A minimum clear space of 1500 mm dia. must be provided between the counter and the opposite wall to facilitate wheelchair turning.

Shelves should be such that they are not more than 500 mm deep and not more than 1200 mm high from finished floor level. There should be a minimum gap of 400 mm between the edge of the work-top and the lower edge of the upper shelves.

Thus, the barrier-free environment is designed to ensure that buildings and facilities accessible to people with disabilities such as the inability to walk, difficulty while walking, resting on crutches, blindness, speech defects, hearing or vision.

Providing the building with all the necessary requirements for persons with disabilities will provide an opportunity for everyone to participate in all spheres of society (social, sporting, economic, educational, entertainment, etc.).

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UDC 662.613.1

PERSPECTIVES OF USING ASH FROM THE COMBUSTION OF PEAT IN CIVIL ENGINEERING

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The article provides an overview of the composition and properties of ash waste from the burning of peat at power stations in Belarus. It also summarizes suggestions for the areas of peat ash use in the production of building materials. It is shown that peat ash can be used in the manufacture of ceramic products, products of autoclaved hardening and also for water-repellency of dry mixes.

According to the State program on the creation of energy sources based on local fuels the flow of ash waste is to increase up to 300 000 tons annually, amounting to nearly 10 % of the total quantity of municipal and industrial waste [1]. The most widely spread local fuel is peat, the share of which in the total quantity of fuel will have amounted to 4,3 % by 2020 [2]. The largest reserves of low ash and medium ash peat are concentrated in Vitebsk region – 46 % of all stocks of the Republic [3]. Due to its physical and chemical composition peat ash, as a raw material, can be used in different productions and, above all, in civil engineering.

The dependence of the chemical composition of ash or slag ash, as the products of the burning of peat, on the substances which they include is displayed in Table 1 [3].

Table 1 – Averaged chemical composition of the ash and slag ash

SiO_2	AI_2O3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	TiO_2	P_2O_5	SO_3	ПППП
41-65	6-10	8-17	12-28	0,5-0,8	1,1-1,7	0,5-0,7	0,3-0,5	0,4-2,0	0,06-1,4	0,01-6,0

It was found out [4] that peat ashes consist mainly of amorphized by firing clay material and quartz grains, hardly altered by firing. The crystalline phase is represented mainly by quartz; besides, there is calcium oxide, dicalcium silicate, hematite, feldspar, minerals of the melklit group and presumably pyaticalcium trihaluminat.

A phasal chemical analysis of peat ashes, by means of the technique developed by S.M. Royakom, E.I. Nagerovoy and G.G. Kornienko [5], showed that the major part of calcium oxide in the ash is present in the form of silicates and calcium aluminates, these compounds are easily hydrated.

The correlation of the components of ash determines its activity and astringent properties. The main criterion for determining the binding propertie s of ash is the presence of free calcium and magnesium oxides. The major characteristics of the chemical composition of ashes are the module of the basis M0, which is the correlation between mass fractions of the major oxides and the total content of acidic oxides, and the silicate module MC, which displays the ratio of reactive dioxide of silica to the total content of aluminum and iron oxides. For basic slags and ashes M0 > 1, for weak acidic – M0 = 0,9 – 1,0, for acidic – M0 = 0,6 – 0,9, and for strong acidic – M0 < 0,6. However, according to the works P.I. Bozhenov it is more appropriate to apply [6] the Core Touch, which has the following formula:

$$К_{осн} = \frac{(CaO + 0{,}93MgO + P_2O) - (0{,}55Al_2O_3 + 0{,}35Fe_2O_3 + 0{,}7SO_3 + 1{,}27CO_2)}{0{,}93SiO_2}. \quad (1)$$

The concepts of free open $CaO_{открсв}$ free closed $SaO_{закрсв}$ free and total lime $CaO_{сумсв}$ .have been introduced in this work where.

$$CaO_{сумсв} = SaO_{открсв} + SaO_{закрсв}. \quad (2)$$

It has been found out [8] that the basic ash consists essentially of reactive calcium oxide CaO, silicon oxide SiO_2 and aluminum oxide AL_2O_3. Mass fraction of calcium oxide CaO is not less than 10%. The basic ash contains hydraulically active ingredients and is independently astringent.

Acidic ashes consist mainly of SiO_2 reactive silicon with a mass content of not less than 25 % aluminum and AL_2O_3, wherein the calcium oxide content does not exceed 10 % and the mass fraction of free calcium oxide $CaO_{св}$ is not more than 1 %. [8] Acidic ash has properties of typical pozzolans and can be applicable as an active mineral supplement.

Such products of firing clays as: amorphous clay substance of metakaolinit type – amorphous SiO_2 and $A1_2O_3$, and aluminosilicate glass reveal pozzolanic activity in the composition of the ash and slag. Reactivity to calcium hydroxide is different with them and depends on the temperature changes of kaolinite clays during fuel combustion. Having a large specific surface area metakaolinit Al_2O_3 x $2SiO_2$ reacts with Ca (OH) $_2$ at ordinary temperatures to form calcium gidrosilikates and gidrogelenit [3].

Activity of amorphous SiO_2 and $A1_2O_3$ formed at higher temperatures is much less, which is explained by a sharp decrease in the specific surface area due to sintering and crystallization of new formations – mullite and cristoballite. High temperature sintering and melting of clay minerals reduce sharply their surface area and their activity accordingly. Consequently, the glass phase of the ash and waste is of little activity at ordinary temperatures. Increase in the combustion temperature over the allowable limit leads to a drop in activity of most types of fuel ash [3].

The results of the calculations of activity criteria of ash waste solid fuel done in this work [3] are given in table 2.

Table 2 – Quality criteria of ash waste solid fuels at some power enterprises of Belarus

Enterprise	Type of fuel	*Mo*	*Mc*	*К*
Brest Republican unitary enterprise of electricity «Brestenergo»	A mixture of wood chips (60 %) and peat (40 %).	0,39	2,98	0,51
	Peat fuels. PRUTP "Gatcha-Osovsky)	0,36	2,83	0,47
	Peat fuels. TPU "Berezovsky"	0,27	6,27	0,38
	A mixture of 60 % wood chips and peat 40 %.	0,32	4,82	0,45
	Slag	0,55	2,17	0,70
RUE Minsk Electricity «Minsk-energy» Zhodinskaya CHP	Shredded peat briquette	0,59	1,08	0,75
	Milled peat	0,56	2,53	0,73
Berezino District management industrial gas enterprise «Berezinoraygaz»	Milled peat	0,52	3,23	0,76
	Peat briquettes	0,78	1,46	1,08
JSC «TBZ Usyazh»	Peat briquettes	0,52	2,22	0,7
JSC «Starobinsky TBZ» Branch «Nesvizh»	Peat briquettes	0,47	2,78	0,64

The authors of this work [3] draw a conclusion that the investigated ash waste of Belarusian enterprises is mostly of hidden active type, requiring intensification of hardening. It is supposed that they can be used in the manufacture of industrial products hardening by heat treatment alongside with activation.

As a result of previous studies [9] binding properties exhibited by slag from burning peat at autoclaved hardening have been identified. It has been discovered that it is particularly important to have 25 % or more of calcium oxide in ashes, which determines their hydraulic activity during water thermal processing. It has also been found that ash with a lower contents of calcium oxide exhibit binding properties only when lime and gypsum dehydrate are added to it.

A series of bricks with peat ash from the city's CHP was manufactured at theVilnius sand lime brick factory. It was noted [4] that the sand-lime brick with peat ash (ash: lime 1: 1) was sufficiently strong, and after autoclaving it satisfied the requirements of GOST for the products of brand 150.

In the same factory gas silicate partition plates with peat ash binder were manufactured. The molding mixture consisted of 90 % peat ash, 10 % lime (about 90 kg / m^3) and 5 % gypsum dihydrate. Gas silicate strength with the density of 950 kg / m^3, amounted to 4,5 – 5,0 MPa. The binder of the same composition was used to produce ash sand wall blocks. At a consumption of 550 kg of the binder per 1 m^3 of concrete its strength was 22 – 25 MPa [4].

With the peat ash from the Kirov TPP autoclave reinforced slabs were made. 3 % of gypsum was added to the ash. The strength of concrete with 450 kg of binder per 1 m^3 of the product reached 25 MPa. Ash and sand walls of «Krestianin» type were also manufactured on a peat ash basis at Petrashunayskaya TPP. After the maturation under normal conditions, they showed the strength of 20 MPa and were able to stand 15 cycles of freezing and thawing. [4] Organic compounds emitted from peat raw material may be used for hydrophobization of dry mortars, preventing caking, clumping, and consequently, the loss of activity during storage and transportation. [3] Our work prooves that the concrete and cement solutions prepared on the basis of hydrophobized mixtures have reduced water permeability, water absorption, high frost resistance and so on.

Bitumens are considered to be initially composed of hydrophobic peat raw materials. It was proposed to carry out the activation of the hydrophobic organic mineral mixture in order [10] to give the disperse material a maximum water proofing effect. It was found that the hydrophobic effect of the modified cements increases with the rise in the degree of decomposition of the peat raw materials used to prepare the additives. The comparison of a group chemical composition of peat organic matter, used for production of additives, showed that the cements (dry mix), which were filled with the modifiers with predominant contents of bitumen as well as humic and fulvic acids, have the highest hydrophobicity. The system acquires high water repellency properties with the optimum ratio of the initial components in a dry mortar.

According to their strength characteristics concrete and cement mortars based on hydrophobized peat binding additives are not inferior to the samples of unmodified materials, with the concentration of the mineral binder [10] up to 3 – 5 % of the weight. [11] It is pointed out in this work that the ash of solid fuels can be used in the manufacture of ceramic products, providing a reduction in density of a ceramic crock and improving the thermal protective performance of brick. It was discovered that, depending on the chemical and technological properties of the clay and the desired characteristics of the finished product the amount of peat ash injected into the charge can vary from 5 to 20 %. Adding ash clay to charge, besides reducing the coefficient of sensitivity to drying, can improve the rheological properties of the clay by increasing plastic strength, thereby reducing the number of defects, arisen during the process of extrusion, in macrostructure of the ceramic skull, thus enhancing mechanical strength and frost resistance of brick [3].

Thus, the results of the research and experiment suggest that the ash waste from the burning of peat at Belarusian enterprises are hidden active. It is possible to use peat ash as part of binders in the manufacture of products of autoclaved hardening. First of all peat ashes with a share of calcium oxide of 25 % or more are to be used.

Organic compounds released from peat raw materials, can be used for water-repellency of dry mixes.

The addition of 5 to 20 % of ceramic ash peat to the composition of clay in the manufacture of batch products can provide a reduction in the density of ceramic crock and improve a thermal protective performance of brick.

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