October 2011, Volume 2, No.5
International Journal of Chemical and Environmental Engineering

Reuse of Waste Rice Husk Ash and Expanded Polystyrene Beads as an Alternative Raw Material in Lightweight Concrete Bricks

Ling I. H-[a]., Teo D.C.L.[a,b]
[a]*Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia.*
[b]*Corresponding Author*
E-mail:tdelsye@feng.unimas.my

Abstract
Nowadays, the demand for lightweight building materials has been growing worldwide. This paper presents an investigation on the use of renewable resources such as waste rice husk ash (RHA) and expanded polystyrene beads (EPS) beads as alternative raw materials for the production of lightweight concrete bricks. The RHA is used as partial cement replacement while waste EPS is used as partial aggregate replacement in the mixes. The key properties for the concrete bricks namely density, compressive strength, compliance for dimension and thermal conductivity were investigated. The mixes prepared were made of RHA of 5%, 10%, 15% and 20% as partial replacement for cement and with the same amounts of sand and EPS. A control concrete without any RHA replacement was also produced. The results showed that the samples with 10% RHA replacement not only gained the highest compressive strength compared to other samples but also complied with the class 2 requirement for load bearing bricks at 28days as specified in Malaysia Standard, MS76: 1972. In general, the results showed that the RHA EPS concrete brick has good potential as building material

Keywords: Compressive Strength, Rice Husk Ash (RHA), Expanded Polystyrene Beads (EPS), Lightweight, Thermal Conductivity n

1. Introduction

Cement is one of the most important building materials around the world. It is one of the most produced materials in the 21 century. In 2010, there was nearly 2 billion tonnes of cement produced worldwide [1]. The mass production of Portland cement has lead to the release of a significant amount of carbon dioxide (CO2) and other greenhouse gases (GHGs) causing global warming [2]. With the every ton of cement produced, almost a tonne of CO2 is emitted [3].

The accumulation of unmanaged waste materials either from industrial waste or agricultural waste is another environmental issue faced today.These waste materials such as expanded polystyrene beads (EPS) and rice husk ash (RHA) normally are burnt or dumped in open fields as landfill. Some of these waste materials even are dumped into rivers and canals causing not only a serious pollution to the environment but also causing the outbreak of diseases especially in poor countries [4].

In view of the escalating environmental problems faced today, environmentalists as well as researchers are challenged to replace as much cement as possible by supplementary cementitious materials especially by using waste materials. Waste materials from agricultural industries such as rice husk ash (RHA) have been one of the priority choices for researches to partially replace cement for the production of more environmental friendly building materials.

Rice husk is an agricultural residue from the rice milling process. It is abundant in many parts of the world, especially in countries where paddy plantation is the main industry. Each tonne of paddy rice can produce approximately 200 kg of husk, which on combustion produces about 40 kg of ash [5]. The burning of the rice husk produces RHA which is either burnt or dumped as waste in open fields. RHA contains nearly 95% silica [6]. Silica obtained from RHA is highly reactive. Therefore, it is a suitable mineral admixture for cement and concrete [7]. The behavior of cementitious products varies with the source of RHA [8, 9] and most of these mineral admixtures have a favorable influence on the strength and durability of concrete [10-12].

Expanded polystyrene (EPS) waste from the packaging industry is a kind of stable foam with low density, consisting of discrete air voids in a polymer matrix. The polystyrene beads can easily be incorporated in mortar or concrete to produce lightweight concrete, with a wide range of densities [13]. EPS lightweight concrete can be used for various structural elements such as cladding panels, curtain walls, composite flooring systems, load-bearing concrete blocks, and floating marine structures and also