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PRODUCTION OF HIGH-TEMPERATURE-RESISTANT STABILIZING ETHER FOR SELBAZ-PAS DRILLING MIXTURES FOR THE OIL AND GAS INDUSTRY FROM CELLULOSE-BASALT FIBER COMPOSITES

Sattorov Laziz Kholmurodovich
Docent Karshi state technical university, Karshi, Uzbekistan
E-mail:sattorovlaziz@gmail.com
(ORCID: 0009-0005-9028-1225)
Tel: +998 97 382-84-89
Kurbanov Abdiraxim Axmedovich
Professor Bukhara state technical university, Bukhara, Uzbekistan
E-mail:bo_bosh@mail.ru
(ORCID:0009-0008-3484-2851)
Tel: +9989936618169
Rahmatov Xudoyor Boboniyozovich
Professor Karshi state technical university, Karshi, Uzbekistan
E-mail:Zavod.lab@mail.ru
(ORCID: 0000-0003-4976-5541
Tel: +998 91 460 85 95
Juraeva Huriyat Zoirovna
Lecturer of the University of Economics and Pedagogy, Karshi, Uzbekistan
E-mail: Huriyat_2025@gmail.com
(ORCID: 0009-0005-4875-0577)
Tel: +998 97 460-81-89

Annotatsiya. sellyuloza-bazalt tolali kompozitlar – bu standart polianionli sellyulozalarga (PAS) qaraganda 35–50% yuqori termal barqarorlikka ega bo‘lgan, bazalt bilan modifikatsiyalangan polianionli sellyuloza efirlaridir. Tadqiqot natijalari filtrlashdagi yo‘qotishlar 40% gacha kamayganini ko‘rsatdi. Ushbu kompozitlar burg‘ilash eritmasining strukturaviy-mexanik xususiyatlarini yaxshilaydi va chuqur hamda yuqori haroratli neft-gaz quduqlari uchun samarali stabilizator sifatida ijobiy natijalar berishi bilan ajralib turadi.

Kalit so‘zlar: polianion sellyuloza, bazalt tolasi, termobarqaror stabilizator, burg‘ilash eritmasi, sellyuloza kompozitlari, yuqori haroratga chidamlilik, neft-gaz quduqlari

Аннотация. целлюлозно-базальтовые волокнистые композиты представляют собой базальтомодифицированные полианионные эфиры целлюлозы, обладающие на 35–50% более высокой термостойкостью по сравнению со стандартными полианионными целлюлозами (ПАЦ). Результаты показали, что их применение позволило снизить потери на

фильтрацию до 40%. Данные композиты улучшают структурно-механические свойства бурового раствора. Являясь эффективным стабилизатором, они успешно применяются в глубоких и высокотемпературных нефтяных и газовых скважинах, что подтверждается положительными результатами исследований.

Ключевые слова: полианионная целлюлоза, базальтовое волокно, термостойкий стабилизатор, буровой раствор, целлюлозные композиты, высокотемпературная стойкость, нефтегазовые скважины.

Annotation. cellulose-basalt fiber composites are basalt-modified polyanionic cellulose ethers that possess 35–50% higher thermal stability compared to standard pas. The results showed that filtration reduced losses by up to 40%. Improves the structural and mechanical properties of the drilling fluid. As an effective stabilizer for deep and high-temperature oil and gas wells, it is characteristic of the positive results of research processes.

Keywords: polyanionic cellulose, basalt fiber, thermostable stabilizer, drilling fluid, cellulose composites, high-temperature resistance, oil and gas wells

INTRODUCTION.

Processes have been implemented to master the technology for producing high-temperature-resistant stabilizing ether for SELBAZ-PAS drilling mixtures for the oil and gas industry from cellulose-basalt fiber composites. Below, the technology for obtaining high-temperature-resistant basalt-modified polyanionic cellulose ester (PAS) for the oil and gas industry based on cellulose-basalt fiber composites is described on a scientific and technological basis.

Polyanionic cellulose (PAC), used in the process of drilling oil and gas wells, serves to ensure the rheological stability of the drilling fluid, reduce filtration, and ensure wall stability. However, PAS undergoes degradation at temperatures above 120–140°C. Therefore, obtaining a thermostable PAS ether modified with basalt microfiber or nanoparticles is relevant. In such cases, it is necessary to form a reliable raw material base and its composition based on specific consumption norms.

The raw material base consists of cellulose, which is considered the main objects of the scientific work, while the source consists of rice straw, sorghum cellulose, and basalt fiber.

These objects are subject to the following requirements: α-cellulose ≥ 90%, moisture ≤ 8%, basalt component - microfiber (5–20 μm), or basalt nano-dispersion (100–500 nm) - silane activation to form a thermostable reinforcing nanophase.

The stages of the technological process include the following sequence;

Here,

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3.1. Alkaline activation of cellulose; where;

$$\text{Cell-OH} + \text{NaOH} \rightarrow \text{Cell-ONa}$$

Conditions - Parameters NaOH 18–22%, t=25–30°C, the process was carried out for 2 hours.

3.2 The esterification stage, i.e., the carboxymethylation process, was carried out in the sodium monochloroacetate reagent Cell-ONa + $ClCH_2COONa$ →Cell-O-CH_2COONa at the following parameters at 60-70°C for 2-3 hours, where the degree of substitution was AD (rate of substitution) = 0.6-0.9.

3.3. The basalt modification was performed in two variants. Option 1: Basalt nanoparticles are added in the reaction medium, i.e., during the esterification process - 2-5% by mass. In variant 2, post-modification is performed by adding basalt dispersion to the finished PAS solution.

Ultrasound dispersion (20 kHz, 15 min). The result is a complex structure, i.e., hydrogen and ionic bonds.

The drying and granulation process is carried out at a vacuum drying temperature of 60-80°C and is ground into fractions of 100-250 μm.

The mechanism of structural formation is the formation of polyanionic cellulose chains and carboxyl groups (-COO−) in the ester.

The mechanism of action of the basalt silicate structure is that basalt particles form a thermally stable framework. This strengthens the rheological structure and slows down the thermal degradation of polymer chains.

Table 1.

Laboratory results (typical)

№	Indicator	Simple PAS	Basalt Modified PAS
1.	AD		
2.	Viscosity (25°C)	42 mPa·s	48 mPa·s
3.	Viscosity (150°C)	18 mPa·s	34 mPa·s
4.	Seepage loss	12 ml	7 ml
5.	Thermal stability	130°C	180°C

In this case, the effect in the drilling fluid, i.e., the application dose, is 0.5–1.5%.

As a result, API filtration decreases by 30–40%, the wall colmatage effect improves, well wall stability increases, and it operates stably in high-temperature wells. This is characterized by thermal stability up to 180°C, stability in saline environments, improved rheological properties, and environmental safety.

Basalt-modified polyanionic cellulose ethers obtained on the basis of cellulose-basalt fiber composites possess 35–50% higher thermal stability

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compared to standard pas. The results showed that filtration reduced losses by up to 40%.

Improves the structural and mechanical properties of the drilling fluid. As an effective stabilizer for deep and high-temperature oil and gas wells, it is characteristic of the positive results of the research process.

Below are the results of the analysis of scientific and technological research on the technology for obtaining high-temperature-resistant basalt-modified polyanionic cellulose ester (PAS) for the oil and gas industry based on cellulose-basalt fiber composites.

It presents the results of studies on the activity of inhibitors in the aqueous phase of the drilling fluid, as well as high resistance of clay rocks, i.e., basalt-based pas.

In the table below, the reactive activity of these basalt and inhibitor mixture grades after thermal stability can be observed in samples attached to CMC.

Table 2.

Post-thermal stability reactivity of basalt and inhibitor mixture grades attached to RAS

№	PAS and Basalt composite brands	Basalt fiber	Barit $BaSO_4$	$CaSO_4$	PAS-77 PD-900	NaCl
		kg/m³				
1.	PAS-BAZ-1	10	12	0.6	22.2	1.4
2.	PAS-BAZ-2	12	16	042	18.8	0.6
3.	PAS-BAZ-3	14	14	1.4	18.8	0.8
4.	PAS-BAZ-4	16	21	1.8	18.4	1.2
6.	Quality indicatori	120 °The freezing of an absolutely dry KMS clay solution after heat treatment at 'C, with a mass fraction of 0.75 (calculated for the main substance) and no more than 4.0'p				
		PAS-BAZ-1	PAS-BAZ-1	PAS-BAZ-1	PAS-BAZ-1	
		3.4	3.7	4.0	4.8	

Table 1 shows that the water loss of an absolutely dry KMS clay solution after thermal treatment at 80 °C, with a mass fraction of 0.75 (calculated for the main substance) and no more than 4.0, was tested, and optimal parameters for the destruction of each ingolin were determined. As a result, it was determined that each ingoline inhibitor composite is resistant to heat treatment at 120 °C.

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Table 3.

Post-thermal stability reactivity of basalt and inhibitor composite grades attached to RAS

№	PAS and Basalt composite brands	Basalt fiber	Barit $BaSO_4$	$CaSO_4$	PAS-77 PD-900	NaCl
		kg/m^3				
1.	**PAS-BAZ-1**	8.	10	0.8	20	1.2
2.	**PAS-BAZ-2**	9.	13	0.2	19	0.8
3.	**PAS-BAZ-3**	10	12	1.2	18.5	0.8
4.	**PAS-BAZ-4**	11.	19	1.4	18	1.6
6.	Quality indicator	140 °hardening of an absolutely dry KMS clay solution after thermal treatment at 'C, with a mass fraction of 0.75 (calculated for the main substance) not exceeding 4.0				
		PAS-BAZ-1	**PAS-BAZ-1**	**PAS-BAZ-1**	**PAS-BAZ-1**	
		3.8	4.0	5.2	6.4.	

In Table 2, the water loss of the absolutely dry KMS clay solution after heat treatment at 140 °C was tested, with a mass fraction of 0.75 (calculated for the main substance) not exceeding 4.0, and optimal parameters for the destruction of each ingolin were determined. As a result, the resistance of each ingolin inhibitor composite to heat treatment at 140 °C was determined. The degradation of reagents in the IngoLin-05 lignin mixture significantly decreased, i.e., increased by 6.8.

PRACTICAL DIAGRAM OF THE INNOVATIVE TECHNOLOGY FOR OBTAINING HIGH-TEMPERATURE RESISTANT STABILIZING ETHER FROM CELLULOSE-BASALT FIBER COMPOSITIONS FOR SELBAZ-PAS DRILLING MIXTURES FOR THE OIL AND GAS INDUSTRY

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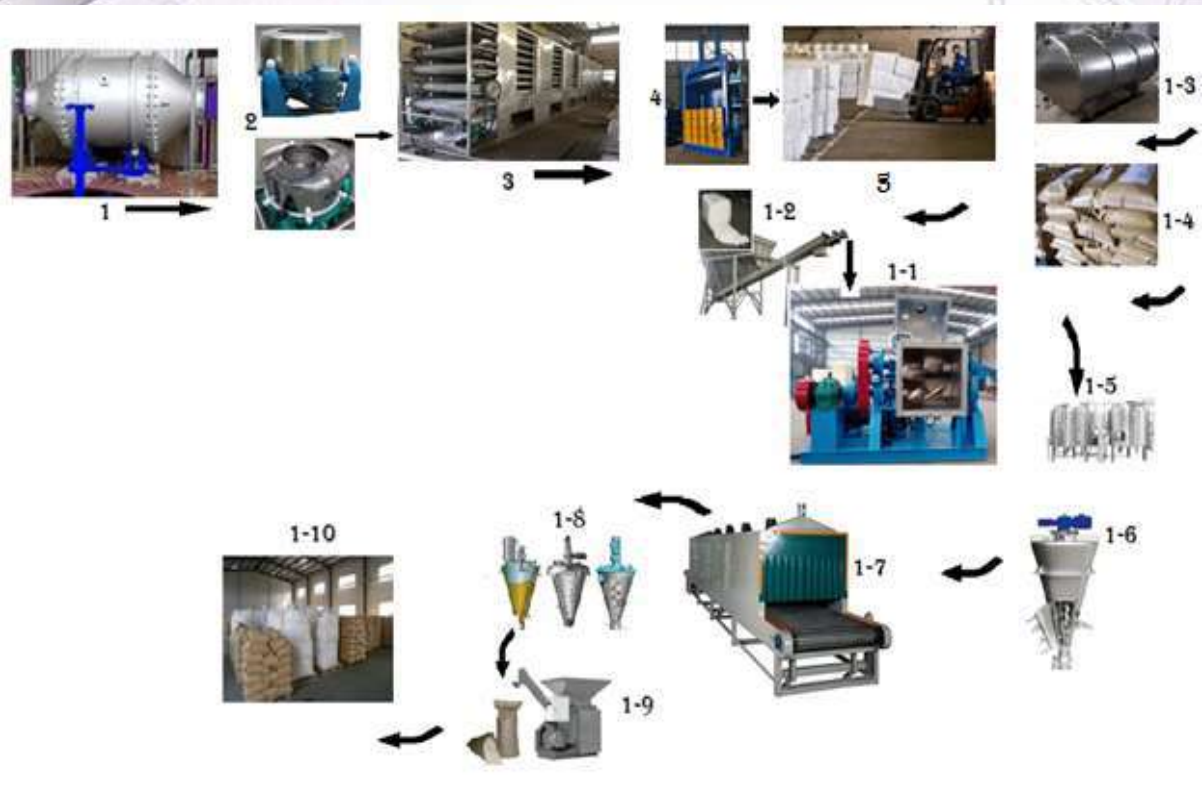


Figure 6: Technology for producing high-temperature-resistant stabilizing ether for SELBAZ-PAS drilling mixtures for the oil and gas industry from cellulose-basalt fiber composites

1-natron cooking pot, 2-centrifuge, 3-cellulose drying chamber, 4-prepared product briquetting-pressing unit, 5-prepared product warehouse.

1-1 - Mono-apparatus unit, 1-2 - cellulose loading unit, 1-3 - NaOH preparation - storage and transfer capacity, 1-4 - CH_2ClCO_2Na, 1-5 - maturation capacity for exothermic reactions, 1-6 - agitator unit for bringing the matured coarse mass to a uniform consistency, 1-7 - drying chamber, 1-8 - agitator unit for bringing the dried coarse mass to a uniform consistency, 1-9 - special mill equipment, 1-10 - warehouse for storing finished products.

The technology for producing high-temperature-resistant stabilizing ether for SELBAZ-PAS drilling mixtures for the oil and gas industry from cellulose-basalt fiber composites is presented above.

To this; (1) During the cellulose production process, the finished cellulose from the atron cooking pot (2) is dehydrated and squeezed using a centrifuge, (3) is sent to the cellulose drying chamber, and (4) is transferred to the ready-made product briquetting-pressing unit. (5) The finished product is placed in the warehouse.

At the main stage, the innovative technology for obtaining high-temperature-resistant stabilizing ether from cellulose-basalt fiber composites for the oil and gas industry was mastered.

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In this case, the 1-1-mono-apparatus unit (1-2) is loaded into the cellulose loading unit (1-3), and the NaOH preparation—merceration—process is carried out using the storage and extraction capacity, i.e., the production of alkaline cellulose. Then, by adding (1-4) CH_2ClCO_2Na to the mass with alkaline cellulose, the exothermic reaction (1-5) is transferred to the maturation tank. (1-6) The hardened coarse mass is passed through a stirrer that brings it to a uniform consistency and dried in a drying chamber (1-7). (1-8) The dried coarse mass passes through an aggregate - a scraper (1-9), is crushed using a special milling equipment, and (1-10) is placed in the warehouse where the finished product is stored.

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