(54) Title: METHOD OF PRODUCING FOAM CONCRETE USING A PROTEIN FOAMER

In order to produce foam concrete, a binder, a foamer and water are mixed in the presence of air. The foamer is previously obtained by the effect of hydrated lime and water on cereal products. It is preferable to use the ratio of cereals, hydrated lime and water as 2 : 1 : 3. The foamer may be used as a paste or solution.
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Method of Producing Foam Concrete  
Using A Protein Foamer

The present invention relates to the field of producing construction materials, in particular, concretes and can be used in fabrication of concrete-based noise and thermal insulating materials.

Foam concretes are sufficiently known in the construction industry. They could find broad application in industry provided the cost of foam concrete constructions were not so high.

In particular, a method is known for producing foam concrete (RU patent 2062772 C 04 B 38/02, 1996) comprising mixing cement, a silica component (sand), superplastifier C-3 based on sodium salts of the product of naphthalene sulfonic acid condensation with formaldehyde, aluminium powder, crashed hydrated cement and water. The resulting product is highly costly due to the use of superplastifier and aluminium powder. Furthermore, use of aluminium powder results in environment being polluted by aluminium/alkali reaction products.

In order to provide mass production of foam concretes, it is necessary to have a foamer having at the same time a low cost, accessible source of raw materials, high foam strength and technological feasibility of application.

At different times, as foamers products were proposed of neutralising of resin water solution wood thermolysis with powdered lime (SU, 321503), saponin (SU, 889639), hide glue (SU, 1268552), bone glue (SU, 303305). However, all these foamers of organic nature were costly enough, were produced from deficient raw materials and did not show high stability and foam ratio.

In part, this problem has been resolved by further developments in the foam concrete production field.

A method was developed for foam concrete production (RU patent 2038340 C 04 B 38/10, 1995) according to which mineral binder, fine filler, foamer additive,
crashed burnt lime, plastifier and water were mixed at the following component ratio (wt %):

- mineral binder: 45.4 - 47.9
- fine filler: 35.9 - 36.5
- foamer additive: 3.5 - 8.0
- crashed burnt lime: 0.03 - 0.4
- plastifier: 0.3 - 0.4
- water: the rest

It was proposed to use densified wastewater of yeast production as the foamer additive. While the source of the foamer additive was relatively inexpensive and available, the known method still has not found any broad application due to complexity of the foamer additive production technology. The use of densified wastewaters required the presence of sufficiently expensive and complex-in-use equipment which could not be utilised on construction sites. Use of similar equipment at yeast production sites would result in the need to transport densified wastewaters to the consumption site which would unnecessarily increase the cost of foam concrete. Accordingly, the known method cannot find broad application.

The technical problem to be solved by use of the present invention consists in developing an inexpensive method of producing environmentally clean foam concrete having high noise and thermal insulating characteristics.

The technical result obtained in implementing the invention consists in reducing the costs of producing foam concrete construction elements due to use of a simple, environmentally safe technology, as well as to use of cheap cereal products as raw materials for foamer production.

In order to achieve said technical result, it is proposed to employ cereal products (wastes of flour-milling, flour, forage grain, wheat bran, soya flour, etc.) as a base for the foamer. To obtain a paste-like foamer, the source cereals, preferably in a ground form, are mixed with hydrated lime and water. It is preferable to use as
cereals wheaten flour which is mixed with hydrated lime and water in the ratio 2:1:3. The mixture is kept in a closed receptacle for a time until ammonia smell appears. At temperatures of 20-35°C, the process takes at least 24 hours. A binding component (cement and/or hydrated lime) and water are loaded into the mixer. After producing a binding suspension, the foamer in the form of paste or solution is added to it. The foamer solution is produced by diluting of the paste-like foamer in water at the preferable foamer paste/water ratio of from 1:5 to 1:10. Sand and/or other fillers may be added to the resulting binding suspension mixture. Sand may be added to the binder suspension prior to foamer introduction. The resulting composition is mixed in the presence of air. Upon mixing the composition may be poured into a mould directly on the construction site or in different moulds with subsequent use of ready-made blocks in building constructions.

By mechanical strength of the produced foam concrete as well as its noise and heat absorbing characteristics are highly competitive with similar characteristics of foam concretes obtained according to the known technology. In foam concrete production according to the proposed method, a manufacturing line (Fig.1) may be employed comprising, in sequence order, a paste-like foamer dissolving unit (1) having attached to it a water tube and paste-like foamer supply line, an outlet of the unit 1 being connected, via tubing and proportioning pump 2, with a first inlet of a foam generator 3 having attached to its second inlet an air compressor 4. The foam generator 3 outlet is connected with an input of a gravitation mixer 5. Cement and filler dosers 6, 7 as well as water are also supplied there.

To obtain 1000 kg of the paste-like foamer, preferably 330 kg of wheat bran, 170 kg hydrated lime and 500 kg of water are used. During 48 hours, 1000 kg of the paste-like foamer will be produced.

To obtain 1 cubic metre of foam concrete having a density of 400 kg/m³, 320 kg of cement, 150 kg of water and 7.2 kg of paste-like foamer are mixed.
Pre-mixing of the paste-like foamer and water is performed in the foam generator while supplying air to the mixture using a compressor or an air-drawing mixer.

To obtain thermally insulating foam concrete of lesser density (of the order of 250 kg/m³), the foamer may be mixed with dry cement. To obtain construction thermally insulating foam concrete of the density of 1000 kg/m³, 300 kg of cement, 600 kg of sand, 150 kg of water and 5.2 kg of paste-like foamer are mixed.

To obtain foam concrete with the density of 1600 kg/m³, 300 kg of cement, 1200 kg of sand, 150 kg of water and 3.0 kg of paste-like foamer are mixed.

In all the above examples, the foamer may be pre-mixed in the presence of air with a corresponding amount of water which should be taken into account in further mixing of components.

In all the above examples, apart from pre-mixing the paste-like foamer with water in the foam generator, it is possible to mix all components in a single mixer with simultaneous supply of air to the mixer.

The suspension produced in the mixer is poured into moulds and left until setting forming blocks of the desired shape, or it is poured into a construction mould with subsequent obtaining, after setting, of foam concrete noise and heat insulation for walls, ceilings, floors, as well as monolithic foam concrete used as a construction element in building constructions.

The proposed method of foam concrete production enables to rapidly and cheaply, right on a construction site, obtain foam concrete construction from the commonly available raw materials.
Claims

1. A method for producing foam concrete using a protein foamer comprising mixing a binder, a foamer and water in the presence of air, distinguished in that as the foamer a previously obtained product of reaction between cereals, hydrated lime and water is used.

2. A method according to claim 1, distinguished in that, additionally, sand and/or fillers are introduced to the mixture at the mixing step.

3. A method according to claim 1, distinguished in that in producing said protein foamer, the ratio of cereals, hydrated lime and water as 2 : 1 : 3 is used.

4. A method according to claim 3, distinguished in that the reaction between cereals, hydrated lime and water is carried out at a temperature of 20 to 35° C.

5. A method according to claim 4, distinguished in that the process is carried out during at least 24 hours.

6. A method according to claim 1, distinguished in that said foamer is added as a paste-like product.

7. A method according to claim 1, distinguished in that said foamer is added as a water solution.

8. A method according to claim 7, distinguished in that said foamer water solution contains said paste-like foamer and water in the ratio of from 1 : 5 to 1:10.

9. A method according to claim 1, distinguished in that cement is added to said foamer water solution.
## INTERNATIONAL SEARCH REPORT

### A. CLASSIFICATION OF SUBJECT MATTER

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<td>A</td>
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