COMPARISON OF SUITAILITY OF DIFFERENT BINDING MATERIALS IN BRIQUETTE FORMING

A.M.D.Shyamalee

(09/8967)

Degree of Master of Science in Sustainable Process Development

Department of Chemical and Process Engineering

University of Moratuwa

Sri Lanka

August 2013

COMPARISON OF SUITAILITY OF DIFFERENT BINDING MATERIALS IN BRIQUETTE FORMING

Aththanayaka Mudiyanselage Daham Shyamalee

(09/8967)

Thesis submitted in partial fulfillment of the requirements for the Degree Master of Science in Sustainable Process Development

Department of Chemical and Process Engineering

University of Moratuwa

Sri Lanka

August 2013

DECLARATION, COPYRIGHT STATEMENT AND THE STATEMENT OF THE SUPERVISOR

"I declare that this is my own work and this thesis does notincorporate without acknowledgement any material previously submitted for aDegree or Diploma in any other University or institute of higher learning and tothe best of my knowledge and belief it does not contain any material previouslypublished or written by another person except where the acknowledgement ismade in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right toreproduce and distribute my thesis/dissertation, in whole or in part in print,electronic or other medium. I retain the right to use this content in whole or partin future works (such as articles or books).

Date: 11/11/2013

A.M. Daham Shyamalee

The above candidate has carried out research for the Master thesis under my supervision.

Signature of the supervisor: Dr. A.D. U.S. Amarasinghe Date: 12/11/2013

Signature of the supervisor: Dr. S.A.M.A.N.S. Senanayaka Date: 11/11/2013

ABSTRACT

The process ofmanual saw dust briquette making was tested with different binding agents in the laboratory with 1.5 ton hydraulic jack. Dry cow dung, wheat flour and paper pulp were selected as binding agents. This briquette was designed with size 35mm Diameter x 35mm length and cylindrical shape.

Saw dust was sieved through 2mm screen mesh and 6 different samples were prepared with sieved saw dust and each binding agents as 5%, 10%, 20%, 30%, 40%, and 50% dry basis. Cow dung samples were shown difficulties of mould detaching. Wheat flour and paper pulp binder samples with 5%, 10%, and 20% (dry basis) binders also failed onmould detaching due to breaking of briquettes. The minimum requirement of binder percentage was found to be with 30% dry binder of wheat flour and paper pulp to form stable briquette and hence it was selected for comparison of properties. Densities of briquettes with 30% binder of wheat flour and paper pulp were 373.7 kg/m^3 and 289.8 kg/m^3 respectively.

Compression behavior of briquettes with 30% (dry basis) binding agents was examined for cyclic loading applied using the hydraulic jack. Maximum load of 110kg (35.9 kg/cm^2 pressure) was maintained for all the experiments. Number of force cycles needed to reach the pre-determined load was recorded; paper and wheat flour binder briquettes were needed five cycles and cow dung briquettes were needed additional two cycles.

Natural drying time was evaluated at 86~89% relative humidity and 25~30^{o}C ambient temperature, It was recorded that briquettes came to 25% moisture content (Wet basis) within 33 hours and 20% moisture content (Wet basis) within 35 hours.

Compressive strength of the briquettes was tested for binder percentages of 30%, 40% and 50% (dry basis)of wheat flour and paper pulp binders. Results have indicated that compressive strength increased with the increase of binder percentage. Paper binder briquettes have comparatively high compressive strength in the range

of 0.124N/mm^2 to 0.238N/mm^2 while wheat flour briquettes have 0.032N/mm^2 to 0.055N/mm^2.

Calorific values of raw materials and briquettes were tested. Briquettes obtained from 30% paper binder and 30% wheat flour binder has calorific values of 18.14MJ/kg and 20.04MJ/kg respectively.

ACKNOWLEDGEMENTS

I take this opportunity to those who have done an immense support to enable my thesis work a success from its start to the end. First of all my sincere thanks goes to my supervisor Dr. ADUS Amarasinghe, Former head, Department of Chemical and Process Engineering, University of Moratuwa for his continuous in depth guidance throughout my research. The valuable suggestions and technical guidance given by my co-supervisor Dr.SAMANSSenanayake, Senior lecturer, Department of Mechanical Engineering, Open University of Sri Lanka is remarkable. I am grateful to Dr.ThusithaSugathapala and Dr. MahinsasaNarayana as examiners of my thesis work for their guidance which made me encouraged to comprehensively studying the research area. I also thank to Mr. JayanthaSisira Kumara, Senior technical officer, Department of Mechanical Engineering, Open University of Sri Lanka for his technical support given to me.It is great pleasure to mention the financial support given to me from NOMA fund from Telemark University, Norway.

I am grateful to my mother, father, Husband and family for giving me their best support and encouragement. Finally, my warm thank goes to all staff colleagues in the Department of Mathematics and Philosophy of Engineering, Open University of Sri Lanka as they were with me to share my research experience.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES