

Addition of Natural Lime in Incinerated Sewage Sludge Ash Concrete

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ABSTRACT: The reason of carrying out this investigation was to study the ISSA concrete after adding eggshell powder to it. In this study, four different percentages of eggshell powder with respect to cement were added into the concrete mix of Grade 30. The percentage of the ISSA was fixed at 10% as the partial cement replacement with incinerated at 800°C. The materials used were Ordinary Portland Cement, coarse aggregates, fine aggregates, ISSA and eggshell powder. Based on the investigation, all the slump test results of eggshell ISSA concrete were at the desired range of workability from 65-80 mm. Eggshell concrete with 15% achieve the highest compressive strength at 38.96 MPa with was 21% higher than the normal plain concrete. Moreover, addition of ISSA and eggshell powder had shown a significant reduction of the rate of water absorption. Although the trend of the compressive strength decreased when the addition of eggshell powder increased up to 20%, the compressive strength of the specimens still able to be used as structural components.

Keywords: incinerated sewage sludge ash, eggshell powder, compressive strength, water absorption, partial cement replacement

1 INTRODUCTION

The use of the sewage sludge ash in the concrete production has attracted an international interested because of the significant growth of the sewage sludge. Moreover, Malaysia is one of the largest egg consumers in the world amounting 36.5 million eggs daily (Chong, 2015). Most of the sewage sludge and eggshell are disposed as landfills without go through any pre-treatment (Tsai et al, 2007). The sewage sludge is not recommended to be buried in the soil or used as agricultural fertiliser due to its high heavy metal content (Kartini et al, 2015). Cu, Zn, Pb and Cd are the main elements that often reported to cause contamination of soil and food chain which lead health problem (Al-Musharafi et al, 2013). The number of landfilling increase significantly from 49 in 1988 to 161 in 2002, yet the number is still increasing annually (2010). Moreover, the increasing demand of using cement in construction had made the possible of searching alternatives cement replacement. Sewage sludge ash and eggshell powder are rich in SiO₂ and CaCO₃ respectively. High content of SiO₂ and CaCO₃ in sewage sludge and eggshell is useful for strength development of concrete. Thus, the combination of sewage sludge and eggshell powder can be possibly potential materials in concrete production.

2 MATERIALS

In this study, sewage sludge ash and eggshell powder were used as cement replacement in con-

crete production The quantity of the sewage sludge used as 10%, while the eggshell powder were 5%, 10%, 15% and 20%. Weng et al (2003) recommended the optimum of sludge was 10%. The sewage sludge was collected from STP Megamall located at Kuantan, Pahang, while the eggshell powders were obtained from Eggtech Manufacturing Sdn Bhd located at Puncak Alam. The sewage sludge was incinerated process at 800°C, while the eggshell powder was dried at controlled temperature of 105°C for 24 hours. The incinerated sewage sludge and eggshell powder were ground into incinerated sewage sludge ash (ISSA) and eggshell powder. ISSA and eggshell powder then were sieved using 2.36 mm. and the particles that pass through 2.36 will be used as the partial cement replacement. The size of the concrete cubes used in this study was 100 mm x 100 mm x 100 mm The other type of materials that used in this study was Ordinary Portland cement, granite, river sand and water. The Ordinary Portland Cement manufactured by YTL Orang Kuat, which is suitable for structural concreting. The granite and river sand are taken form Pancing, Pahang. Figure 1 and 2 shows the sample of the incinerated sewage sludge ash and eggshell powder that were used in this investigation.