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Obtaining and Applying Filters On the basis of Bazalt Fiber Along with Natural Polymers

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KEY WORDS: Cellulose from topinabour, cellulose from cotton linters, basalt fiber, strength, composite filter paper, fiber hydration, filler.

ABSTRACT: Composite filter paper obtained on the basis of cellulose from topinambour, cotton linters of cellulose and basalt fiber. The composition and properties mineral filler, which were used in the preparation of filter paper were studied. The results obtained are shown in graphical form.

I. INTRODUCTION

At present, there are about 650 types of paper for different purposes worldwide. Among them, cardboard and paper are produced from mineral raw materials. As you know, products for various purposes of construction and national economy are manufactured on the bases of mineral raw materials. The technology of manufacturing fiber and various products from mineral products is reflected poorly in technical literature. Our goal is to overcome these shortcomings. Researches in this area are mainly conducted in China, Russia and Ukraine.

Numerous studies have been carried out on the creation of a method for obtaining fibers from basalt, including mineral raw materials. Researchers developed an uninterrupted method of producing fibers from basalt in the 1960s. Research workshave been carried out to improve technology and equipment. These works were carried out in the 80s of the last century. In the late of 90's, the factory was built. However, this technology required a lot of energy. Basalt fiber was for military purposes, but the cost was not paid much.

By 2000, the technology of basalt fiber production and basic equipment was improved, resulting in lower product costs, and the number of customers expanded. In 2000-2002, products manufactured by the factories were started to be used widely in the automobile industry.

The first factory to produce basalt fiber was built in China. The energy consumption of the new technology has dropped dramatically: it cuts its natural gas consumption by three times, and electricity is five times lower. Chengdu company “Chengdu Aerospace Tuohim Science & Technology Co., LTD” and the company “Chandu and Shanghai Russia Gold Basalt Fiber” in Shanghai have launched the production based on the technology and modular equipment developed by Chinese S.P.Osnos.

Currently, Chanducompany produces about 1800-2000 tonnes of basalt fiber per year. The company in Shanghai is 2000 tons per year. In Russia, based on the TE VSG 2000 technology line, NPO began production of "Vulkan". Its capacity is 1800-2000 tons per year.

As you know, basaltic fibers are resistant to chemicals. It preserves90-98% mass under the influence of 0.5-2n sodium hydroxide solution, and in 2n chloride acid - 50-70%. In addition, basaltic fibers are resistant to high temperatures (300-700^{o}C). These properties of basaltic fibers allow to use as a filter material for the production of products with acidic and alkaline state and for wastewater treatment.

Basalt fiber filters are widely used in the filtration of the dusty air witha working temperature of 300-650^{o}C emitting from metallurgical and chemical enterprises.

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Filter materials made of 17-25 μm of diameter of basalt fibers are sufficiently durable, waterproof, robust and elastic.

In the manufacture of wine and cognac, fine-fiber sulphide cellulose (bleached), asbestos-fiber filters are used. Depending on the amount of asbestos added to the cellulose, the filter materials will be of different markers: ЯК-1, ЯК-2 and ЯК-3. The appropriate branded filter is selected depending on the filter mass concentration. For example, ЯК-3is used for filtering a medium viscosity strong and disertedwine.

II.METHODICAL PART

.To obtain a filter material, the composition should be prepared before. Preparation of samples is carried out on LA-3 paper-molding device. The machine is prepared prior to sampling. After that, the paper-molding processis started. The prepared paper mass is mixed. Designed for $1m^2$ of paper weighing is taken from the calculated mass. The surface of the paper-molding device is 0.0314 m^2. If the weight of 1 m^2 of the sample of paper to be extracted is 60 g, then absolute dry fiber (when the finished paper has a moisture content of 7%) will need to $60 \times 0{,}0314 \times 0{,}93 = 1{,}7$ g. Before filling the paper, wet the net and position it properly.

Then the water is poured into the forming chamber up to 7 l at first and then 8 l. The suspension is slowly mixed not touching the walls of device and a web without generating foam. Then the tap is opened and water goes out from the molding device. Here, the fibrous layer begins to sink on the surface of net. The remaining water in the suction chamber is absorbed by vacuum pumping when 2 liters of water is left in the moldingchamber. After absorbing fluid from the molding chamber, the fiber layer formed on the netis further dehydrated for 10 sec. The net sieve is dried over the drying chamber. Dried paper samples are weighed on technical scales.

III. EXPERIMENTAL PART.

Taking into account the above points, we have identified the goals of our research. Initially, the experimental conditions and quantities of raw materials contained in composition were determined and their resistance to alkali and acid activity was studied. (Table-1)

Table-1

The loss of mass under the influence of chemical solutions on the basalt fibers,%

Basalt fiber samples	H_2O	0.5 nNaOH	2 nNaOH	2 nHCl
№ 1	99.63	98.3	92.8	76.9
№ 2	99.7	98.9	90.7	49.9
№ 3	99.6	94.6	83.3	38.8

Table 1 shows that basaltic fibers are very resistant to alkaline solution. It has been concluded that this property of basaltic fibers can be used as a filter material for cleaning industrial wastewater and municipal sewage. In the next step, the thermal resistance of the selected basaltic fibers was examined and the results were analyzed. Table-2 shows the thermal resistance of the basaltic fibers.

Table-2

Comparative thermal resistance of basalt fibers at different temperatue, %

Temperature, ^oC.	300	400	500	600	700
Initial comparative resistance	100				
№ 1 234,kg/mm^2	98.7	88.7	58.9	38.4	25.0
№ 2 240,kg/mm^2	99.0	89.0	61.0	39.0	27.0
№ 3 254,kg/mm^2	100	90.0	65.0	38.8	28.6

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As can be seen from the table, the material prepared from basalt fibers can also be used at 600°C. We selected two types of fiber for the next research. Filter materials were obtained using 2 types of basalt fiber (ultra and tough fibers).

The basalt fiber produced in Uzbekistan on the basis of basalts of the Osmansay deposit possesses a complex of properties that put it forward to one of the first places in the world production of mineral fibers. The appearance of the basalt fiber is shown in the properties are given in table 3.

Table-3

Properties of basalt fiber on the basis of raw materials of the Osmansay deposit and topinambour

Properties of basalt BSTV	Values	Properties oftopinambour	Values
Base length, mm	6-12	Whiteness,%	78,0
Modulus of elasticity, GPa	84,2+1,7	Content of a + cellulose,%	88,6
Strength, MPa	2245,3	Ash content	0,79
Average fiber diameters, mkm	Less0,8	Humidity,%	3,0-3,5
Thermal conductivity at an average temperature of 50-300 ^{0}C, Wt / m. K	0,02-0,06		

Paper material was prepared from Jerusalem artichoke and basalt fiber of the brand "Superthin". Dry Jerusalem artichoke was kept in a moist environment until swelling and increasing the volume by 2-3 times. In order to create a homogeneous jelly-like mass, the swollen Jerusalem artichoke was ground and brought to an increase in the bulk density by approximately 2 times. Successively, 5-20% CMC solution was injected into the bulk of the Jerusalem artichoke in an amount of 5 volume% basalt fiber. Basalt fiber is a fragmented material with a fragment size of 1-3 mm. The paper material was a layered composite. The casting of composite paper pulp was done on a fine screen with a maximum mesh size of 40 μm or a smooth surface. Drying was carried out in two stages. Initially, residual moisture content no more than 6.5% final drying was carried out at temperatures of 58-68 ° C for 12 hours. The resulting paper material had the characteristics shown in Table 3.

Table-3

Properties of paper material based on topinambur and basalt fiber of the Osmansay deposit

Properties			The content of basalt fiber brand "Superthin", mass. %	The content of topinambour, wt. %	Content of CMC Glutolingoid 77, mass. %
Ash content,%	Absorbance of H_2O (per cm^2)	Breaking load kg / cm^2			
0,7	0,9	0,6	10	90	5
0,6	0,8	0,9	20	80	5
0,5	0,7	0,8	30	70	5
0,4	0,5	0,8	40	60	5
0,3	0,5	0,9	50	50	5

The obtained samples of cardboard paper have more improved physical properties, can be used as packaging and thermal insulation material.

In the next table a number of samples of cotton lint cellulose and basalt fiber composition were examined.

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Table-4
Quality indexes of filter materials produced from the composition of basalt fibers and cotton lint cellulose

№	Amount of samples and types	Rough , ml/min	Porosity, ml/min	Ash content %	Breakage length, km	Tearing resistance in dry state, H
1	Cotton lint, 84g/m^2	321-468	204-206	0.257	3502	42.0-44.57
1	Ultra-typed basalt fiber, 81g/m^2, 20/80	730	478	16.24	1806	23.57
2	Ultra-typed basalt fiber, 81g/m^2, 40/60	762	480	15.88	1900	24.60
3	Ultra-typed basalt fiber, 81g/m^2,60/40	803	482	13.12	2004	26.89
4	Ultra-typed basalt fiber, 81g/m^2,80/20	837	484	12.17	2202	28.94
1	Tough-typed basalt fiber, 76,8 g/m^2, 20/80	637	410	19.46	2200	29.20
2	Tough-typed basalt fiber, 76,8 g/m^2,40/60	670	412	17.9	2360	29.87
3	Tough-typed basalt fiber, 76,8 g/m^2,60/40	701	413	16.54	2525	30.16
4	Tough-typed basalt fiber, 76,8 g/m^2, 80/20	721	415	14.7	2696	30.77

IV. CONCLUSION

Year by year the demand of ecologists is growing. Industrial enterprises and municipalities should reduce pollutants. One of the main ways in which environmentalists can address this problem is by reducing the discharge of the atmosphere and water into the filter. The best way to do this is to use a basalt fiber filter. This material is very resistant to chemicals (salt, acids and alkalis) and can be used for a long time.In addition, there are different compositions of filters produced from basalt fibers, which can be used for purifying gases emitting from metalworking plants with 800^{o}C waste, chemical plants, construction materials manufacture and energetics. Thus, the basaltic fiber filter can be used to purify the air at the state with working temperature of 300-650^{o}C.

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