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STUDY OF THE COMPOSITION AND PROPERTIES OF FOAM CONCRETE USIN G LIME (SLUDGE) WASTE

U. M. Abdullaev
Fergana Polytechnic Institute Assistant
u.abdullayev@ferpi.uz

Abstract
The article analyzes the application of lime waste (sludge) to foam concrete and the results of a study of the thermal insulation of lime waste foam concrete and the compressive strength of structural foam concrete, various ratios of solid lime waste to lime waste for more efficient use in the development of new foam concrete building materials and based on laboratory experiments it was found that lime waste (sludge) foam concrete can be used as a filler.

Keywords: strength, lime waste (sludge), foam generator, medium density, thermal insulation, structural thermal insulation.

Introduction

The main components in the production of lime foam concrete are cement and fillers. Practice has shown that, depending on the type of lime-spent foam concrete produced, the composition of the components varies significantly. An increase in the amount of filler leads to an increase in the strength and average density of lime foam concrete.

In addition, when using heavy coarse-grained fillers, the foam concrete mixture settles. For this reason, fillers of less than 2.5 mm in size are used in the manufacture of foam concrete -mainly sand, lime waste (sludge) and crushed industrial waste.

Considering that the solid particles and mineralogical composition of sand and lime (sludge) waste are different, the influence of the composition of the components on the properties of foam concrete obtained from lime waste was considered.

Methods of work:

The research was carried out in the following order, initially a separate technical foam was prepared. The amount of foaming agent was 0.5% water. The foam was cooked for 3 minutes, then cement and filler (sand and ash) were added to the foam. Mixing the foam concrete mixture took 2 minutes. Then the mixture was poured into metal molds measuring 15x15x15 cm. The foam concrete samples were cured under natural conditions. The characteristics of the obtained samples were determined after 7, 14 and 28 days.

When determining the effect of the granulometric composition of sand, sand and sifted sand of a natural solid composition were used as a filler in Tables 1 and 0.63; 0.315; 0.14 and 0.14, and in Table. 2 as a filler, the fineness module of Ferganaazot lime waste is 300 microns 150 microns 0.75 microns and more.

Table 1 Physical characteristics of spring sand

№	Pointers	Units of measurement	Quantity
1	Actual density	g/cm^3	2,33
2	The magnitude module	-	1,6
2	Bulk density	kg/m^3	1,56
3	№ 063 residue in the sieve	%	13,2
4	Number of large grains: 10 mm. 5 mm. 0.16 mm. nevertheless	%	 0,3 7 25
5	The amount of clay and pollen	%	0,3

Table 2 Physical parameters of lime waste (sludge)

№	Pointers	Units of measurement	Quantity
1	Actual density	g/cm^3	2,69
2	The magnitude module	-	1,6
3	Bulk density	kg/m^3	1,025
4	the remainder in the sieve № 075	%	53.91
5	The number of large grains 300 microns . 150 microns . 0.75microns . nevertheless	%	 0,3 5,12 25
6	the amount of powdered substance of lime waste (sludge)	%	40,14

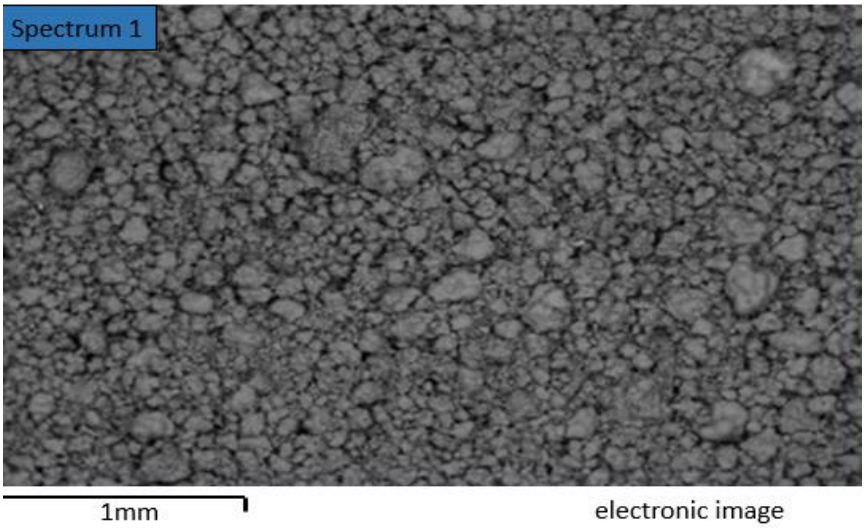


Figure 1. Electron microscopic analysis of a mixture of lime waste.

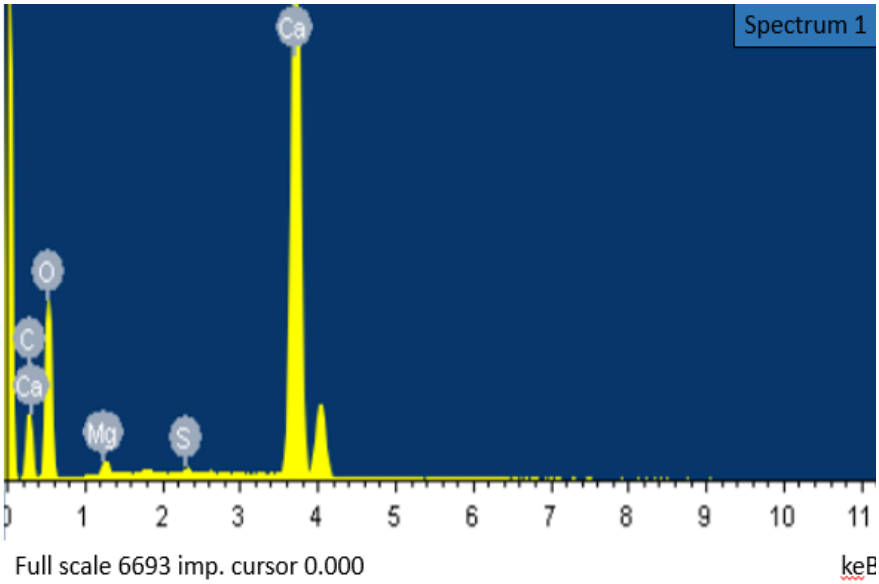


Figure 2. Chemical analysis of lime sludge

Name	Chemical composition, weight. %								
	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	K_2O	Na_2O	Сумма
lime slurry	1,37	0,14	0,08	48,63	1,28	0,38	0.01	0.08	51,97

Table 3 The effect of the composition of lime sludge on the properties of foam concrete

The composition of the mixture	Water hardness	Average density, kg/m3	Compressive strength, MPa		
			Solidification time, day		
			7	14	28
Cement-60% lime slurry–40%	0,5	605	0,6	1,2	1,9
Cement-50% lime slurry–50%	0,5	620	0,5	1,1	1,5
Cement-40% lime slurry–60%	0,5	670	0,4	0,8	1,2
Cement-30% lime slurry–70%	0,5	710	0,3	0,6	1,0
Cement-20% lime slurry–40%	0,5	750	0,5	0,5	0,8

Analysis:

The effect of lime waste on the strength of foam concrete will be studied in this article. The density of the dry foam concrete used in this experiment is 600 kg/m3, which is mainly used in foam concrete to conserve heat in construction. [3,4]

For more efficient use of solid lime waste for the development of new foam concrete building materials, various ratios of lime waste are investigated, and this article analyzes the appearance of density, mechanical properties and microstructure of foam concrete in a dry state of various service life.

For experimental studies, Portland cement of the PS400 D20 brand of the Kuvasoicement plant, the composition of foam concrete (Tables 4, 5), the Brand of thermal insulation and structural foam concrete M800 were used.

In an experimental study of various foam concrete compositions, high efficiency indicators of the components were observed in the presence of lime waste in the composition. The construction foam concrete of lime waste was studied by manufacturing 2 serial samples of twin prisms measuring 4x4x16 cm. The first series is with control samples, the second is with a lime dump. The trial periods are 1, 3, 7, 14 and 28 days after quenching. The test results are shown in the table.

Table 4 Laboratory composition with sand, thermal insulation and thermal insulation structural foam concrete mixtures

№	Name of the material	The composition of the foam concrete mixture, kg	
		per 1m^3	Test control in the volume of 5 liters
1.	Cement	300	1500
2.	the fraction of sand 0-5 mm	300	1500
3.	Foam	50	250
4.	Water, liter	160	800

Table 5. Laboratory composition with lime waste, thermal insulation and thermal insulation structural foam concrete mixtures

№	Name of the material	The composition of the foam concrete mixture, kg	
		per 1m^3	Test control in the volume of 5 liters
1.	Cement	260	1500
2.	Lime waste	240	1500
3.	Foam	50	250
4.	Water, liter	180	900

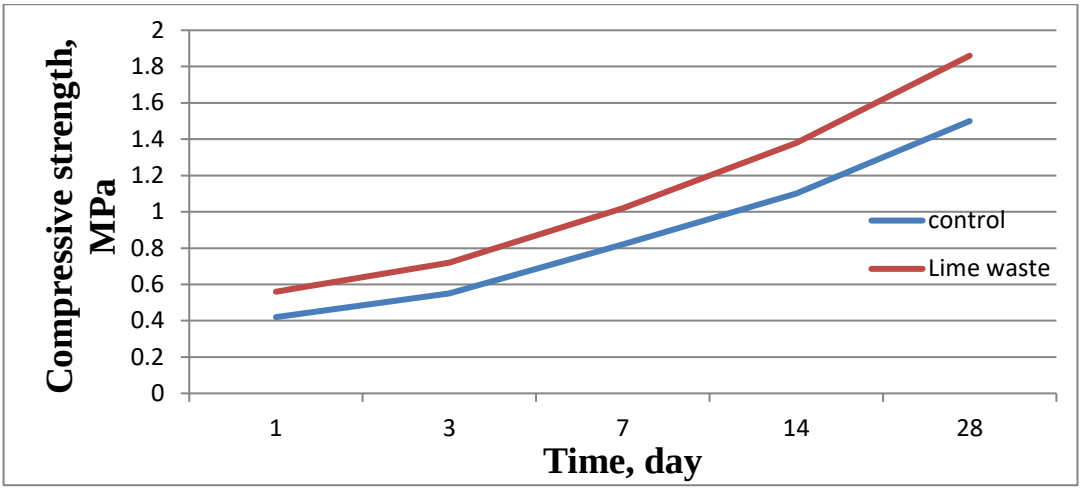
The introduction of lime waste into the composition of thermal insulation and thermal insulation structural foam concrete increases the strength of thermal insulation and thermal insulation structural foam concrete during the entire solidification period.

Table 6 The results of the study of the compressive strength of thermal insulation and structural foam concrete

№	Name of the material	Average density, kg/m3	thermal insulation strength of structural foam concrete (MPa) and its increase during the day (%).				
			1	3	7	14	28
1	foam concrete made of sand	700	0.85 100	1.55 100	2.9 100	3.8 100	4.2 100
2	foam concrete made of lime sludge	605	0.96 113	1.72 114	3.25 112	4.3 113	4.75 113

Graph 1.

The effect of thermal insulation of lime waste and thermal insulation on the compressive strength of structural foam concrete



Conclusion

Thus, various compositions of foam concrete with the addition of lime debris (suspension) as a filler in the production of chemical fertilizers as a secondary resource have been experimentally studied, without losing the strength of foam concrete, but, on the contrary, increasing its strength. It turned out that higher rates of lime-spent (slurry) foam concrete can be achieved using various superplasticizers.

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