A Concept Proof Approach for Conversion of Leaf Litter into Humus with The Help of Self-Aerated Composting Units

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Abstract. About 68% of leaf litter conversion into humus was attained within 30 days using composting technology, which was made possible by employing the perforated composting unit for self-aeration developed by the author Saveetha School of Engineering campus. It can be related to conventional composting system CHs, but comparatively, it takes longer than these self-generated units to attain the same output say 60days. The self-generated composting units once achieved a sustainable environment and did not show any sign of stress on them since moisture maintenance was done regularly. Within the first 10 days of service of the composting machine, efficiency was under 17%, which might be because the micro-organisms needed time to become acclimatised to feed, which was more texture-hard and nutrient leaner than the feed (cow dung) the organisms used to feed. In comparison, cow dung has to be supplemented even higher (50% or more). As the days passed by, there was a dramatic rise in humus conversion efficiency, which reached near the ultimate of 100% by the end of 70 days. Overall, the humus production increased with time in a linear fashion in Figure 1; the regression-correlation being significant at $r^2 = 0.99$.

Keywords: Leaf litter, Composting, Self-aerated, Economical, CO₂, Cowdung

1. Introduction

1.1. General methods of disposal of Leaf litter and its effects

Uveitis Leaf litter has emerged as a problematic constituent of solid waste because its disposal methods by simply burning leaf litter contribute to global warming and other forms of pollution. Leaf litter can be subsequently converted to biogas/briquettes. However, for a long time, these processes consume greater energy, water and cow dung per tonne of leaf litter [1]. It, in turn, causes pollution of water, air, and land. Also, biogas generation is done only in a few cities where the biogas plants exist. In most towns and other cities, this is not possible. For example, in Chennai city, the capital of Tamil Nadu, all leaf litter is set on fire in the open here and there, sometimes along with plastics and other combustibles [2]. Even the leaf litter generated by the other institutions or any domestic area around is 'disposed of' in this manner, leading to releases of harmful organics into the air alongside global warming gases, such as CO₂ is released in the atmosphere causing serious air pollution [3].

If leaf litter can be composted, the process would convert most of its carbon into humus, which is known to be rich in soil-friendly and plant-friendly micro-organisms, hormones, and enzymes [4]. Since self-aerated composting involves the action of micro-organisms, within the composting unit it achieves adequate air circulation of the composting area. Due to this, much of the energy needed to accomplish in the conventional composting method is not required in self aerated composting. Hence, if achieved at a fast rate (to enhance process efficiency and proportionately reduce costs) [5],
composting can convert leaf litter into a useful product with very little or no stress to the environment. Even more significantly, this option enables sequestration of all the carbon contained in the leaf litter. As that carbon had already been derived from plants [6] that had sequestered CO₂, composting in effect erases some of the existing carbon footprints!

However, there has been little success in the past to composting of leaf litter. Some authors have tried to compost leaf litter but as a minor additive of cow dung[7]. However, such processes have not been, and cannot be, used to dispose of leaf litter economically for the following reasons:

a) Cowdung is an increasingly expensive and scarce commodity as it has many mutually competing applications. Any process which needs seven parts or more of cow dung for every three parts or lesser of leaf litter will be unsuitable for handling the large quantities of leaf litter that need to be handled.

b) The reported processes are painfully slow, requiring two months or more. Also, the process efficiency in composting (because no other inputs influence the economics to a significant extent), slower a process and costlier.

Information Mining and Machine learning calculations are picking up quality as a result of the capacity to deal with tremendous amounts of information to consolidate information from various sources and coordinate setting data [8]. In [9] Diabetic ketoacidosis and nonketotic hyperosmolar trance like state is a portion of serious complications. In [10] exploratory presentation of each of the three calculations is estimated on various tests, and great precision is achieved. In [11] research has indicated that AI algorithms work better in the determination of various maladies. In [12] discussed about privacy of the healthcare system using cloud and blockchain trending techniques for content Deduplication. The prediction result affirms that [13] Androidspy can be improved to distinguish vindictive applications by utilizing the framework for bunch assessing with the previous work. In [14] the method executed a guess mechanized construction as Filtered Wall (FW) and it separated discarded substance from OSN customer substances In [15] framework adequately utilizes these highlights for glaucoma location they are removed utilizing the optical thickness changed fundus picture alongside the first highlights.

1.2. Conventional composting
The slow operation, which takes 3-4 months to turn a certain amount of feed into humus, is traditional composting using low-tech windscreen. This factor so far, has been negative in terms of economics and the use of composting technologies.

To eradicate these disadvantages, the author has introduced the concept of self-generated composting units and processes that can translate the concept into real-time practice. The following are the attributes of the self aerated composting process:

a) It utilises a self-generated composting unit that is ideal for the process, which ensures mixing and aeration of the content by the openings provided at its sides, thereby anaerobic pockets formation.

b) One side of the unit is completely left open to make harvesting as simple as possible.

c) Running of a nutrient is prevented because there is little provision for collecting water at the bottom get collected is sprayed back in the unit itself.

1.3. The present work
The present work has aimed to establish the feasibility of applying the concept of self aerated composting unit to the conversion of leaf litter into humus within a short time.

2. Materials and method
Rectangular units made of cement provided with a self aerated perforation at all three sides are aiding air movement throughout the process. In two self-aerated composting chambers, each unit was charged with 5 kg of leaf litter and blended with 200 g of fresh cow dung was used. The dry weight was 3 kg and 90 g respectively, obtained by oven drying at a steady weight of 105 °C.
During the daytime and nighttime temperatures at $29 \pm 2^\circ$, composting units were kept in equal ambient conditions. Relative humidity was between 55 and 70%. The composting unit feed was holding in the moisture content of $80 \pm 10\%$. If there is additional water, it can flow into the assembly naturally, and the depletion of nutrients has been assessed in the whole process.
Every five days, hummus was separated from the composting unit and quantified in its dry weight taken at 105 °C. Equivalent quantities of leaf litter were introduced to restore the feed mass to its original level. Figure 2 discusses about the pattern of increase in humus production concerning time for composting unit 2.

3. Results and discussion
Table 1 summarises the results for one month of reactor activity in 5 days. The medium values are given in the table; replicates are accepted in compliance with the unit feed's heterogeneity within ±10%, which can be adequately considered correct.

Within the first 10 days of service of the composting machine, efficiency was under 17%, which might be because the micro-organisms needed time to become acclimatised to feed, which was more texture-hard and nutrient-leaner than the feed (cow dung) the organisms used to feed. In the next 10 days, the pace continued to rise and triple.

By the time about 20 days had elapsed, the conversion rate doubled and reached 45%. As the days passed by, there was a dramatic rise in humus conversion efficiency, which reached near the ultimate of 100% by the end of 70 days. Overall, the humus production increased with time in a linear fashion in Figure 1; the regression-correlation being significant at $r^2 = 0.99$.

Table 1: Humus production in self aerated two composting units (1 and 2) over 30 days.

| S. No | Days from start Composting Unit 1 | Humus generated on a dry weight basis (%) | Days from start Composting Unit 2 | Humus generated on dry weight basis (%) |
|-------|----------------------------------|------------------------------------------|----------------------------------|----------------------------------------|
| 1     | 5                                | 10.4                                     | 5                                | 9.7                                    |
| 2     | 10                               | 16.9                                     | 10                               | 17.4                                   |
| 3     | 15                               | 30.1                                     | 15                               | 32.0                                   |
| 4     | 20                               | 45.3                                     | 20                               | 46.7                                   |
| 5     | 25                               | 56.9                                     | 25                               | 59.4                                   |
| 6     | 30                               | 69.7                                     | 30                               | 67.4                                   |

4. Conclusion
The findings establish the fact that even with a mere 25% supplementation of cow dung by weight, very rapid and sustained conversion of leaf litter to humus is achieved through self aerated composting units. In just 70 days, this approach contributed almost to a quantitative conversion of the leaf litter, 2-3 times faster than in traditional systems. Within the first 10 days of service of the composting machine, efficiency was under 17%, which might be because the micro-organisms needed time to become acclimatised to feed, which was more texture-hard and nutrient-leaner than the feed (cow dung) the organisms used to feed. In comparison, cow dung has to be supplemented even higher (50% or more). As the days passed by, there was a dramatic rise in humus conversion efficiency, which reached near the ultimate of 100% by the end of 70 days. Overall, the humus production increased with time in a linear fashion in Figure 1; the regression-correlation being significant at $r^2 = 0.99$.

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