

RECYCLING OF WASTE GLASS IN MORTAR MIXTURES

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ABSTRACT

There is a growing environmental concern in many countries around the world from the accumulation of solid waste glass since not all glass can be recycled into new glass. This study explores the recycling of solid waste glass in concrete mixtures to reduce the environmental pollution and to improve the properties of concrete material. Three waste glass powder (WGP) levels were considered in this study: 5%, 10% and 15%. The properties investigated include: setting time, workability, compressive and flexural strength and micro-structure of mortar. The mortar mixtures proportions were 1:3:0.7 by weight for cement, sand and water, respectively. The results showed that the solid waste glass can be recycled in cement concrete mixtures and improve the properties of concrete. The setting time of cement paste increased and the workability decreased with the increase of the WGP content. The compressive strength of mortar increased with the increase of WGP as partial replacement of limestone sand under moist curing. The flexural strength of mortar increased with the increase of WGP as partial replacement of cement or sand under moist curing. The autoclaved WGP mortar showed higher compressive strength and lower flexural strength compared to the moist cured mortar. The scanning electron microscopy images showed that WGP material is good filler because it reduced the porosity of mortar.

Keywords: Autoclaving; Mortar; Mechanical properties; Setting time; Waste Glass powder; Workability

INTRODUCTION

The accumulation of solid waste glass in many countries around the globe is making a major environmental problem since not all glass can be recycled. This study investigates the recycling of waste glass in concrete mixtures to aid in reducing the environmental pollution resulting from the solid waste glass and to improve the properties of concrete material. Concrete is the most important construction material used all over the world. It can be defined as the material which results by mixing cement with sand and water. Engineers prefer to

use concrete in their work for many reasons: first the ease of using concrete to form a structural concrete element with any shape and volume, second concrete ingredients are cheap and available all over the world, third concrete has a good durability and resistance to water unlike other construction materials such as steel and wood (Mehta and Monteiro, 2005).

Recently, several researches studied the ability of adding mineral materials to concrete mixtures to improve the mechanical properties, durability of concrete, and increase the service life of concrete structures (Binici et al., 2008; Tangchirapat et al., 2006; Kula et al., 2007; Elinwa and Mahmood, 2002; Ismail and Al-Hashmi, 2008; Ganesan et al., 2007).