RESEARCH ON OBTAINING OF SUPERPLASTICATOR ADDITIVES WITH LOCAL RAW MATERIALS AND SECONDARY PRODUCTS

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Introduction

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Water-reducing chemicals are additives used in concrete mixtures to reduce the amount of water required without compromising its workability[1]. These chemicals are frequently used in construction projects to increase the durability and efficiency of concrete structures. Once the water content is reduced in a cement mixture, the strength and durability of the produced concrete will increase [2]. Concrete plasticizing (i.e., improved concrete flowability) might also be achieved through the addition of water reducers to the cement mixture[3]. Despite the increase in the fluidity of concrete at a constant water-to-cement ratio with the addition of water reducers, its compressive strength remains not affected [4]. Plasticizers and superplasticizers are the main two types of water-reducing chemicals. Plasticizers, also defined as regular water reducers, are commonly used in low-strength concrete mixtures [5] and can decrease the water by 5–10%. Superplasticizers, on the other hand, are high-range water reducers that are suitable for use in high-strength concrete mixtures [6]. Superplasticizers can reduce the water content of a concrete mixture by approximately 30% while maintaining workability or enhancing it. They are frequently used in applications requiring high strength and durability, such as bridge and high-rise building construction [7].

This experimental study included determination of compressive strength of concrete containing processed and graded construction demolition waste and/or glass waste with or without additives. On addition of construction demolition waste aggregates obtained from stronger original concrete, 28-day compressive strength of concrete was at least equal to or better than that of control specimen. When fine aggregate was replaced with glass waste up to 30%, compressive strength improved[8]. The objective of this study was to investigate the effect of superplasticizer and mineral admixture contents on the properties of Self-Consolidating Concrete (SCC). Silica fume was used as a mineral admixture and polycarboxylate based third generation superplasticizer was used as a chemical admixture. In order to determine the optimum admixture dosages; trial mixes were prepared with varying admixture dosages. Nine concrete mixtures with different admixture dosages were prepared from trial mixes. Hardened concrete properties and self-compactability criteria of these series were determined and test results were compared between these SCC mixtures. It was observed that 10S1.3A (10% Silica Fume, 1.3% Superplasticizer) and 10S1.5A (10% Silica Fume, 1.5% Superplasticizer) mixtures show the best performance with regard to fresh and hardened concrete properties[9].

[10].

2. Experimental part

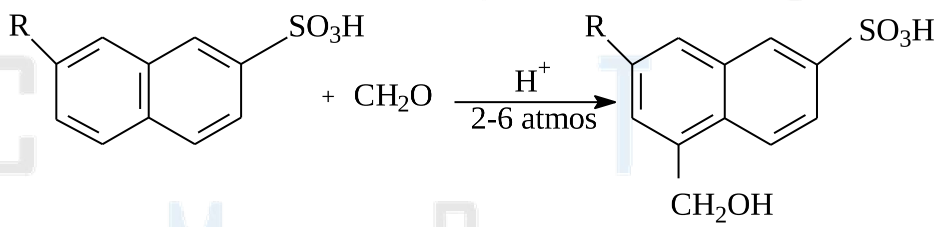
Table-1.

№	Ratios of mol	Time, hour	Yield, %	№	Ratios of mol	Time, hour	Yield, %
1	1:1:1	1	26,2	11	1:1:1	**3**	49,4
2	1:0,5:2,74		37,3	12	1:0,5:2,74		65,8
3	1:0,5:1		47,4	13	1:0,5:1		72,5
4	1:1,5:2,74		54,3	14	1:1,5:2,74		78,7
5	1:1:2,74		56,5	**15**	**1:1:2,74**		**79.8**
6	1:1:1	2	35,5	16	1:1:1	4	49,5
7	1:0,5:2,74		60,5	17	1:0,5:2,74		65,9
8	1:0,5:1		70,5	18	1:0,5:1		72,6
9	1:1,5:2,74		72,4	19	1:1,5:2,74		78,7
10	1:1:2,74		75,5	20	1:1:2,74		78,9

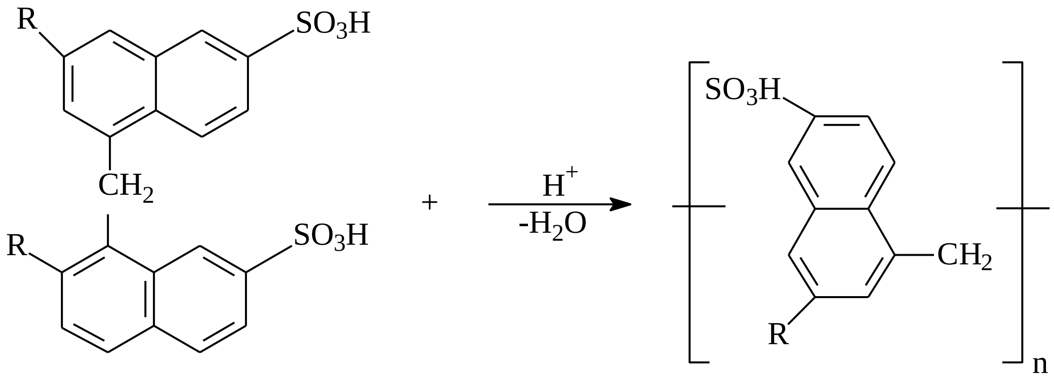
Based on the results presented in Table 1, it represents the influence of various factors: time and the mole ratio of the initially obtained substances on the yield of the superplasticizer.

3.Results and Discussion

At the 2nd stage of the reaction, methylol-ß-naphthalene sulfonic acid is formed due to the equimolar addition of formaldehyde to the α-C atom of the non-sulfonated naphthalene sulfonic acid ring. This methylation is mainly carried out at 160°C to speed up the reaction. In practice, they mainly work with a small amount of formaldehyde (the ratio of naphthalene: formaldehyde moles ≈ 1: 1.2).



Then, when heated to 140-160 °C, methylol-naphthalene sulfonic acid first condenses into a dimer in an acidic environment, which then turns into an oligomeric resin by dewatering (condensation).



The condensate resin obtained in acid form was then neutralized with NaOH and it was observed that the process was optimal [3]. The technology for obtaining naphthalene sulfonic formaldehyde superplasticizer based on pyrolysis oil was developed. As a result of superplasticizer synthesis, optimal conditions for superplasticizer production were studied. The synthesized superplasticizer meets the requirements of GOST according to technical parameters. In order to prevent the increase of sodium ions in the superplasticizer, the method of neutralization with diethanolamine was chosen, which improves the expansion properties of the superplasticizer. As a result of studying the synthesis of superplasticizer, the optimal modes of superplasticizer production were selected.

4. Conclusion

The compressive strength of concrete samples with added superplasticizer was studied. The synthesized superplasticizer classifies the following classes of chemical additives to concrete: plasticizing, water-retaining, ensuring water resistance of concrete and others. The main advantage of superplasticizers is that they do not reduce the strength of concrete, despite the strong liquefaction effect.

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