PRODUCTION AND CHARACTERIZATION OF ENVIRONMENTALLY FRIENDLY MORTAR USING TEXTILE WASTE

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FEBRUARY 2024

ACKNOWLEDGEMENTS

Upon completion of this project, I would like to express my gratitude to many parties. My heartfelt thanks goes to my supervisor, Ms. Sarah Laila Binti Mohd Jan for all the guidance, feedback, encouragement words and motivational support given throughout the process of completing this thesis. Based on her expertise and experience in chemistry field, Ms. Sarah Laila has given countless advice which have helped me a lot to overcome the difficulties I faced. I also want to sincerely thank all laboratory assistants; Sir Haji Nik Mohd Zamani Nik Ismail, Sir Abdul Muhaimin Bin Ab Aziz, Mrs. Norasidah Haron, Ms. Raja Nur Ernashahida Binti Raja Jaafar, Sir Mohd Faidzal Bin Mohamed and Sir Suhairi Suib for their kindness in helping and guiding me while conducting experiments and analysis. Last but not least, I am also grateful for all the prayers and emotional support given by my beloved family throughout the journey of completing this final year project. Thank you very much.

Diana Afrina Binti Rila @ Rella

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ABSTRACT

PRODUCTION AND CHARACTERIZATION OF ENVIRONMENTALLY FRIENDLY MORTAR USING TEXTILE WASTE

The use of cement in construction activities encourages cement production, which in turn contributes to carbon dioxide, CO_2 emission. CO_2 is the primary greenhouse gas in the atmosphere that is responsible for global warming. Apart from that, every year over 100 million tons of textile waste are being incinerated or dumped in landfills around the world. The fast fashion in the clothing industry leads to the mass production of clothes, which contributes to an increase in textile waste ending up in landfills. In this research project, environmentally friendly mortar samples were produced by incorporating cotton textile waste ash (CTWA) as partial replacement of Ordinary Portland Cement (OPC) at varying percentages of 0.1%, 0.5%, 1% and 2%. The mix ratio of 1:2.25 (cement to sand) and the water-to-binder (w/b) ratio of 0.40 were used for all cement mixes. After 28-days of curing, compressive strength test, Fourier Transform Infrared Spectroscopy (FTIR) analysis, and Scanning Electron Microscopy with Energy-Dispersive X-Ray (SEM-EDX) analysis were conducted in order to characterize the mechanical, physical and chemical properties of the mortar samples. Results revealed that the mortar sample with 2% CTWA showed high compressive strength value of 19.17 MPa which exceed the compressive strength value of the control sample containing 0% CTWA. Moreover, the compressive strength of 2% CTWA mortar samples also fulfill the ASTM C270 standard requirement value of 17.2 MPa. The improved compressive strength can be explained and supported by the FTIR and SEM-EDX results. The SEM images of 2% CTWA mortar sample showed increased formation of calcium silicate hydrates (C-S-H) gel. The increase in compressive strength at 2% CTWA mortar sample can also be associated with the high percentage by weight of silicon (Si) and calcium (Ca) elements in the EDX spectrum of CTWA. These promising results suggests that CTWA is suitable and has the potential to be used as material to partially replace OPC in cement mortar.