



The Sustainability of Cement Mortar with Raw Sewage Sludge and Rice Husk Ash

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Abstract

This study devotes to investigate the use of Raw Sewage Sludge (RSS) and Rice Husk Ash (RHA) to obtain sustainable construction materials. This study focuses on the evaluation of using cement-based materials having RSS and RHA. The methodology of this study could be summarized by replacing water by RSS and replacement of 10 %RHA from the weight of cement. Five groups have been used with different ratios of RSS/binder; for each group with and without RHA. In addition, the sand/binder ratio has been changed for Group 2. This method includes testing the flowability, compressive strength, Total Water Absorption (TWA) and density for the mortar mixes containing these materials. The results indicate that mixes with added materials encourage the results compared to control mixes. Addition of RHA considerably decreases flowability; however it enhanced compressive strength for all groups especially for Groups 3, 4 and 5. Moreover, the minimum values of TWA were recorded when 10% RHA was utilized as a cement replacement for both RSS and water mixes. Finally, it was found that replacing RSS by water, leads to the reduction in flowability and TWA in all mixes especially at 10% RHA; whereas the strength and density increase.

Keywords: Raw Sewage Sludge; Rice Husk Ash; Sustainability; Cement Mortar; Concrete.

1. Introduction

To reduce the cost of concrete construction, different studies are trying to figure out alternatives for the ingredients of concrete without a significant reduction in its strength [1]. These could be sustainable materials such as RHA and RSS.

The RHA is from the burning of rice husk which is very widespread in East and South-East Asia because rice production is so high in this area. The RHA is then utilized as a substitute or admixture in cement. Therefore the entire rice product is used in an efficient and environmentally friendly approach [2].

The RSS is a residual stream of suspended/dissolved organic and inorganic materials that result from the treatment processes of municipal wastewaters. The RSS is a liquid or semisolid liquid state depending on the percentage of solid by weight resulting from different processes applied [3]. The RSS may be collected from secondary and tertiary settlement tanks. The RSS is approximately produced up to 35 million tons per year in the UK [4].

The RSS as a water replacement was used with unprocessed fly ash as a cement replacement. The results of using RSS and unprocessed fly ash were encouraging. Better properties of engineering, durability and environmental comparing with the control mixes [5, 6].

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