Materials

Science, Chemistry

Chemistry 14 November Materials in Green Cement The largely used construction material globally is Portland cement with an annual production of about 12 billion tones. However, its production utilizes vast amounts of raw materials such as limestone and sand, liberating a ton of carbon dioxide gas per ton of cement produced (Shah & Wang 15). The current focus on sustainable development in concrete technology aims at producing more environmentally friendly cement, which spawns less carbon dioxide and expends less energy. Such environmentally favorable cement is what is referred to as “ green cement.” This paper focuses on the advancement of “ non-clinker green cement” through the utilization of cement kiln dust (CKD) and fly ash (FA) (Shah & Wang 16).

CKD has incompletely calcified substances possessing hydraulic and cementitious qualities. In addition, sulfate, alkali, and chloride elements are high and may affect the quality of cement performance. FA, on the other hand, contains mostly vitrified alumina-silica melt and minute amounts of crystalline elements such mullet, quartz, and mica (Shah & Wang 16). Previous research indicates that appropriate blending of CKD and FA may yield a cementitious matter, thus changing waste into useful substances. This paper looks at three methodologies of activating the hydration of CKD-FA binders. These are mechanical, thermal, and chemical. Chemical activation involves the addition of 2 % and 5% sodium hydroxide to the CKD-FA systems. Thermal activation entails curing at temperatures between 38 and 50oC in comparison with curing at 24oC. The study utilizes various compositions of FAs and CKDs. Finally, mechanical activation engages various grinding regimens ranging from simple, vibratory mill, ball mill,

combined (ball mill and vibratory mill grinding) and grinding aid in the form of high-speed mixing (Shah & Wang 17).

The process realizes that various activation methods give various strengths at different compositions of CKD and FA. For example, highest strength arises from the addition of 2% NaOH to a binder comprising of equal quantities of CKD and FA cured at 38oC (27 MPa (4000 psi) at age of 56 days) (Shah & Wang 17). Grinding activates the materials both chemically and mechanically.

This paper, therefore, concludes that estringitte is the key crystalline hydration outcome of CKD-FA, vibrator grinding for four hours is the most efficient mechanic-chemical activation technique. Addition of NaOH hastens chemical disbanding but lowers estringitte development in hydration of the binder. Overall, utilization of proper ratios of CKD-FA and activation techniques yields agreeable results.

Work Cited

Shah, P. Surendra & Wang, Kejin. “ Development of “ Green” Cement for Sustainable Concrete Using Cement Kiln Dust and Fly Ash.” International Workshop on Sustainable Development and Concrete Technology. N. d. 15-23. Web. .