USE OF WASTE POLYETHYLENE FOR PROPERTY IMPROVEMENT OF CONCRETE

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Master of Science

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Sri Lanka

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Thesis submitted in partial fulfilment of the requirements for the degree Master of Science in Materials Science

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Declaration

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the partial fulfilment of the requirements for the Degree of Master of Science in Materials Science under our supervision.

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Signature of the supervisor: Date:

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Abstract

Polyethylene waste products, especially thin polyethylene bag wastes have become a global problem in Environment Pollution Control Management. The primary objective of this project was to manufacture a property improved Polymer-Concrete Composite mix for building construction, using waste polyethylene grocery bags, made out of high-density polyethylene (HDPE). This is proposed as a means of reuse for this polymer product which would give even more benefits.

Research observations, including laboratory test reports indicated that the blending of suitable percentages of polyethylene flakes in to the concrete mixes gives higher workability performance in fresh concrete and it improves the durability characteristic of hardened concrete.

It was verified by controlled laboratory tests that the adding of appropriate proportions of polyethylene cut fragments to grade C30/20 concrete gives very good fresh concrete properties like cohesiveness and workability (flowability) and improved hardened concrete durability properties like higher compressive strength, lower water absorption, low initial surface absorption (ISAT), low water penetration and lower Rapid Chloride Permeability (RCPT).

This research also proposes theoretical explanations for the observations of property changes.

Keywords: concrete, waste polyethylene, environmental pollution, compressive strength, slump, cohesiveness, workability, durability, permeability, penetration, absorption, pore structure.

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List of Abbreviations

PE	Polyethylene
HDPE	High Density Polyethylene
MDPE	Medium Density Polyethylene
LDPE	Low Density Polyethylene
GGBS	Ground Granulate Blast-furnace Slags
WAT	Water Absorption Test
ISAT	Initial Surface Absorption Test
WPT	Water Permeability Test
RCPT	Rapid Chloride Penetration
FTIR	Fourier Transform Infrared Spectroscopy
DTA	Differential Thermal Analysis
TGA	Thermogravimetric Analysis
PCC	Polymer Composite Concrete
FRC	Fibre Reinforced Concrete

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