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PHYSICAL AND MECHANICAL EVALUATION OF CONCRETES MODIFIED WITH POLYCARBOXYLATE SUPERPLASTICIZER AND SEWAGE SLUDGE FLY ASH WASTE

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Abstract

The quality of concrete depends not only on the type of binder or additive used but also on the optimal proportion of individual ingredients. The development of self-compacting concrete means that new generation admixtures, such as polycarboxylates, are increasingly sought after. The study assessed the impact of the addition of a polycarboxylate superplasticizer (PCSP) admixture and the variable content of cement-water paste on selected physical and mechanical properties of C30/37 class concrete. In the experimental work, three concrete mixtures were designed with different contents of sand, gravel, Portland cement, water, superplasticizer, and fly ash waste from the thermal processing of municipal sewage sludge. These concrete mixtures were tested for water penetration depth, frost resistance, water absorption, consistency of the concrete mixture, aeration of concrete samples using the pressure method, as well as the compressive strength of the concrete. An improvement in all tested parameters was observed when the content of PCSP admixture increased and the addition of cement-water paste decreased. Correlation analysis confirmed the positive effect of the addition of the admixture on the properties of concrete. The obtained results of compressive strength of up to 55 MPa suggest the transition of the tested samples to higher classes C40/50 and C45/55, which is associated with potential use in stronger building structures. The obtained research results translate into economic and environmental benefits and may also find potential application in the construction industry.

Key words: compressive strength, concrete, physical and mechanical properties, polycarboxylate, sewage sludge fly ash waste, superplasticizer

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