UNIVERSITI TEKNOLOGI MARA

THE PERFORMANCE AND THERMAL CONDUCTIVITY ASSESSMENT OF KENAF CORE-QUARRY DUST BRICK (KCQB)

ABDUL HADI BIN HASSAN

MSc

February 2021

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Abdul Hadi Bin Hassan
Student I.D. No.	:	2016719037
Programme	:	Master of Science (Civil Engineering) – EC750
Faculty	:	Civil Engineering
Thesis Title	:	The Performance and Thermal Conductivity Assessment of Kenaf Core-Quarry Dust Brick (KCQB)
Signature of Student	:	.....
Date	:	February 2021

ABSTRACT

Rapid development has increased the demand for sand as the main source of sand brick and other construction purposes. High demand and environmental issues contribute to the shortage of the resource and the cost of the material keeps increasing. To overcome this matter, there is a need to search for replacement materials as alternative resources for fine aggregate. In Malaysia, one of the renewable resources from biomass that can be easily converted to an aggregate material is the woody part of kenaf. It is commonly known as kenaf core and available in abundance after the processing of kenaf stem for bast fiber production. Besides, quarry dust is also an underutilized by-product produced during the crushing of aggregates at quarries, which is dumped into landfills and might contribute to serious environmental pollution if it is not well managed. The combination of kenaf core and quarry dust is observed to have great potential as aggregate replacement materials for sand. However, the study on the combination of quarry dust and kenaf core as aggregate replacement materials in brick production is still limited, especially on thermal conductivity. This research focuses on the thermal conductivity, compressive strength, density, and porosity of kenaf core-quarry dust brick (KCQB). Nine types of samples for bricks, plates, and brick walls were prepared by varying the kenaf core content, which are denoted as M1 for 100% sand brick (S), M2 for 100% quarry dust brick (QD), M3 for kenaf 100% core brick (KC), M4 for 75% quarry dust (75QD), M5 for 5% kenaf core (5KC), M6 for 10% kenaf core (10KC), M7 for 15% kenaf core (15KC), M8 for 20% kenaf core (20KC), and M9 for 25% kenaf core (25KC). M1, M2, M3, and M4 were used as the control samples, while M5, M6, M7, M8 and M9 were the variable samples containing kenaf core from 5% to 25%. Quarry dust was fixed at 75% for every variable mix and the balance of 25% sand was replaced by kenaf core at 5% interval until the portion of sand is 0%. The ratio of cement and material was fixed at 1:6 for all types of mix proportions. Meanwhile, the water-cement ratio was kept constant at 0.6. Based on all the properties studied, the addition of kenaf core affected the compressive strength, density, porosity, and thermal conductivity. The compressive strength and density decreased as the kenaf core increased. However, the inclusion of kenaf core resulted in higher porosity. Meanwhile, the addition of kenaf core from 5% to 25% as sand replacement improved the thermal conductivity values from 0.63 W/m·K to 0.42 W/m·K.

ACKNOWLEDGEMENT

First and foremost, Alhamdulillah, I would like to thank Allah SWT for giving me this great experience along the journey to complete my MSc successfully. My sincere gratitude and thanks to my research supervisors, Prof. Dr. Zakiah Ahmad and Assoc. Prof. Ts. Dr. Hj. Mohd. Fadzil Arshad for allowing me to conduct research and provide invaluable guidance throughout this study. Their dynamism, vision, sincerity, and motivation have deeply inspired me. It was a great privilege and honor to study under their guidance.

My appreciation goes to the top management of the National Kenaf and Tobacco Board for the opportunity and approval of the NKTB-UiTM Research Team to carry out this research and development project.

I am extremely grateful to my mother, Hajjah Khalijah Saleh for her love, prayers, caring, and sacrifices. I am very much thankful to my wife, Dian Md. Desa and both our children, Irfan Danial Abdul Hadi and Aisyah Hasanah Abdul Hadi for their love, understanding, and continuous support to motivate me to complete this research work. My special thanks to my brothers and sisters for their supports and valuable prayers.

I would also like to say thanks to all my friends and research colleagues, especially to Mr. Mohd Za'im, Miss Nurul Aini, and Mr. Anuar for their help, encouragement, and support. Finally, my thanks go to all the people who have supported me to complete the research work directly or indirectly.

TABLE OF CONTENTS