PHYSICO-CHEMICAL PROPERTIES OF CONSTRUCTION MATERIALS BASED ON MINERAL BINDERS

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ABSTRACT

Wood waste (sawdust, sawdust, leaves, etc.) and crushed wood materials (shavings, pieces, branches and twigs) are effectively used as fillers in the production of various materials based on mineral binders. Such materials are characterized by low density (30...800 kg/m^3) and thermal conductivity of 0.093...0.23 W/(m^{o}C), as well as good workability. Also, it is relatively more convenient to produce wood filler materials on the basis of high-strength gypsum.Groups of effective materials obtained on the basis of wood waste and fillers and mineral binders include arbolite, fibrolite and opilkobeton (GOST 4598-93, GOST 26988-86, GOST 8994-81, UzRSt 747-96, etc.).

Keywords: Arbolite block and panels in construction, the vapor protective layer is placed. Installation, normal compaction of the mixture, when the relative humidity of the environment is higher than 60%, arbolite block, wall panels, cement-fibrolite plates, the reinforcement is placed inside the concrete protective layer, and when the humidity is high,

INTRODUCTION

Wood waste (sawdust, sawdust, leaves, etc.) and crushed wood materials (shavings, pieces, branches and twigs) are effectively used as fillers in the production of various materials based on mineral binders. Such materials are characterized by low density (30...800 kg/m^3) and thermal conductivity of 0.093...0.23 W/(m^{o}C), as well as good workability[2]. By impregnating wood fillers with mineralizers and then mixing them with mineral binders, biological and fire resistance of such materials is ensured. The main disadvantage of materials obtained from wooden fillers is high water absorption and relatively poor water resistance[1]. Depending on the purpose of use, such materials are divided into heat-retaining, constructional - heat-retaining and constructional types[3].

All mineral binders can be used in the composition of wood fillers, especially portland cement is the main one. Fast-hardening cements are used effectively[5].

Compared to cementitious binders, high-strength gypsum ensures fast hardening and allows obtaining low-density high-strength materials (when the consumption of binders is uniform)[4]. Also, it is relatively more convenient to produce wood filler materials on the basis of high-strength gypsum.Groups of effective materials obtained on the basis of wood waste and fillers and mineral binders include arbolite, fibrolite and opilkobeton (GOST 4598-93, GOST 26988-86, GOST 8994-81, UzRSt 747-96, etc.)[6].

Arbolite is compacted mass consisting of organic fillers (wood shavings, crushed reed, hemp, hemp and straw), cement and water, if necessary, additives. Minerals such as calcium chloride and liquid glass are used as additives (Fig.1)[8].

Products made on the basis of arbolite (panels and blocks) are widely used in industrial, civil and agricultural construction for the construction of external walls and fences, as well as heat-retaining and sound-proofing plates. Arbolite constructions should be used in rooms with a relative humidity of up to 60%. When the humidity is high, it is necessary to install a vapor barrier layer[10].

The surface of arbolite constructions exposed to the external environment is covered with a decorative layer (with a plaster mixture). Arbolite, dried to a constant mass, is divided into heat-preserving (rm=500...850 kg/m^3) grades (Table 1.1)[11].

Table 1.1 Average density of arbolit

The size of the arbolite	Compression strength class	Average density of arbolite			
		chopped wood	ground cotton stalks	hemp	ground rice stalks
Heat preservation	V 0,35	400...500	400...450	-	500
	V 0,75	450...550	450...500	400..450	-
	V 1,0	500	500	450...500	-
Constructive	V 1,5	500...650	550...650	500	600...700
	V 2,0	500...700	600...700	550...650	–
	V 2,5	600...750	700...800	600...700	–
	V 3,5	700...850	-	–	–

The heat preservation of arbolite depends on its average density and the quality of fillers[12]. For example, the thermal conductivity of arbolite based on chopped wood with an average

density of 400...850 kg/m^3 is on average 08...17 W/(moS), chopped agricultural wood that of arbolite based on plants (hemp, straw, hemp, etc.) is equal to 0.07...0.12 W/m^{o}C[13].

The strength of arbolite is determined by the quality of the wooden filler. In addition, its strength is affected by the density of fillers, cement consumption, C/C (water-cement) ratio, used additives and homogeneity of the structure[14 the 16].

The strength of arbolite mainly depends on its moisture content. This material achieves maximum strength when the moisture content is 16...17%. Its water absorption is relatively high. But the advantage of this material is that it has the ability to quickly release absorbed water, that is, it dries quickly. Arbolit's cold resistance is determined depending on the conditions of use and the place of construction. In any case, it should not be less than F25.[17].

The composition of arbolite is determined by calculation. Consumption of cement, organic fillers and water depends on the compressive strength of arbolit. For example, cement consumption for heat-retaining arbolite of class V0.35...V1 is 260...360 kg/m^3, and for structurally stable arbolite of class V1.5...V2.5 is 330... .450 kg/m^3 will be[15]. Low cement consumption is achieved when using pine wood waste and shavings. Consumption of calcium chloride and liquid glass 8...9 kg/m3, and aluminum sulfate is 15...20 kg/m^3 [18].

The production technology of arbolite products consists of such processes as the selection of raw materials, the preparation of arbolite mixture and its placement in molds, hardening and drying, processing of the outer part and storage[19].

In addition to non-reinforced arbolite products, products reinforced with steel reinforcements are also produced. When the relative humidity of the environment is higher than 60%, the reinforcement is placed inside the concrete protective layer. Or a protective layer is formed by applying special compounds to the surface of the armature[20].

Arbolite products are produced in the same way as concrete and reinforced concrete products using conveyor, aggregate-flow and stand methods. The arbolite mixture is prepared in forced-motion concrete mixers. The main technological process in the preparation of products is the densification of the mixture to the required density[21]. The arbolite mixture does not obey the general laws corresponding to the properties of the concrete mixture due to the elastic properties of the fillers. Conventional compaction is not very effective in compacting the mixture, and pressing leads to the destruction of the compacted structure. Therefore, in practice, it is necessary to maintain a high water-cement ratio (S/S=0.75...0.9)[22].

The last step in the production of arbolite is hardening with the help of heat. In this case, hardening is carried out by low-temperature and light-mode processing (at a temperature of 50...60^{o}C and in a humid environment of 70...80%). In this mode, arbolite reaches the release strength at 18...20^{o}C. Humidity is around 30...35%. Then the products are stored in a closed warehouse with a temperature of 16...18^{o}C for 7 days. During this time, the products will reach the desired consistency, and their moisture will decrease[23].

When using arbolit, the costs of assembling structures are reduced, the panels can be prepared in the conditions of the enterprise in accordance with the size of the entire room (with door and window frames installed). Since arbolit has better heat preservation properties compared to expanded clay concrete, the thickness of the walls reconstructed from it will be thinner. In some constructions, when the usual materials are replaced with arbolite, the mass of the building decreases up to 1.3...1.5 times[24].

When using arbolite, cement consumption is reduced by 35...55 kg/m^2 per surface unit compared to expanded clay concrete. Table 1.2 shows the technical and economic indicators of 1m^2 of the outer wall made of arbolite and other materials[25].

Table 1.2

Technical and economic indicators of the outer wall built from different materials

Indicators	Single layer panel			External brick wall
	Arbolitli	Keramsite-concrete	serg‘ovak betonli	
Average density, kg/m3	700	900	750	1800
thickness, cm	22	28	24	66
mass, kg	154	270	200	1200
accounting price, %	44	64	59	100
quoted costs, %	40	67	61	100
labor volume (production and assembly), working hours.	2,6	4,1	3,7	8,5

It is known from the production experience that in the construction of low-rise buildings, arbolite products can be effectively used instead of brick, expanded clay and aerated concrete. Also, according to a number of usage properties, it is higher than them[16].

In construction, arbolite blocks and panels, roof and partition plates, interior curtain wall panels, floor tiles, heat-retaining and sound-proofing plates, as well as volume-spatial constructions and cast constructions are effectively used. According to its description, arbolite is a very good wall material. Small-sized arbolite blocks are widely used in house construction (Fig. 1). Such blocks are mainly produced in 200x200x400, 200x250x500, 100x200x600, 150x300x600, 200x300x600 mm sizes. After the blocks are hardened with hot-moisture, they are removed from the molds and matured in the next stage in a closed warehouse (Fig.2)[26].

Figure 1. Arbolite block

Figure 2. Maturation of arbolite blocks in natural conditions in a warehouse.

Arbolite blocks are made of heat-retaining, class V0.75...V1 and constructional arbolite, class V1.5...V2.

Structural arbolite class V2...V3.5 is used for making wall panels. The inner and outer parts of the panels are covered with concrete of class V10...V15 or a cement-sand mixture of grade 100. The thickness of the protective layer is selected depending on the humidity of the external environment and the conditions of their use.

Arbolite panels with an average density of 750 kg/m3, class V2.5 are used for construction of external walls of agricultural buildings (livestock, poultry, etc.). Their outer part is covered with a cement-sand mixture with a thickness of 2 cm, grade 100. Such panels are produced in thicknesses of 200, 240, 280, and 350 mm, heights of 600, 900, and 1200 mm, and lengths of 1500, 1700, 1800, 3000, 4500, and 6000 mm (Fig. 3).

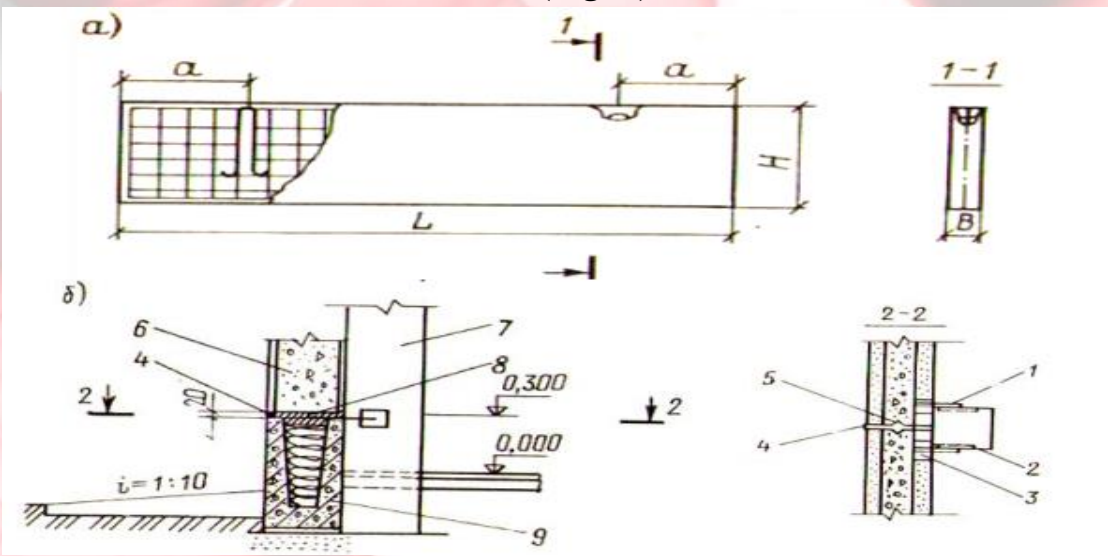

Figure 3. Single-layer arbolite wall panel. general view of a-panel; Installation of b-panel on the foundation block; 1-diameter 12 mm, class A-1 steel rod; Welding detail of the 2nd column; 3-base block welding detail; 4th mastic; 5-grade 50 cement-sand mixture; 6-arbolite wall panel; column 7; 8th layer of moisture protection

Cement-fibrolite slabs are effectively used as structural heat-preserving fillers for frame constructions of standard wooden houses, to provide thermal protection of thin brick and concrete walls in various agricultural constructions. Also, fibrolite is used as a heat-retaining layer in wall and wall panels in residential construction, and as a heat protector in roof sheathing.

The advantages of cement fibrolite slabs are that they can be used as a formwork in the construction of various concrete structures. In such cases, they are left as an element of constructions and serve as a heat-retaining coating. In industrial construction, cement fibrolite is used as a warming coating material for brick walls

35 mm thick acoustic cement-fibrolite plates are used as a sound-proof coating in industrial and public buildings. Painting and finishing of the surface of the plates is carried out after their seams are filled with the composition of the mixture. Polyvinyl acetate solutions with various colored powders are used for painting and finishing works.

Cement-chip boards (CCHB) are a new structural sheet material, made by pressing special wood chips and portland cement mass under high pressure. Sawdust from deciduous and deciduous wood is used as raw material. It is desirable that the average length of wood chips is at least 3 times larger than its width. That is, their length is 25...30 mm, width 1.6...4.8 and thickness 0.3...0.4 mm (UzRSt 896-98).

The production of cement-flake board consists of the following technological processes: storage of wood raw materials in a warehouse; preparation of shavings; homogenization and fractionation of shavings in grinders; preparation of cement-flake mixture; molding and pressing of plates; hardening; maturation and condensation; treatment of the outer part (smoothing, application of lok-paint materials).

Such plates with a density of 1200...1400 kg/m^3 have high strength, are resistant to the external environment, do not burn, do not rot from biological effects, are well glued to wood, plastic and metals, and are easy to process. , can be nailed and x. k.High physical and mechanical parameters of cement-flake plates expand their field of application. Constructions based on sQP are effectively used in residential, industrial and agricultural construction. Such plates are widely used in covering external and internal walls, roofing of low-rise buildings, covering wooden and metal frames, suspended ceilings, floor coverings, as well as in the construction of energy-efficient heat-preserving wooden-frame residential buildings. They serve as external and internal cladding and formwork in wooden-framed buildings. After the plates are installed on the outside and inside of the wooden beams, the space is filled with heat-retaining materials. As a result, there is no need to finish the surface of the external walls.

The mass and materials of cement-flake tiles, as well as the cost of labor and cost in their preparation and installation, are cheap and convenient compared to other, for example, asbestos-cement, plywood, DVP, DSP or lightweight reinforced concrete tiles, which expands the field of application of such tiles.

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