, pH and moisture content was analyzed with digital thermometer, pH & moisture meter respectively.

Table 4 *Trial 2 Readings in Reformers Rotary Drum Composter*

Days	Trial 2		
	MC(%)	T(ºC)	pH
1	70	23.9	7.00
2	70	35.8	7.50
3	70	29.8	7.20
4	60	33.6	7.10
5	60	32.1	7.30
6	60	31.6	7.80
7	60	28.9	7.90
8	50	31.6	7.80
9	50	24.4	7.50
10	50	26.6	7.50
11	40	26.7	7.50
12	40	26.7	7.50
13	55	26.8	7.50
14	55	25.9	7.50
15	55	25.8	7.50
16	55	26.8	7.50
17	55	25.4	7.50
18	55	25.2	7.50
19	55	25.3	7.70
20	55	24.4	7.70
21	55	24.9	7.70

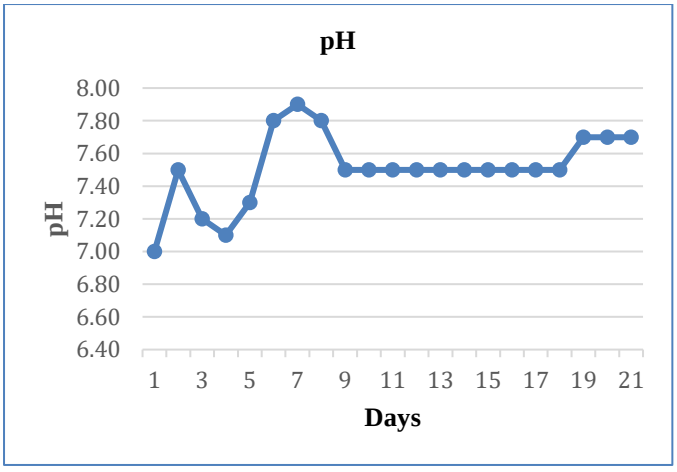
Variation in Temperature



Graph 4 *Graph of Temperature Vs Days*

The temperature was observed in the range 23℃ to 35℃ at the initial stage of composting process of trial 2 in Reformers Rotary Drum Composter the temperature observed at higher stage as microbial activity starts. Then slight difference is observed in the first 7 days of composting process after 8 th day there was sudden drop down in the temperature then it remains constant for next 7 days. as there was no decrement in temperature at the final stage. so, it can conclude that the composting process was correct for these trial as we get positive results.

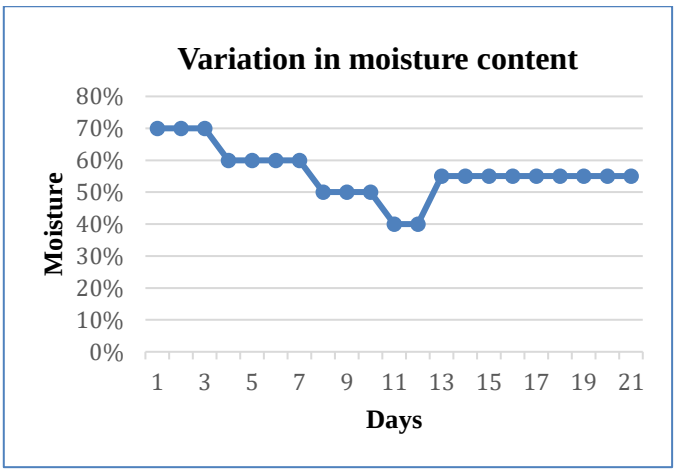
Variation in pH



Graph 5 *Graph of pH vs Days*

From the initial stage of these trial pH was observed in the range of 7 to 8. So that it was observed pH was optimum. The sample is in alkaline state. So, the compost produced from these process can be used for plant

Variation in Moisture Content



Graph 6 *Graph of Moisture Content vs Days*

To prevent organic matter from excessive heat. The moisture content should be in the range 45% to 55%. As it was in the range from the starting of the composting process of trial 2 in the rotary drum composter. So, it can be said that the process of composting was correct and the compost produced from these trial can be said nutrient rich fertilizer.

Mass Balancing of Trial 2 in Reformers Rotary Drum Composter

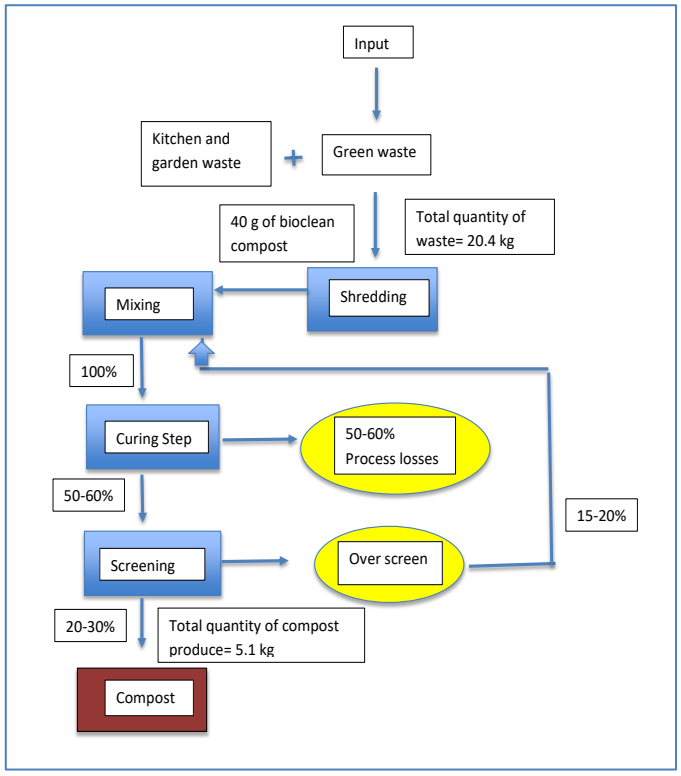


Figure 4 *Mass Balancing of Trial 2 in Reformers Rotary Drum Composter*

- The total input of waste i.e combination of Water Hyacinth, Cow Dung and Rice Straw in the proportion (6:3:1) and kitchen and garden waste is 20.4 kg.

- At the end of curing step there is (50-60%) process loss (10.2 kg).
- The compost produced is (20-30%) i.e, (5.1 kg).

4. CONCLUSION

Composting Trial 1

1. Highest temperature recorded during composting trial 2 was 31.2^{0}C, there was rise in the temperature due to breakdown of organic matter.
2. Moisture content at some point was excess due to increase in the quantity of water at the time of mixing of cow dung slurry.
3. The quantity of compost produced by the whole process was 7.2 kg.

Composting Trial 2

1. The highest temperature recorded was 35.8^0 C during the process. Decomposition rate was faster due to the addition of bio-clean compost.
2. Moisture content was in the range of 50- 70 which was optimum requirement for composting process to take place.
3. The pH was within the range (6-8), the addition of cow dung regulates carbon content, bulk density and PH
4. Rice straw acted as a bulking agent and balanced the moisture content produced by Water Hyacinth.
5. Decomposition rate was faster compared to the other trials as this trial was performed on rotary drum, rotary drum improved the aeration and turning action.
6. The quantity of compost produced during this trail was 5.1 kg.

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