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Development of Green Construction Material from MWA Water Treatment Sludge

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Extended Abstract

Most water treatment plants (WTP) produce by-products of sludge in the process of water production. The properties of sludge produced from the surface water source depend on geology of flood plain, sludge drying bed, coagulation and flocculation process, together with chemical admixture. Metropolitan Waterworks Authority (MWA) is public utility provider serving the population with sufficient quantity of good quality water for residents in Bangkok, Nontha Buri and Samut Prakarn Province which account for approximately 10 million households. Due to the great amount of sludge volume produced each year, MWA now is facing with the challenge of increasing of sludge volumes due to the rising in water demand thus the sustainable way of reusing of the accumulating sludge is urgently needed. MWA has 4 water treatment plants. The biggest one is Bang khen Water Treatment Plant which produces a minimum sludge of 150 tons/day in the dry season and approximately 200 tons/day of dry solid sludge in rainy season.

In the past, the sludge has been used in a conventional way of land filling. Later MWA has initiated the research to apply the sludge from the water treatment process into construction building materials or what is called Portland cement as a part of zero-waste policy. However, this Portland cement requires a lot of carbon footprint as the production of 1 ton of Portland cement releases about 1 ton of carbon dioxide.

Currently, MWA intends to develop more sustainable sludge products [1]. The development of an alternative green construction and building materials without the usage of Portland cement as a cementing agent is invented. The geopolymerization is now replacing the use of cementation. The liquid alkaline activator used was a mixture of sodium silicate solution (Na2SiO3) and sodium hydroxide solution (NaOH). This is to prove that sludge can be used in a sustainable manner to develop geopolymer masonry units and light weight block, respectively. The compressive strengths of both products meet the Thailand Industrial Standards (TIS) [2].

The aim of this study is to present the development of MWA-WTS for green material products and further development of the green materials which reduce more carbon footprint by incorporating the use of rice husk ash into WTS-rice husk ash (RHA) geopolymer without using Portland cement. The maximum compressive strength of WTS-RHA geopolymer is found at 30% RHA and curing at a temperature of 40°C. The 28-day strengths of the samples cured at high temperature are significantly higher than those cured at room temperature. The result shows that WTS-RHA geopolymer meets the strength requirement for using as a non-masonry unit and stabilized pavement base material. All proportions of WTS-RHA geopolymer are higher in strength than that required by Thailand Industry Standard (TIS) and Department of Highway Standard, DH-s2533/204 & DRR .2556-244.

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