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The effect of various particle size fractions of fly ash additions on the properties and performance of oil well cements

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ABSTRACT

Fly ash as supplementary cementitious materials had reduced the total price of Portland cement and has reduced the greenhouse gas emissions resulting in a sustainable “green” concrete. This study investigates the effect of various particle size fractions of fly ash as additive to cement in various amount on the properties and performance of oil well cements. An investigation on the effects of the different particle size and the various compositions was made. The fly ash were separated using sieves laid on top of the other and were allowed to vibrate allowing sieving of the fly ash. Various sieve sizes were used including 25um, 38um, 45um, 53um, 68um, 75um as well as 90um respectively. The retained fly ashes within the sieves were tested for performance when mixed at 0.35 water to cement ratio.

The fly ash - cement slurries were tested for their shear stress and rate, compression strength, as well as water loss for a specific particle size and in different compositions. Graphs were plotted to show the different performance of cement slurries at different particle size composition against shear rate and shear stress. Experiments were carried out to determine the performance of the different particle size composition on the compressive strength and water loss. AAS was also used to determine the chemical composition of the fly ash and cement.

Higher and low compression strength were observed for 38um and 75um particle size of the fly ash, respectively. Low fly ash content (10%) showed better strength compared to 40 %. Rheology test showed that fly ash - cement slurries followed the Bingham plastic model. An increase in fly ash content (from 10% to 70%) decreases the apparent viscosity from 596.59 and 394.17Pa. Results also showed that higher content fly ash lowered the yield stress of cement mixture. Finally, highest rate of water loss was recorded for low fly ash content (10 %).