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IMPORTANCE OF NEUTRALIZATION OF SUPERPLASTICIZERS FOR CONCRETE MIXTURE

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Abstract. In the neutralization process, diethanolamine was used in an amount from 5% to 30% relative to the superplasticizer mass. The obtained results showed that when diethanolamine was used in an amount of 10% compared to the mass of superplasticizer, the plasticizing property showed the highest result, and the elasticity of the cement mixture was 20 cm. When diethanolamine is used in the amount of 20%, the flowability is 16%, when 25% is used, the flowability is 14cm, and when diethanolamine is used in 30%, the superplasticizer obtained when applied to the cement mixture shows the lowest plasticizing property and is 11cm. It can be seen that in the process of neutralizing the superplasticizer with diethanolamine, a superplasticizer with the highest plasticizing properties was obtained when 5% of the superplasticizer mass was used from a 20% diethanolamine solution.

Keywords: sulfonaphthalene, concrete, neutralization, spreadability, diethanolamine, pH, flowability.

1.Introduction.

It is estimated that 15 countries worldwide cultivate about 87.4% of the total production of sugarcane crops. Among them, major countries include Brazil, India, Pakistan, Thailand, Cuba, the Philippines, Mexico, Myanmar, and Argentina [1]. Furthermore, it is expected that annual production of sugarcane will be greater than 1.5 billion tons worldwide [2]. The fibrous residue, approximately 40–45% sugarcane after juice extraction, is called “Bagasse” [3]. It is reused as fuel in the sugar cane factory to produce heat, generating 8–10% of ash, known as sugarcane bagasse ash (hereafter SCBA) [2]. Every year, Brazil manufactures 2.5 million tons of SCBA [4], the largest in the world. India is the second largest producing country of sugarcane crops after Brazil, which yields nearly 350 million tons per annum [5]. Thereby, the application of plasticizer or superplasticizer becomes a satisfactory solution [6]. The actions of plasticizers go beyond improving workability, as they reduce the volume of voids in hardened concretes, improving their mechanical performance [7]. In the case of concretes with RA, the absorbed water is offset with the use of chemical admixtures to obtain the same workability as conventional concretes [8]. In the studies about recycled concretes, several are the chemical admixtures adopted, such as plasticizer based on a blend of organic polymers and admixtures; lignosulfonate-based superplasticizer; and superplasticizer of high activity based on a combination of modified polycarboxylates in aqueous solution.

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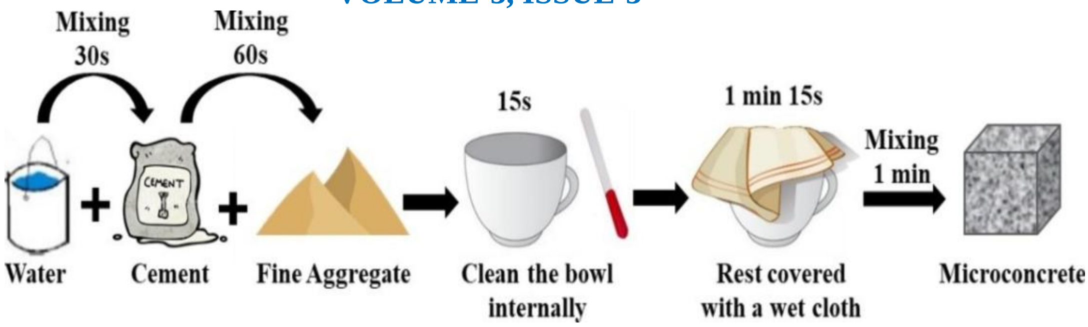

Figure-1. Mixing sequence scheme [9].

The water-reducing admixture contents were not the same in all researches, with variation from 1% to 1.5%, by the cement weight. Therefore, improvements in studies about the effects of these chemical admixtures in concretes with FRA are necessary[9].

2. Experimental part

As a result of experiments, it was found that sulfonaphthalene-formaldehyde type superplasticizers have a less plasticizing and water-reducing effect on concrete mixtures than polycarboxylate hyperplasticizers. In the study, NSF superplasticizer was created using local raw materials. Special attention is paid to the process of neutralization of the obtained superplasticizer, because the increase in the amount of added alkali or diethanolamine has a negative effect on the expansion and strength of the superplasticizer when it is added to concrete. Neutralization of the superplasticizer was carried out in 2 ways. In the first method, it was neutralized with NaOH solution. In the second method, it was neutralized with diethanolamine. The neutralization process is stopped when the pH of the environment is 7-8. The resulting product was dried in a drying cabinet at a temperature of 1050C until the mass did not change. As a result, a light brown hard brittle product was formed. The dried solid product was ground to powder using a rotor mill. This powder dissolves well in water, retains its plasticizing properties[10].

3. Results and Discussion

The process of neutralization of the synthesized superplasticizer was carried out using a 20% aqueous solution of sodium hydroxide. The purpose of treatment of synthesized superplasticizers with an alkaline solution is to neutralize sulfogroups in the structure of the superplasticizer. During our scientific research, we were convinced that the amount of alkali in the neutralization process affects the plasticizing properties of the superplasticizer. The effect of the alkali content of superplasticizers on the plasticizing properties of superplasticizers is shown in the graph in Figure 1 below.

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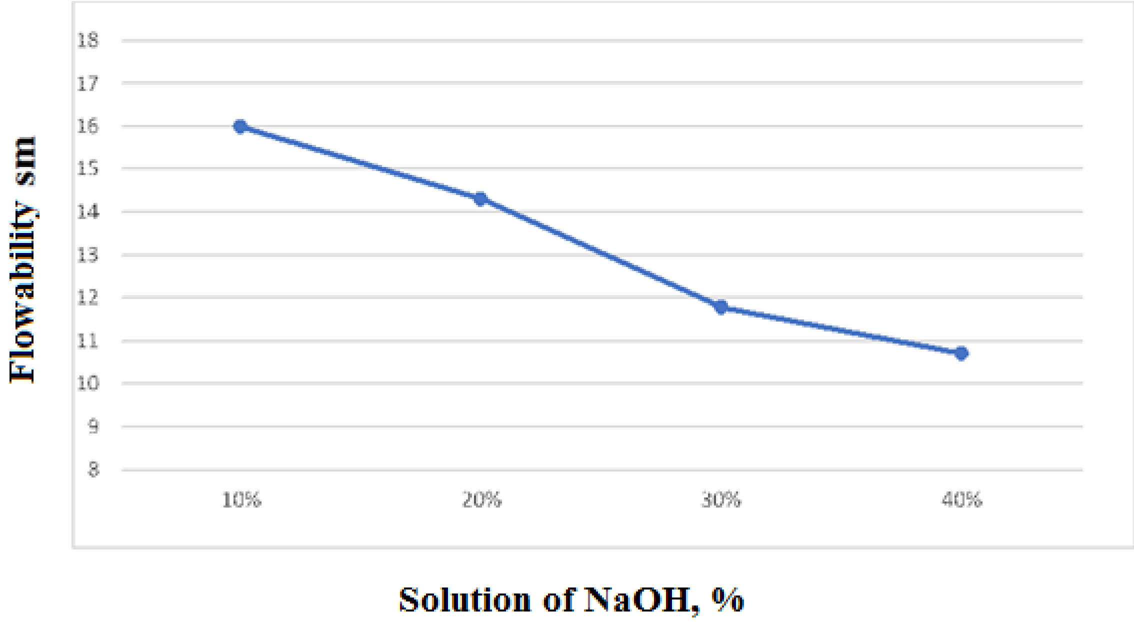

Figure 1. The effect of NaOH concentration on the fluidity of the cement mixture when neutralizing the resulting plasticizer

As can be seen from the diagram in Figure 1, when processing the resulting superplasticizer with NaOH solution, its amount significantly affects the fluidity of the cement mixture. In the neutralization process, superplasticizer was used in an amount from 10% to 40% by mass. The obtained results showed that when the alkali solution was used in an amount of 10% compared to the mass of the superplasticizer, the plasticizing property showed the highest result, and the expansion of the cement mixture was 16 cm. The flowability of 20% alkali solution was 14, when 30% was 12 and when 40% alkali solution was used, the superplasticizer showed the lowest plasticizing property when applied to the cement mixture and was 10.8 cm. It can be seen that in the process of neutralizing the superplasticizer, when 10% of the 20% sodium hydroxide solution is used in relation to the mass of the superplasticizer, the superplasticizer with the highest plasticizing properties is obtained[11].

The effect of diethanolamine concentration on the fluidity of the cement composition during neutralization of the synthesized superplasticizer is presented in Figure 2:

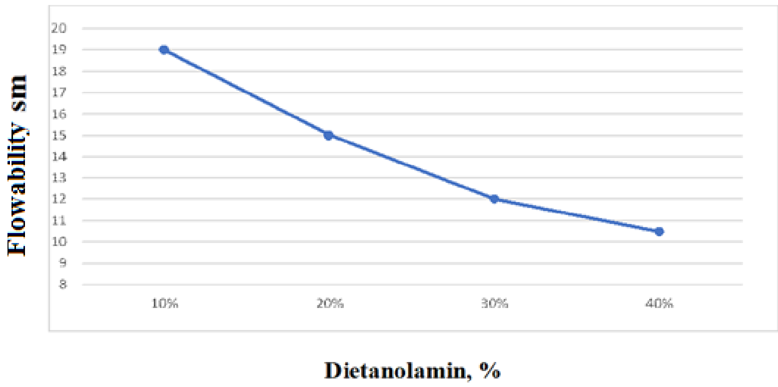

Figure 2. The effect of diethanolamine concentration on the fluidity of the cement mixture during neutralization of the obtained plasticizer

As can be seen from Figure 2, when processing the resulting superplasticizer with NaOH solution, its amount significantly affected the fluidity of the cement mixture. However, NaOH-neutralized superplasticizer has a requirement for Na ion. Therefore, we found it necessary to neutralize the synthesized superplasticizer with diethanolamine instead of NaOH. In the neutralization process, diethanolamine was used in an amount from 5% to 30% relative to the superplasticizer mass.

The obtained results showed that when diethanolamine was used in an amount of 10% compared to the mass of superplasticizer, the plasticizing property showed the highest result, and the elasticity of the cement mixture was 20 cm. When diethanolamine is used in an amount of 20%, the flowability is 16%, when 25% is used, it is 14cm, and when diethanolamine is used at 30%, the superplasticizer obtained when applied to the cement mixture shows the lowest plasticizing property and is 11cm.

Conclusion

It can be seen that in the process of neutralizing the superplasticizer with diethanolamine, a superplasticizer with the highest plasticizing properties was obtained when 5% of the 20% diethanolamine solution was used in relation to the mass of the superplasticizer. It was found that when adding superplasticizers neutralized with diethanolamine and sodium hydroxide to mixtures based on cement binders, the elasticity and strength increase.

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