

Rheological Study of Cement Modified with a Lignin Based Admixture

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Abstract: Experiments involving the use of the dynamic shear rheology technique utilising a parallel plate configuration were conducted to investigate changes in the rheological properties of Trinidad Portland cement paste blended with Lignosulfonic acid, acetate sodium salt additive. The rheological properties of plastic viscosity (PV) and yield stress (YS) of the cement blend as defined by Bingham were calculated. Water/cement ratios of 0.40, 0.45 and 0.50 were used with a 0 - 0.50% additive at room temperature and the samples were tested at intervals of 10, 30, 60 and 90 minutes after mixing. The results showed maximum values of the PV between 0.05% and 0.10% admixture concentrations for the various water/cement ratios and time measurements. PV values were generally lower as water/cement ratios increased demonstrating improvements in the rheology. A PV value of 0.7 centipoise obtained with the control sample can be reproduced with the addition of approximately 0.05% admixture using 20% less water. Maximum values of YS generally occur between 0.05% and 0.10% admixture concentrations as a more compact, homogeneous paste system develops. Consistent with previous studies utilising this technique, YS data was generally sporadic. The ability to synthetically alter the rheological properties of Trinidad Portland cement adding a lignin based admixture can serve to optimise the strength, workability and shrinkage due to the reduced water-cement ratio.

Keywords: Portland cement; Rheology, Admixtures, Plastic Viscosity, Yield Stress, Lignin