UNIVERSITI TEKNOLOGI MARA

INFLUENCE OF POLYETHYLENE TEREPHTHALATE (PET) AND CRUMB RUBBER ON THE PROPERTIES OF CONCRETE

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ABSTRACT

Plastics and rubbers are user friendly but not eco-friendly as they are non-biodegradable. Generally, plastics and rubbers disposed by landfill treatment. However, this practice of disposing is becoming unacceptable because of the rapid depletion of available sites due to the volume of wastes increasing at a fast rate. To address this problems encountered, polyethylene terephthalate (PET) and crumb rubber (CR) have been suggested to be used as partial replacement to fine aggregate (FA) in concrete. Most of the studies conducted by previous researchers show that there is a feasibility of using these waste materials in concrete. Thus, recycling wastes PET and CR as FA in concrete could be one of the best solutions for disposing of it, given its economic and ecological advantages. Therefore, this research was conducted to enhance better understanding of the possibility of using PET and CR as FA replacement in concrete. Besides, the study on the combination of PET and CR in construction industry is still lacking. Thus, the aim of this research is to determine the influence of PET and CR on the properties of PET, rubberised and PET-rubberised concretes. The FA was replaced by PET (5%, 10%, 15%, 20%, 25% and 30%) and CR (10%, 20% and 30%) by weight and tested for 7, 28, 60 and 90 days of curing. As an improvement for rubberised and PET-rubberised concretes, the treatment using NaOH to the CR prior to mixing was applied to increase the hydrophilicity of the rubber particle surface. The mechanical properties of the concretes were assessed through its compressive strength and flexural strength. Also, the properties of the concrete were determined by conducting electrical resistivity, water absorption and skid resistance tests. The results show that higher replacement level of FA with PET (up to 30%) and CR (up to 30%) lower the compressive strength, lower the flexural strength, increased the electrical resistivity, increased the water absorption and lower the skid resistance readings in comparison with the control concrete. Prolong the days of curing would increase the compressive strength, flexural strength, electrical resistivity and skid resistance readings but reduced the water absorption characteristic of the concrete. It was also exhibited that the compressive strength, flexural strength, electrical resistivity and skid resistance characteristics increased and the water absorption reduced at constant replacement level of CR at different replacements of PET. The treated CR with NaOH increased the inter-phase bonding between the rubber particles and cement. From Analysis of Variance (ANOVA), it was pointed out that at 95% confidence level, the independent variables which are replacement level of PET and CR have significant influence on the properties of concrete measured. The correlation coefficients of determination (R^2) shows that the fitness of the selected models are good and the models could be used for further investigations. The overall test results revealed that PET and CR can be utilized in concrete mixture as FA replacement in concrete.

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