

Self-Compacting Concrete Incorporating Various Ratios of Rice Husk Ash in Portland Cement*

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ABSTRACT

We evaluated self-compacting concrete mixtures containing various weight ratios of treated rice husk ash (RHA) obtained from electric power plant combustion. Ordinary or Type 1 Portland cement (OPC) was partially replaced by rice husk ash at levels of 0, 20, 40, and 60% of the total weight of binder materials (OPC and RHA). The binder material content for all mixtures was maintained at 525 kg/m³. Fresh and hardened state properties were tested including unit weight, slump flow J-ring, V-funnel flowing time and compressive strength. The rice husk ash consisted of partially amorphous silicon dioxide (SiO₂) particles with an equivalent volume mean particle size of 24.32 μm. Increasing the rice husk ash fraction resulted in a decrease in unit weight and an increase in the corresponding T₅₀ V-funnel times. A 40% rice husk ash replacement level in ordinary Portland cement can potentially develop the highest compressive strength, up to 440 kg/cm².

Keywords: High weight ratio, Self-compacting concrete, Electric power plant, Rice husk ash

INTRODUCTION

Biomass has long been an important renewable energy source. In rural Thailand, biomass fuels are not traded, but instead mostly home-grown or collected by family labor. However, biomass is also increasing in commercial value in energy markets where modern technology and competition have previously dictated the use of more efficient and clean fuels.

Rice is a major agricultural product in Thailand, and disposal of rice husk is a serious problem for larger mills. In several plants the husks are used for cogeneration and power production. The rice husk ash (RHA) produced in these operations has its own disposal costs and problems. We sought an effective method of reducing these costs by using the ash to produce the high-performance building material known as self-compacting concrete (SCC).

*Presented in the 1st ASEAN PLUS THREE Graduate Research Congress (AGRC), March 1-2, 2012, Chiang Mai, Thailand.