

**STUDY OF THE EFFECTS OF BINDING AGENTS ON  
THE PROPERTIES OF COMPOST PELLETS**

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Degree of Master of Science

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November 2017

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Thesis submitted in partial fulfillment of the requirement for the degree  
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## **Declaration**

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## Abstract

Composting of the organic Municipal Waste (MW) is one of the sustainable answers for the management of MW. The bulky nature of the loose compost is one of the main drawbacks in promoting the use of compost in agriculture governed by various practical and economic reasons.

Pelletization of compost seems to be the solution to offset the drawbacks caused by loose compost. The pelletizing process with a die and roller pelletizer is comparatively less complex compared to other common pelletizing methods. This research identified the optimum conditions to form a pellet with the desirable properties of high density, compressive strength, ideal pellet length and disintegration ability with three mesh sizes (2.5 mm, 3.5 mm, and 5 mm sieves), five moisture contents (25%, 30%, 35%, 40%, and 45%), three binding agents (Rice Flour (RF), Lime, Eppawala Rock Phosphate (ERP)) and three different binding agents' percentages (1%, 2%, and 3%) by weight basis. The pelletizing process increases the bulk density of compost by about 30%.

Pellets made with  $\leq 5$ mm particles are longer and show higher strength (50% more) than those prepared with the other two particle sizes ( $\leq 2.5$  mm &  $\leq 3.5$  mm). It was evidenced that 25% moisture content produces the highest strength pellets than higher moisture contents.

Pellets with binding agents at  $\leq 5$ mm particle size and 25% moisture content were tested for bulk density, strength, percentage of long pellets and disintegration ability. It was observed that the tested properties have varied compare to pellets without binding agents. Lime and ERP showed promising results that enhancing pellets' bulk density and compressive strength and percentage of long pellets than RF. However, the disintegration ability nearly 100% in RF added pellets, which was less than 30% and 10% in ERP and Lime respectively and 0% in non-binding agent added pellets over one month of time in immersed water. With the increasing weight percentages of the binding agents, pellets strength increased in Lime and ERP and the same decreased with RF. Disintegration ability improved in RF and increased with the increased weight percentages. Same decreased in Lime and ERP and when increase the binding agents' weight percentages, longer the time to disintegration the pellets.

*Key words:* binding agents, co-compost, moisture content, particle size, pellets

## **Acknowledgement**

I would like to extend my heartfelt gratitude to my main supervisor Dr.(Mrs.) Sanja Gunawardena and co-supervisor Dr. Sudarshana Fernando for their immense support during my graduate research work, guiding and assisting in every part of this thesis. Further, many thanks to the members of the review panel, Dr. Aruna Manipura and Dr. P.G. Rathnasiri for their valuable comments that paved the way for the success of my research work and the thesis. I would like to thank specially to Ms. Nilanthi Jayathilake, Researcher at International Water Management Institute for her valuable contribution throughout the period.

I would also like to acknowledge International Water Management Institute for providing funds to conduct the research work. I place special appreciation to the Public Health Officer, Supervisors and other workers at the compost site, Kurunegala for their patience, allowing me to conduct research activities at their work place.

Finally, I would like to thank my family members for their understanding and the support given to me to complete my job successfully.

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## List of Abbreviations

cm	- centimeter
Ca(OH) <sub>2</sub>	- Calcium Hydroxide
CaCO <sub>3</sub>	- Calcium Carbonate
Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>	- Calcium Phosphate
CaO	- Calcium Oxide
Ca <sup>2+</sup>	- Calcium ion
<sup>0</sup> C	- Celcius
C	- Carbon
CO <sub>2</sub>	- Carbon Dioxide
C-SDFS	- Composted Saw Dust Feecal Sludge
DFS	- Dried Feecal Sludge
EC-DFS	- Enriched Compost Dry Feecal Sludge
ERP	- Eppawala Rock Phosphate
FS	- Feecal Sludge
G	- gram
H	- Hour
HP	- Horse Power
I-DFS	- Irradiated Dry Feecal Sludge
K	- Potassium
Kg	- kilo gram
km <sup>2</sup>	- Square kilo meter
L	- Liter
LAs	- Local Authorities
Mm	- millimeter
MSW	- Municipal Solid Waste
m <sup>3</sup>	- Cubic meter
MPa	- Mega Pascal
MCK	-Municipal Council Kurunegala
mL	- milli Liter

m	- meter
N <sub>2</sub>	- Nitrogen
N	- Newton
O <sub>2</sub>	- Oxygen
OH <sup>-</sup>	- Hydroxide ion
P	- Phosphate
PC	- Particle Category
PO <sub>4</sub> <sup>3-</sup>	- Phosphate ion
RF	- Rice Flour
SL	- Sri Lanka
SW	- Solid Waste
T	- Temperature
V	- Volt
W	- Watt
W <sub>f</sub>	- Weight final
W <sub>i</sub>	- Weight initial