



THE EFFECT OF SUPERPLASTICIZERS ON THE POROUS STRUCTURE OF FOAM CONCRETE OBTAINED USING LOCAL INDUSTRIAL WASTE AS A SECONDARY RESOURCE

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Abstract: The article presents the results of experimental studies to determine the effect of superplasticizer SDj-3 based on ester polycarboxylate on the porous structure of foam concrete obtained from local industrial waste using lime waste as a secondary resource. It is established that the plasticizer has a significant effect on the porous structure of calcareous foam concrete. It is noted that the additive SDj-3 makes it possible to increase the proportion of closed pores of foam concrete while reducing the volume of open pores and, instead of open capillaries, create a group of evenly distributed small spherical pores, thickening the interporous walls.

Keywords: foam concrete, calcareous spent foam concrete, pore structure, total porosity, open porosity, closed porosity, average pore size index, superplasticizer, chemical additive.

Introduction. In recent years, there has been a growing worldwide interest among technology scientists and builders in foam concrete based on polished concrete technology [1]. Scientific research works aimed at improving the properties of foam concrete are being carried out. Currently, a lot of research and development is underway aimed at selecting fillers for the production of high-quality foam concrete, controlling the formation of structure in a hardening binder using chemical and mineral additives, optimizing the composition and forming a solid structure of foam concrete [2-4]. Therefore, it is important to study the physical and technical properties of foam concrete, to develop a technology for their production, which reduces the consumption of mineral binders, energy-saving, using local raw materials and secondary resources.

As is known, the strength of loose concrete depends on the strength of the pore walls and the overall porosity (density). Suleymanova L. A., Kara K.A. [6-8] and others, it was shown that the strength of raw concrete is also influenced by the characteristics of the pore structure - the size of the pores and their statistical size distribution. At the same time, the issues related to the effect of plasticizing additives on the properties of the porous structure of loose concrete have not been sufficiently disclosed.

This article describes the results of a study of the superplasticizer sdj-3 based on a complex polycarboxylate [9] to determine the effect of lime on the pore structure of foam concrete.

MATERIALS AND METHODS OF RESEARCH. The research used Portland cements of the PTS400 D20 brand produced by Kuvasoitsement, which meet the requirements of GOST 31108-2020.

The porous structure of foam concrete was studied on samples measuring 150x150x150mm, without additives, as well as on samples with chemical additives 0.8; 1.0 and 1.2% SDj-3, hardened for 28 days under normal conditions.

The parameters of the pore structure given in the normative act GOST 12730.4-78 were the indicators of total porosity (F_{um}), open porosity (F_{och}), Burke porosity (F_b), the average pore

size index (F) and the pore size uniformity index (α).

THE RESULTS AND THEIR DISCUSSION. The test results and graphs based on them are shown in Table 1 and Figure 1,2.

Table 1

Parameters of the porous structure of lime-spent foam concrete samples

Parameters	SDj-3 additional amount,%			
	0	0,8	1,0	1,2
F _{um}	67,0	69,0	71,1	70,1
F _{och}	31,1	24,0	20,1	20,2
F _b	35,9	45,	51,0	49,9
F	1,8	1,5	1,2	1,3
α	0,3	0,7	0,9	0,6

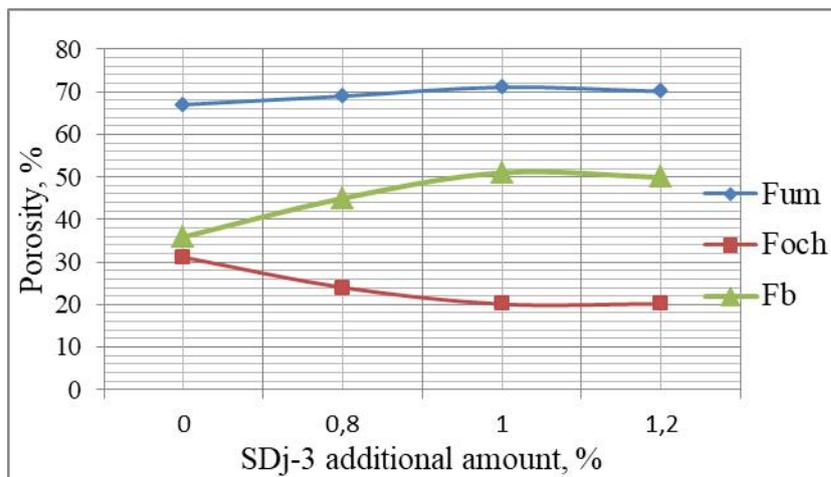
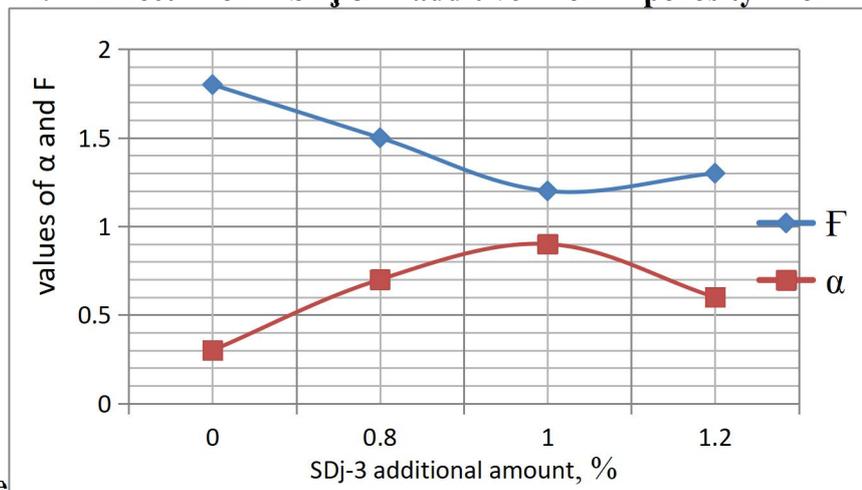


Figure 1. Effect of SDj-3 additive on porosity of calcareous foam



concrete

Figure 2. The effect of the SDj-3 additive on the pore size parameters of lime-spent foam concrete

The curves shown in Fig.1,2 and the data shown in the table indicate that the structure of the porous structure of lime-spent foam concrete depends on the amount of complex chemical additives.

The addition of SDj-3 has practically no effect on the overall porosity of lime-spent foam concrete, but, with an increase in the volume of open pores, it reduces the proportion of closed pores. Instead of randomly arranged open pores and capillaries, a group of evenly distributed small spherical pores is formed in concrete, and the interporous walls thicken (Fig. 3).

a)

b)

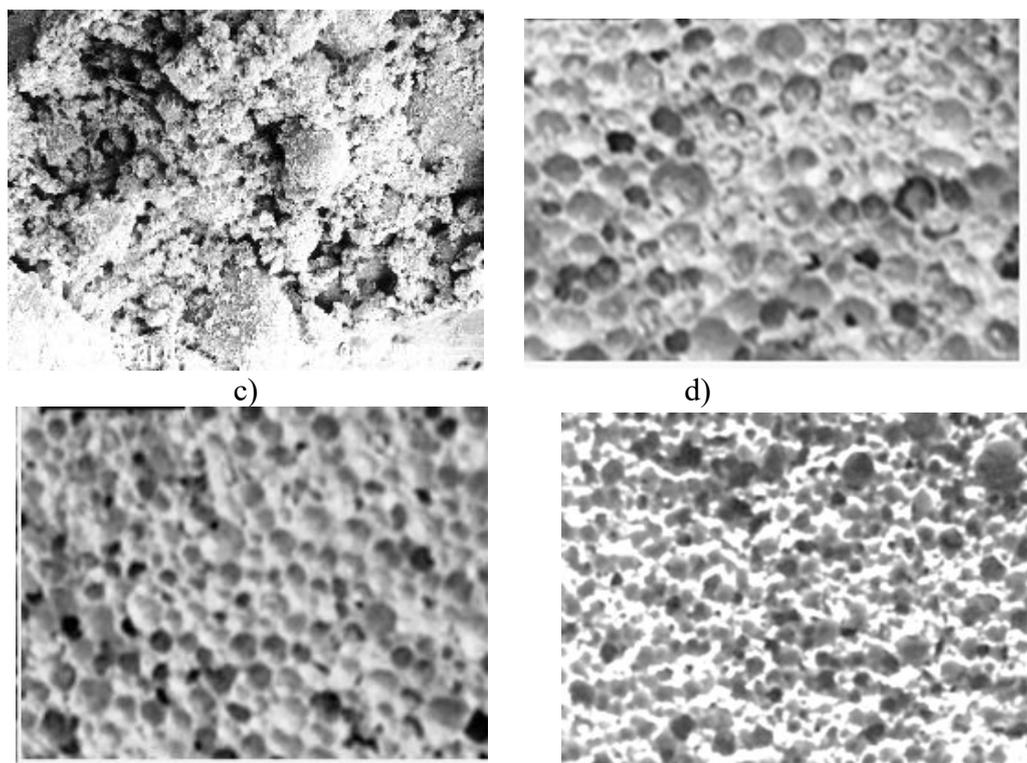


Figure 3. Without additives (a) microstructure of lime-spent foam concrete with an SDj-3 content of 0.8% (b), 1.0% (c) and 1.2% (d).

As a result of the modification with the addition of SDj-3, small pores of the same size are formed in lime-spent foam concrete. According to the results of the research, it was shown that optimization of the porous structure of lime-spent foam concrete can be achieved by adding the chemical additive SDj-3 in an amount of 1.0% to the weight of Portland cement, when this amount of the additive is exceeded, open pores of different sizes are formed.

Conclusion. An analysis of the research results showed that the superplasticizer SDj-3 based on ester polycarboxylate has a great influence on the formation of the pore structure of lime-spent foam concrete. The parameters of the porous structure make it possible to obtain lime-spent foam concrete of specified values, which in turn makes it possible to increase the strength, frost resistance and energy-saving properties of concrete.

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