The American Journal of Engineering and Technology
(ISSN – 2689-0984)
Published: July 30, 2021 | **Pages:** 9-14
Doi: https://doi.org/10.37547/tajet/Volume03Issue07-02

IMPACT FACTOR
2021: 5. 705
OCLC - 1121105677

Journal Website: https://theamericanjournals.com/index.php/tajet

Ways Of Foam Concrete Production Development

Abdullaev I.N.
Candidate Of Technical Sciences, Associate Professor, Department Of Construction Of Buildings And Structures, Fergana Polytechnic Institute, Uzbekistan

Abdullaev U.M.
Doctoral Student, Fergana Polytechnic Institute, Uzbekistan

ABSTRACT

The given article provides a brief overview of the literature on the history of the development of foam concrete in the industry of building materials and products. The results of work carried out by foreign and domestic researchers on the production and improvement of the technical properties of foam concrete are presented.

The results of studying the composition of lime sludge waste from the production of chemical fertilizers are presented. The analysis of the chemical composition of CaCo3, Ca (OH) 2, NaOH, Na2CO3, MgO, non-solvent substances in water, moisture in lime sludge is presented. The percentage was studied in order to use lime waste as a secondary raw material for fine aggregate in the production of aerated concrete and aerated concrete.

KEYWORDS

Foam concrete, foaming agent, cellular concrete, thermal conductivity coefficient, strength, deformability, frost resistance, thermal insulation, autoclave treatment, non-autoclaved foam concrete.

INTRODUCTION

Nowadays, lime waste from the local production of chemical fertilizers, that is, lime residues (sludge) used in the milk lime production technology, must be disposed of to sludge dumps, which leads to additional transport costs, the formation of landfills and a negative impact on the environment. There is a need for research on obtaining building material from this residue, that is, limestone sludge. Our purpose is to conduct research on the use of lime waste as a secondary raw material for fine-grained aggregate in the production of aerated concrete and aerated concrete.

Foam concrete is one of the most demanded materials in the construction industry all over the world. The use of the material allows you to reduce the coefficient of thermal conductivity, the mass of the structure and the construction costs. At present, more than 260 enterprises operate in 55 countries, annually supplying more than 60 million m^3 of foam concrete building products.

Foam concrete is a relatively new material, if a brick is 3000 years old, then it is no more than 100. This is an artificial porous stone that can float in water, meeting all the requirements of regulatory documents for building materials, in terms of strength, deformability, frost resistance, its heat-shielding properties are 2-3 times higher than by the brick. Recent years have been characterized by a new surge of interest in aerated concrete. This is due to two reasons: the tightening of standards in relation to the requirements of thermal protection of building elements and new advances in technology and design of cellular concrete products [1].

At the beginning of the twentieth century, the Swedish architect A. Erickson invented new technologies for the manufacture of artificial stone, with characteristics close to those of wood. This event marked the beginning of the development of the history of aerated concrete. This invention was protected by an international patent in 1924, and after 50-60 years, foam concrete was used in more than forty countries of the world. [2]

For example, it is widely known that in the Russian Federation the practice of using foam concrete products in construction has been going on for more than sixty years. It was used to insulate the roofs of industrial buildings. The first all-foam concrete residential buildings were built in 1953 in Berezniki. Plants for the production of foam concrete were gradually closed. One foam concrete plant (insulation and welding) remained in the Russian Federation in the city of St. Petersburg (Leningrad). It was launched in 1958 and produced monolithic insulation for pipes without duct laying. This insulation is still in use today, having successfully passed 40 years of testing in difficult ground conditions. [3].

Development of technology for the production of cellular concrete of naturalhardening took place at a time when issues related to durabilitymaterial has not been studied. The influence of temperature and shrinkage deformations on the durability of concrete, as well as the influence of technological factors of production have been insufficiently studied. Large-sized fencing products made of cellular concrete were characterized by low cracking resistance and were operated without protective coatings at high humidity and exposure to aggressive environments. Under these conditions, the unprotected material quickly collapsed and lost its strength properties.

From the experience of using non-autoclaved aerated concrete products, it follows that during their production, insufficient measures were taken to ensure the protection of the

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material during operation. To protect products from the effects of aggressive environments, a vapor-tight dense layer of cement-sand mortar was used. As a result of the accumulation of moisture at the border of the cement-sand mortar and aerated concrete, destructive processes developed. The dense protective coating collapsed after the first two years of operation. In some cases, the result of the destruction of products was insufficient protection of reinforcing steel from corrosion. When applying measures to eliminate moisture in structures, as well as to protect embedded parts from corrosion, products made of non-autoclaved aerated concrete acquired the required durability [4].Further development of the technology for the production of autoclaved aerated concrete by the Ericsson method in Sweden and in other countries went in two directions. One led to the production of aerated concrete using YTONG (Sverige) technology. This is autoclaved cellular concrete, obtained from a mixture of quicklime with a silica filler, without cement.

The second led to the production of aerated concrete - SIPOREX (Sverige) in 1934, developed by the Finnish engineer Lennart Fopsen and the Swedish engineer Ivar Eklund, obtained from a mixture of Portland cement and a silica component, without quicklime.

In these areas, the production of aerated concrete has been developing since 1935 in many countries. Aerated concrete plants of YTONG (Sverige), SIPOREX (Sverige), HEBEI (Deutschland), WEHRHAHN (Deutschland), MASA-HENKE (Deutschland) are currently operating in many countries of the world. A significant contribution to the production technology was made by the Research and Development Institute of Silicate Concrete (Tallinn), the Research Institute of Concrete and Reinforced Concrete (RICRC). In many scientific institutions of the country (Kiev, Rostov-on-Don, Chelyabinsk, etc.), research is being carried out to find new production methods, improve the properties of the finished material and expand the areas of its application. The departments of engineering and construction institutes in (Leningrad), (St. Petersburg) Voronezh, Novosibirsk, Moscow are engaged in similar work. [5].

The next method for producing aerated concrete was proposed by the Danish engineer E.S. Bayer in 1911, he envisioned the preparation of a concrete mixture by mixing an aqueous solution of raw materials with pre-prepared foam. Depending on the type of binder and silica filler, the materials received the following names: foam concrete, foam silicate, foam silicate, foam slag, gypsum foam concrete, etc. [6]

The production of foam concrete by this method began in 1922-1926. in Denmark, then in Germany and other countries. Since that time, a large number of inventions have been patented on methods of producing foam concrete from different types of mineral components and with various foaming agents. Some types of that material are known abroad under the names "Isobeton", "Betosel" [7].

The first researches of the production technology and properties of lightweight concrete in the CIS countries date back to 1930-1935. P.A. Rebinder, B.N. Kaufman and others have developed a technology for the manufacture of heat-insulating foam concrete, gaining design strength in natural conditions.

I.T. Kudryashovand others have shown the advantages of autoclaved concrete over non-autoclaved ones. Autoclaved concrete has the following advantages: reduced consumption of a binder, reduced shrinkage deformations, increased strength characteristics and reduced time to build design strength. For the first time, large-scale production of autoclaved foam concrete products began in 1939 in Novosibirsk. I.T. In 1940, Kudryashov developed a method for manufacturing products from autoclaved gas silicate using quicklime and finely ground sand. [8]

Research work in the field of lightweight concrete expanded significantly in the post-war period. Research of aerated concrete was divided into two areas: the use of industrial waste for their production and the development of technological parameters for the manufacture of aerated concrete products, including heat treatment modes. So, F.P. Kiviselg and others have done a lot of work in the field of slate ash foam concrete –foam-kermit. P.I. Bazhenov developed the technology of autoclaved foam concrete based on nepheline cement. From the technological research of the post-war years, it should be noted the work on the search for new blowing agents and technological methods for the production of aerated concrete. These are studies of the gas generator "Perhydrol" E.Ya. Ershler and foam concentrate "GK" L.M. Rosenfeld, E.S. Silaenkov carried out work concerning the study of the issues of durability of structures made of aerated concrete. Investigations of the thermal properties of aerated concrete were carried out by K.F. Fokin, B.N. Kaufman. All these and other research works contributed to the further development of the production and use of aerated concrete in construction. [9-12].

Today, the construction industry needs new, rational technologies for the production of foam concrete. This is due to the high cost of raw materials and the low level of quality in the production of products. There are many methods to improve the quality of foam concrete. These include: activation of the components of the foam concrete mixture, modification of the concrete mixture with additives, vibration effect on the concrete mixture, reinforcement with fibrous components, activation of the concrete mixture by the action of electrical energy on it.[10-11]/

We are conducting research on the composition of lime sludge waste from the nitrogen fertilizer plant. The chemical composition and content of $CaCo_3$, Ca $(OH)_2$, NaOH, Na_2CO_3, MgO, insoluble substances in water, moisture in lime sludge percentage are studied. Large volumes of lime waste from the plant create preconditions for their use as secondary raw materials (fine-grained aggregate) for the production of foam and aerated concrete based on local raw materials from industrial waste. Table 1 and the graph (Fig. 1) show the composition of the studied lime sludge in mass fractions.

Table 1

Lime sludge composition (mass fraction,%)

№	Thenameofindicators	Norm	Results
1	Massfractionof CaCo3	%	48,50
2	Mass fraction of Ca (OH) 2	%	0,36
3	MassfractionofNaOH	%	0
4	Massfractionof Na2CO3	%	0,21
5	MassfractionofMgO	%	0,2
6	Mass fraction of non-solvent substances in water	%	50,24
7	Massfractionofmoisture	%	48,92

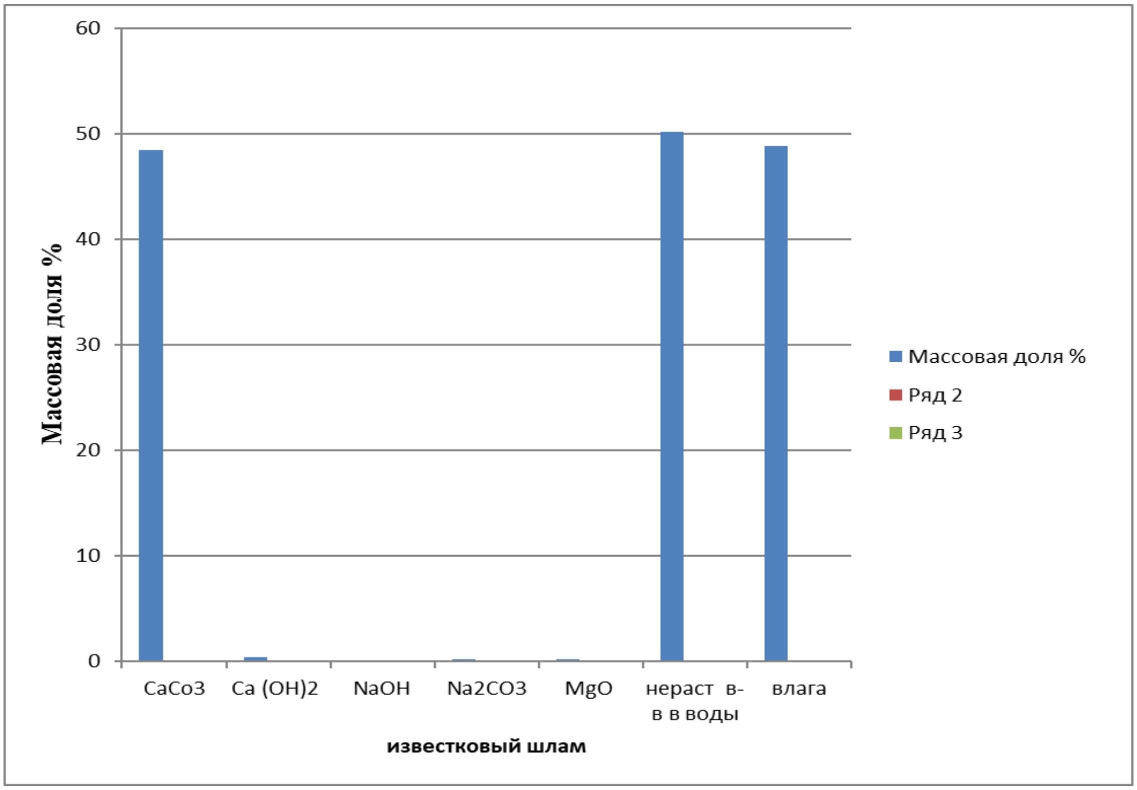

Fig. 1. Composition of lime sludge in mass fractions, in%

If we take into account the following properties of the elements given in Table 1 - CaCo3 - calcium carbonate (calcium carbonate) - inorganic chemical compound, salt of carbonic acid and calcium;

- Ca (OH) 2 - calcium hydroxide (slaked lime, caustic lime) - a strong base, which is a fine crystalline white powder, slightly soluble in water;
- NaOH - sodium hydroxide - an inorganic chemical, the most common alkali;
- Na2CO3 - sodium carbonate (soda ash) - an inorganic compound, sodium salt of carbonic acid, colorless crystals or white powder readily soluble in water.

- MgO - magnesium oxide (burnt magnesia) - a chemical compound - fire and explosion-proof with white crystals, slightly soluble in water, then the conclusion suggests itself that the given composition of waste can be applicable for the production of foam blocks and gas blocks, in connection with which we are conducting experimental work on the manufacture of foam blocks, the study of their mechanical and physical and chemical properties.

REFERENCES

1. Yu.P., Gorlov, A.P Merkin., A.A. Ustenko, Heat-insulating materials technology [Text]: Monograph / A.P. Merkin. - Stroyizdat, 1980.- 399 p.
2. S. Ruzhinsky, A. Portik, A. Savinykh all about foam concrete. Second edition, improved and enlarged. St. Petersburg, Stroy-Beton Publishing House, 2006.
3. A.S. Koroviev, The history of the study of aerated concrete [Electronic resource] // "Site" - Access mode: http://ru.wikipedia.org (free access) - Title. from the screen. - Yaz. Russian.
4. L. D. Silaenkov, Durability of products from cellular concrete. Publishing House, M., 1986.
5. L. D. Shakhova, Foam concrete technology. Theory and practice [Text]: Monograph / Shakhova L. D. - Publishing house of the Association of Civil Engineering Universities, 2010. - 248 p.
6. Yu.M. Bazhenov, Concrete technology. [Text]: Monograph / Yu.M. Bazhenov - Publishing house ASV, 2007.-528 p.
7. V.A. Vasiliev, National Association of Autoclaved Aerated Concrete Producers [Electronic resource] // "Official site" - Access mode: http://www.gazo-beton.org/node/3. (free access) - Title. from the screen. - Yaz. Russian.
8. V.A. Nevsky, Aerated concrete technology. Theory [Text]: Monograph / V.A Nevsky. - Publishing house of the Association of Civil Engineering Universities, 2006. - 156 p.
9. A.P Morozov, Foam concrete and other thermal insulation materials. - Magnitogorsk, 2008.
10. Abobakirova Z. A. Regulation Of The Resistance Of Cement Concrete With Polymer Additive And Activated Liquid Medium //The American Journal of Applied sciences. – 2021. – T. 3. – №. 04. – C. 172-177.
11. Goncharova N. I., Abobakirova Z. A., Kimsanov Z. Technological Features of Magnetic Activation of Cement Paste" Advanced Research in Science //Engineering and Technology. – 2019. – T. 6. – №. 5.
12. Кимсанов З. О., Гончарова Н. И., Абобакирова З. А. Изучение технологических факторов магнитной активации цементного теста //Молодой ученый. – 2019. – №. 23. – С. 105-106.