AJEMA GLOBAL RESEARCH NETWORK

AMERICAN Journal of Engineering, Mechanics and Architecture
Volume 01, Issue 07, 2023 ISSN (E): 2993-2637

INCREASING THE STRENGTH OF CONCRETE MIXTURES

Ismailov F.S, Karimov M.U. Djalilov A.T.

[1]Doctoral student of the Tashkent Research Institute of Chemistry and Technology.
[2]doctor of technical sciences, professor, Tashkent Research Institute of Chemistry and Technology,
[3]Chemical Science of Doctor, Academician of the Academy of Sciences of the Republic of Uzbekistan, Tashkent Research Institute of Chemical Technology

Corresponding author: ismoilovferuz54@gmail.com

Abstract. In order to produce economically effective and environmentally safe superplasticizers for concrete mixtures in the construction industry and to obtain superplasticizers for concrete mixes based on pyrolysis oil in order to constantly improve existing technologies, as well as to adjust the structure formation processes of concentrated suspensions in the construction industry, the properties of finished products and initial It is vital to create new effective organic additives that can purposefully change the mobility of the mixture, physicomechanical, physicochemical properties of concrete mixes.
Keywords: admixture, superplasticizer, suspension, concrete, composition, pyrolysis oil, formaldehyde, diethanolamine.

Introduction

The global trends in technical re-equipment and upgrading of construction enterprises have recently biased toward the wide use of cellular concrete in construction [1]. This is explained by the fact that light concretes are now regarded as the most promising wall materials: the products made of them have low mass but high thermal insulation properties and allow erection of two- or three-story supporting walls and higher structures in combination with brick and reinforced concrete products [2–4]. Among light concretes, aerated concretes are most promising from the viewpoint of low cost of production and ease of control over the required operational properties (strength, frost resistance, hygroscopicity, thermal insulation, durability, etc.) of the obtained building products [5,6]. The recent years have seen extensive researchers, either tests or theoretical exploration, which aim to study the influence of constituents on the mechanical properties of concrete, mainly with a focus on the influence of the shape, particle size, content, and type of coarse aggregate on the compressive strength, deformation, and fracture properties of concrete[7]. Yang et al. analyzed the influence of five types of coarse aggregates on the uniaxial compressive strength of low-, medium- and high-strength concretes and found that the elastic match between coarse aggregates and matrix can help enhance the strength of concrete[8].

It should be noted that the aforementioned research works mainly concern the compressive and flexural strength of normal-strength concrete (NSC) and high-strength concrete (HSC) under uniaxial stress state. With the development of material science and production technology, ultrahigh-strength concrete (UHSC) has gradually been applied in engineering practice, especially in high-rise buildings, marine structures, and large-span structures[9].

The priorities of obtaining organic chemical additives for cement compositions include research on obtaining chemical additives with complex effects, obtaining plasticizing additives based on renewable resources, research on obtaining plasticizing additives with zeolite, silicogels, available includes modification of plasticizing additives by chemical changes[10,11].

2. Experimental part

2.1. Obtaining superplasticizers for concrete mixtures based on pyrolysis oil. It is planned to develop methods of obtaining new high-performance superplasticizers based on local raw materials, to determine optimal conditions for their synthesis, and on this basis, scientific research was carried out. , it is envisaged to develop and put into practice the technology of synthesis of superplasticizers based on diethanolamine, and sodium hydroxide.

Table-1.
Composition of pyrolysis oil

№	Indicator name	Normal	
		Chemical composition	**Clear for analysis**
1	Appearance	Dark brown to dark green oily liquid with unpleasant odor.	
2	Naphthalene	**41,51%,**	**41,45%,**
3	2-Methylnaphthalene	**16,25%,**	Not fixed

2.2. Sulfuric acid- H_2SO_4 is a strong dibasic acid. Under normal conditions, odorless, colorless, heavy oily liquid; density 1.83 g/cm³ (at 15°C), solidification temperature 10.45°C, boiling point 296.2°C.

Table-2.
Physical and chemical properties of sulfuric acid

Molecular formula	**H_2SO_4**
Appearance	Colorless, bluish liquid
The amount of the main substance	99,2%.
Molecular mass	98
Density	1,83g/ml (20°C)
Boiling temperature	296^0C

2.3. Formaldehyde (- **CH_2O** or **HCHO**) an organic compound belonging to the class of aliphatic aldehydes. Under standard conditions, formaldehyde is a colorless gas with a pungent odor. Formaldehyde liquefies at -19.2 ° C, turning into a liquid with a density of 0.8153 g/cm^3. Below -118 °C, formaldehyde turns into a white paste. Liquid and gaseous formaldehyde actively polymerizes at temperatures up to 80 °C.

Table-3.
Physical and chemical properties of formalin

№	Indicator name	Standard

		High grade	The first variety
1	Appearance	Colorless, clear liquid. At temperatures not exceeding 40°C, a small amount of cloudy or white precipitate is allowed.	
2	Mass fraction of formaldehyde, %	36,9-37,5	36,5-37,5
3	Mass fraction of methanol, %	4,0-8,0	4,0-8,0

3. Results and its discussion.

In order to determine the structure and properties of the synthesized substances, the following tools were used to analyze the results.

IR-spectrum of Naphthalene sulfoacid formaldehyde, plasticizer, synthesized on the basis of IR-spectroscopy, was recorded on the spectrometer "IR Tracer-100" (SHIMADZU CORP., Japan, 2017) and it was possible to obtain the desired results.

Microscopic analysis of structural and surface defects and the elemental composition of the substance (EDS - Oxford Instrument) were determined using a scanning electron microscopy device and the necessary results were recorded. The thermal stability of synthesized plasticizers and cement mixtures was analyzed by differential-thermal and thermogravimetric methods in the device of the Japanese company SHIMADZU. SHIMADZU (simultaneous thermal analysis) TGA and simultaneous analysis of TGA-DTA, TGA-DSC analysis methods is an easy-to-use, reliable, and high-performance thermal analysis platform. It was studied in a derivativeograph at a speed of 10 degrees/min, with the sensitivity of T-900, TG-200, DTG-1/10, DTA-1/10 galvanometer, by automatically recording the derivativeogram on photo paper. A sample of studied pigments with a mass of 35-46 mg was placed in a crucible made of aluminum oxide and platinum-resistant to a temperature of 165°C without a cover with a diameter of 10 mm. The differential mode of heating was carried out under atmospheric conditions. During the analysis, the synthesized pigments were thermally analyzed up to a temperature of 20–1000 °C. In addition, endothermic and exothermic points of superplasticizers were proved.

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[12]. The effect of the alkali content of superplasticizers on the plasticizing properties of superplasticizers is shown in the graph in Figure 1 below.

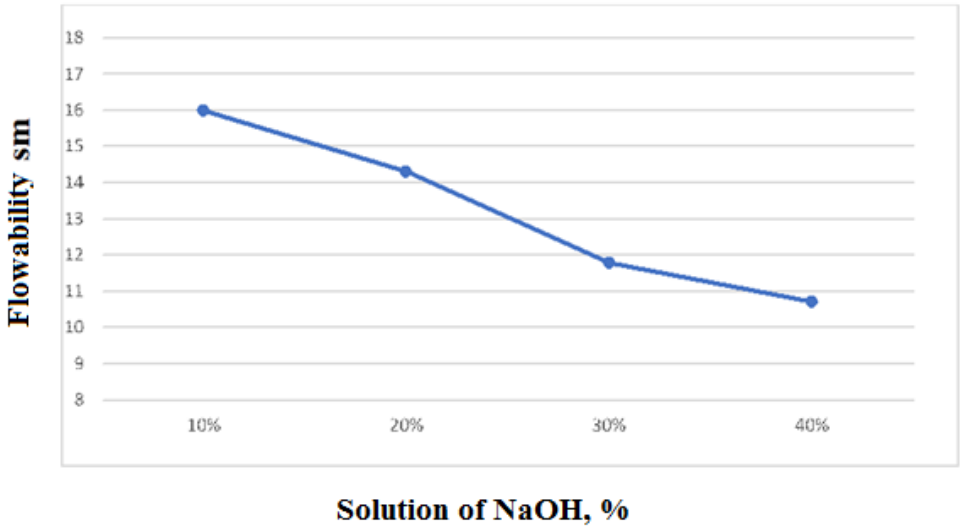

Figure 1. The effect of NaOH concentration on the fluidity of the cement composition when neutralizing the resulting plasticizer

During the neutralization process, it was observed that the amount of NaOH solution significantly affected the fluidity of the cement mixture. Superplasticizer was used in amounts 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. As a result, a superplasticizer with the highest plasticizing properties was obtained. Experiments were carried out on the basis of GOST 310.3-76.

Conclusion

1. Superplasticizers based on pyrolysis oil were obtained and it was found that the obtained superplasticizer has a positive effect on the rheological and physical-mechanical properties of cement stone.
2. It has been proven in the experiment that the obtained superplasticizer has a high plasticizing effect when added to concrete mixtures. Superplasticizers have been experimentally proven to be 10-15% more effective than superplasticizers based on traditional naphthalene formaldehyde resins.

References

1. Pinsker, V.A. and Vylegzhanin, V.P., Cellular concrete as a time-tested material for capital construction of walls, *Stroit. Mater.*, 2004, no. 3, p. 44.
2. Vatin, N.I., Gorshkov, A.S., Kornienko, S.V., and Pestryakov, I.I., Consumer properties of wall products manufactured from autoclaved aerated concrete, *Stroit. Unik. Zdanii Sooruzh.*, 2016, no. 1, p. 78.
3. Weber, H. and Hullmann, H., *Porenbeton Handbuch. Planen und Bauen mit System*, Gütersloh: BertelsmannSpringer Bauverlag, 2002.
4. Besoiu, T. and Popa, A., Infill walls contribution on the progressive collapse resistance of a typical mid-rise RC framed building, *IOP Conf. Ser.: Mater. Sci. Eng.*, 2017, vol. 245, p. 022026.

5. Kornienko, S.V. and Gorshkov, A.S., Full-scale thermal and physical tests of residential buildings manufactured from aerated concrete blocks, *Inzh.-Stroit. Zh.*, 2016, no. 4, p. 10.
6. Elistratkin, M.Y., Lesovik, V.S., Zagorodnjuk, L.H., Pospelova, E.A., and Shatalova, S.V., New point of view on materials development, *IOP Conf. Ser.: Mater. Sci. Eng.*, 2018, vol. 327, no. 3, p. 032020.
7. Mehta, P.K.; Ezeldin, A.S.; Aitcin, P.C.: Effect of coarse aggregate on the behavior of normal and high-strength concretes. Cem. Concr. Aggreg. **13**(2), 4 (1991). https://doi.org/10.1520/CCA10128J.
8. Yang, Z.F.; Qian, J.S.; Tang, Z.Q.: Experimental study about effect of coarse aggregate strength on compressive strength of concrete. Concrete **12**, 23–39 (2004).
9. Ma, J.; Dehn, F.; Tue, N.V.; Orgass, M.; Schmidt, D.: Comparative investigations on ultra-high performance concrete with and without coarse aggregates. In: Proceedings of the 1st International Symposium on Ultra-High Performance Concrete, pp. 205–212, Kassel, Germany (2004)
10. Karimov M.U., G.G. Tukhtaeva, A.A. Kambarova, and A.T.Djalilov. A Note on Influence of Na- carboxymethylcellulose on the Physic-Mechanical Properties of Cement Systems// Journal "Analytical Chemistry from Laboratory toProcess Line" Canada. November. 2015y.
11. Karimov M. U., Vafaev O.Sh., Djalilov A. T., Study of the IR spectra ob-tained superplasticizer and its influence on the physico-chemical and physico-mechanical properties of the cement compositions// Journal "European applied science" Germany. №8.,2015y.77-81p.
12. Karimov M. U., Djalilov A. T., SamigovN. A. Study of the IR spectra ob-tained hyperplasticizer and its influence on the physico-chemical and physico-mechanical properties of the cement compositions// Journal "European applied science" Germany. №7(Iyul). 2015г. 26-30p.