

Development and Design of Household Composter

A. Mohd Shahrir^{1,*}, S. Yahya¹, M.A. Amir Syariffuddeen¹, A. Saiful Azwan¹, S. Masniza¹, M.S. Zainun¹, M.Y. Mohd Akmal¹, M.S. Zainun¹, H. Azman¹, A. Sha'fie¹, M.A.T. Mohd Hafiz¹, S. Amir Redzuan¹, Z.A. Mohd Zaimi¹, J. Shukri¹ and S. Mohd Azmirredzuan¹

¹Engineering Research Centre, MARDI Headquarters, Persiaran MARDI-UPM, 43400 Serdang, Selangor

*Corresponding author. Tel.: +603-8953 6600, Email: shahrir@mardi.gov.my

Abstract

As urbanization influenced the lifestyle of folks in the city, the problem with solid waste management is rapidly becoming a huge consequences. Treating household's waste at source would help to ease the waste management problem before turning into a crisis. A new prototype household composter was designed to accommodate the city households which can manage, dispose and utilize kitchen and food waste. This two-tier household composter with a capacity of 5 kilograms kitchen and food waste and duration taken for composting process between 7 to 8 days, easy maintenance and user friendly. The results indicated the effective operational performance of the prototype household composter in practice and the output compost complies with standard with no bad odour (soil earth odour) and ready to use for plant application. The household composter hence effectively replaces the kitchen waste bin with significant value addition and can help to minimizes greenhouse gases emissions. This will also help to cultivate a culture among householders in adopting the composting practice in their daily activities as common practice.

Keywords: solid waste management, household composter, kitchen waste, food waste, composting process

Introduction

Without a doubt, solid waste management is one of the biggest problems in the world of modern societies. Waste management is an important part which relates to the population lifestyle and economic stature. Management of solid waste can be defined as a discipline connected with control of generation, storage, collection, transfer and transport, processing and disposal of solid wastes (Tchobanoglous, 1993). Population increasing at an exponential rate leading to increasing of solid waste produce (Phiri, 2012). Our earth is facing a tough challenge in order to become and remain sustainable due to the increasing number of global populations over the years (Kevin, 2009). Countries around the world are reacting to these challenges by adopting policies to minimize waste outputs. Landfill space availability is decreasing and increasing cost of creating new landfills, local authorities are having trouble in coping to develop alternative means of waste disposal management. Number of communities in United States and European countries are steadily growing which attracted to the interest of urban solid waste composting as an alternative to the disposal of waste stream in sanitary landfills (Renkow and Rubin, 1996). Local authorities have identified composting as a potentially viable means which can help to lessen the volume of waste entering landfills by diverting the organic fraction. Composting is a controlled biological process which increment rate of biological decomposition of organic materials is through a natural aerobic process. Thus, an equipment or machine is required for this purpose suitable for home domestic usage. The development of home composter has genuine chance of to cater the

issues faced. This work consists in the aspects considered necessary to design and developed a composter for batch-feeding of kitchen and food waste of household usage. The results and conclusion achieved through this study will be applied for better design in the future.

Materials and methods

To review and compare existing compost bins (household and industrial), various composting process, identifying downsides in the existing compost bins and processes. To develop a full-scale working prototype using affordable materials of composter for household kitchen.

Composter Requirements

Frequency of usage: The food waste is input everyday. Due to busy lifestyle of the urban community, the output of compost should be ready within 1 weeks.

Output compost handling: The output compost should be in a convenient form for people handling it and easily used for gardening purpose.

Composter size and location: The composter to be placed in the kitchen with ergonomic dimension to avoid any issues.

Odourless: The composter should not produced unpleasant or bad odour.

Easy operation and mobile: The composter should be easy to operate by everyone in the house and mobility to move about within the kitchen area.

Composter Prototype Design

The composter consists of two parts. The first part is composting and compost-starter storage part. The

second unit is the compost product collection area. Batch-feeding food waste can be mixed with compost-starter by a simple mechanism. The first part, which consists of mixing stirrer is attached to a single-phased motor which help to rotate the stirrer to mixes food waste with compost-starter continuously. Maintaining good ventilation inside the composter is vital to have aerobic condition of the decomposition process. The air filter which contains activated charcoal are used to keep away bad odour and acts as a disinfectant. The second part is a collection tray for final product compost collection. It takes around a week for composting the food waste.

Results and Discussion

Figure 1 shows one of the proposed designs for household prototype composter based on the composter requirement identified. Figure 2 and Figure 3, exhibited composting process using the composter. The process as follows:

- Food waste is placed inside the first part of the composter.
- Compost-starter was added into food waste and mixed thoroughly. Food waste weighed 5kg same as the maximum capacity of the composter.
- Continuous mixing of food waste and the compost-starter for effective composting with the help of mixing stirrer attached to a single-phased motor. The mixer will rotate for 1 minutes for every 3 hours until completion of composting process.
- Use of an air filter (activated charcoal) for avoiding the foul odour and to avoid insects or rodents.
- Use of calcium oxide with the compost starter mixture to maintain the initial heat and to start the composting process.

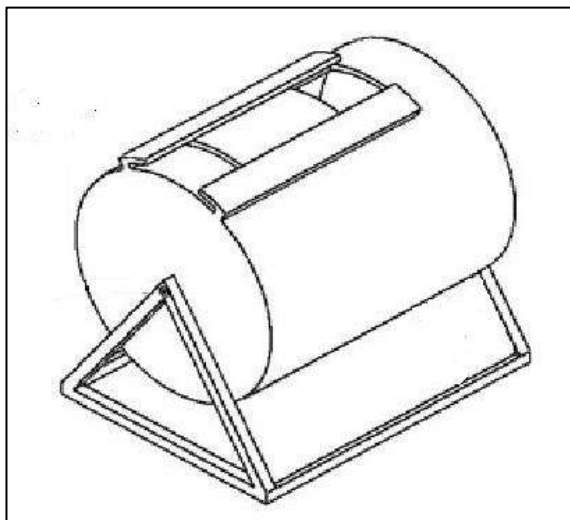


Figure 1: One of propose early design of household prototype composter



Figure 2: Composting process mixture of food waste and compost-starter



Figure 3: Composting progress



Figure 4: Compost end product

Table 1, showed the final compost product achieved by using household prototype composter compared to the existing market composter. The final compost product from the household prototype composter have a similar results compared to the existing market composter but difference in the duration time for composting process to complete. Household prototype composter able to

complete the composting process in 7-8 days only. The proposed household prototype composter also able to compost food waste unlike the existing market composter that only able to compost kitchen and green waste only.

Table 1: Compost characterization between household prototype composter and existing market composter

Parameter	Household prototype composter	Existing market composter (NatureMill Composter)
pH	7.57	5.51
mc (%)	48.20	42.25
c/n ratio	15.94	21.46
composting duration	7-8 days	14-18 days

Conclusions

This household prototype composter can play an important role in solid waste management. As the prototype composter is easy to operate and mobile which can encouraged household user to buy and use it. This will in turn cultivated new culture among household user to start composting at their home. Composting offers great solution to local authority in reduction of landfill and helps in solid waste management.

References

- A. Phiri, L. Godfrey and D. Snyman (2012). Modeling the generation of domestic waste for supporting the planning of municipal waste services, *International Journal of Water Resources and Environmental Engineering*, **4** (2012), 171-191. <http://dx.doi.org/10.5897/ijwree11.030>
- Kevin.J.V (2009). Towards more sustainable urban surface drainage: a comparative case study of impervious cover polices in Portland, Oregon and Seattle.
- Renkow.M.A and Rubin.A.N (1996). Does municipal solid waste composting make economic sense.
- Tchobanoglous,G. Theisen,H. and Vigil,S. (1993). Integrated solid waste management engineering: principles and management issues. McGraw-Hill, New York.