

UNIVERSITI TEKNOLOGI MARA

**INFLUENCE OF WASTE PAPER
SLUDGE ASH PARTICLE SIZE TO
THE CEMENTITIOUS PROPERTIES**

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ABSTRACT

The addition of waste material as Supplementary Cementitious Material (SCM) in blended cement has been proven to give a positive effect to the cement matrix. The potential and performance of blended cement incorporating waste material as SCM depend on the chemical and physical properties of the materials. Physical properties normally include the particle size of SCM is one of the vital properties that can affect the overall performance of blended cement. Due to these factors, this study focuses on the investigation of the influence of WPSA particle size to the cementitious properties of WPSA blended cement. The optimum particle size of WPSA proportionate to replacement level was also determined and compared with Silica Fume (SF) and Fly Ash (FA). Material properties which are chemical, mineralogical and fineness of WPSA, OPC, SF, and FA were deliberated. Four sizes of WPSA were prepared and named as WPSA U, WPSA R63, WPSA R45, and WPSA Pan. All types of WPSA were used as the replacement materials of the Ordinary Portland Cement (OPC) at 5 to 20% mass to mass basis. The prepared WPSA blended cement was then used to determine the standard consistency, setting time, heat of hydration and compressive strength of cement paste. The compressive strength was measured up to 180 days to identify the late strength properties of WPSA blended cement. This study found that the compressive strength WPSA Pan at 5% replacement was 48.47N/mm^2 which is higher than OPC (45.80N/mm^2) at 28 days. Meanwhile, the blended cement of WPSA U, WPSA R63, and WPSA R45 was lower than OPC. The morphology of blended cement also showed that WPSA Pan produces more ettringite and calcium silicate hydrate (CSH) than other types of WPSA. The different particle size of WPSA also influences the setting time and water requirement of WPSA blended cement. Water requirement was increased when the particle size was getting finer. Furthermore, the rate of heat evolution of WPSA blended cement was higher when the finer WPSA (WPSA Pan) particle size was used. From this study, WPSA Pan was found most suitable to apply as SCM as it fulfils the entire requirement outlined in the standard reference. The performance of WPSA pan was also similar with OPC and not significantly different from SF and FA.

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