

Contribution to the amelioration of concrete comportment with the variation of chemical admixture based on local materials

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Introduction :

Nowadays, concrete has become the most widely used material ever, a heterogeneous and composite material. The term "heterogeneity" refers to the significant difference between its compressive and tensile behaviour, while "composite" refers to the composition of concrete. Generally, concrete is composed of cement, the binding element, and the aggregate that represents the granular structure. More components are added to the concrete composition, such as mineral and chemical admixtures. The principal purpose of the introduction of more mineral admixture is to minimize costs and make sustainable concrete, principally if this addition is present in nature with significant quantity and quality in the south of Algeria originally.

Currently, construction technology offers a wide variety of chemical admixtures, which aligns with the development of various types of concrete. These admixtures are generally classified into two categories: the first is workability-modifying admixtures through lubrication, and the second is rheology-modifying admixtures. In our experimental program, we have chosen to use two types of admixtures: a polycarboxylate workability-modifying admixture and an acrylic polymer-based rheology-modifying admixture. Where the behaviour of the chemical admixture varies with the concrete components used, this study aims to achieve two objectives. The first objective is to study the variation of concrete comportment as a function of superplasticizers, and the second is the valorization of local materials. The results of our experiment, if successful, could revolutionize the field of concrete technology, significantly enhancing the performance of concrete and inspiring further research and development in the field.

Résultats :

The objective of using a superplasticiser in the construction industry is to enhance the workability of concrete while maintaining a suitable water-to-cement ratio. For this reason, superplasticisers are also referred to as high-water reducers.

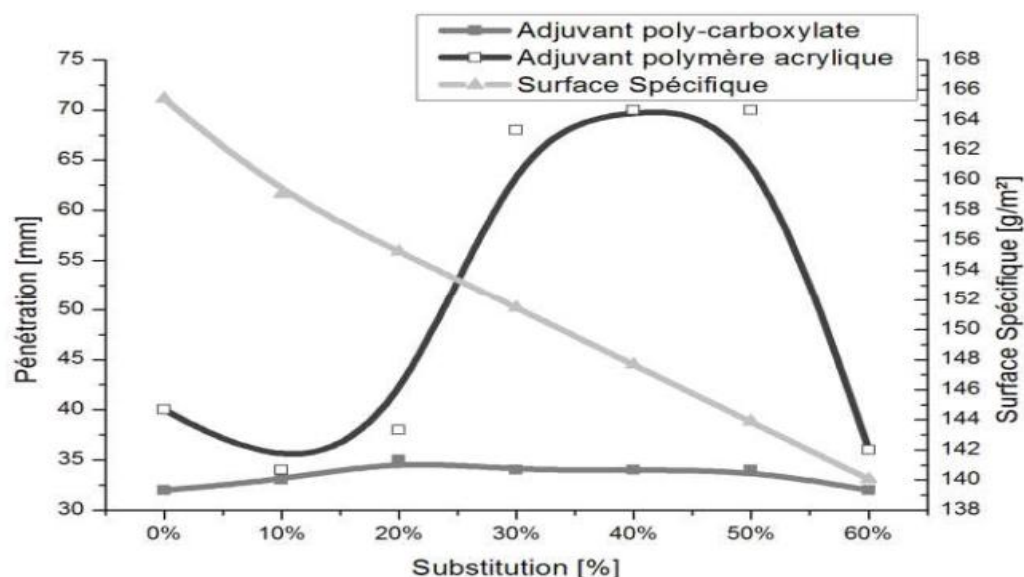


Fig. 1 The variation of workability as a function of the percentage of substitution and the specific surface area based on different superplasticizers.

The first observation to be made is the profitability of the acrylic polymer-based superplasticizer with a workability variation interval of 70 to 34 mm, even at a constant water/cement ratio, while the workability variation interval is between 34 and 32 mm in the case of a carboxylate copolymer-based superplasticizer (Fig. 1). It can be seen that at 40% substitution, the new generation of superplasticizer becomes more profitable in terms of workability due to the lubrication mode of this type of additive. Where at this percentage of substitution, an optimum suspension is achieved by producing an optimal inter-granular rearrangement, where it has been noted that the quantity of the mixture remaining after filling and surfacing the molds decreases from 40% substitution, even at 50% substitution where it is noted that the entire quantity of the mixture is contained in the mold. The use of the new generation of superplasticizer has allowed the appearance of a layer of bleed water which becomes more significant as the substitution progresses. By their nature, acrylic superplasticizers promote the appearance of a layer of bleed water which acts as a protective layer by a molecular film against water evaporation.

Conclusion :

The divergence between the behaviour of the two superplasticizers is mainly due to the different lubrication modes. The polycarboxylate-based superplasticizers, with their long bipolar molecules, have a unique absorption and lubrication mechanism. On the other hand, the innovative acrylic polymer-based superplasticiser, with its unique rheological operation, is pushing the boundaries of superplasticization. It is also a bipolar molecule that acts by intergranular rheological sliding.

Références :

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