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# Creation of New Compositions and Research of Prop-Erties of Carboxymethyl Starch-Based Drilling Mix-Tures from Local Raw Materials

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**Abstract:**

In the article, the rheology of oil and gas well drilling fluid is analyzed, the properties of the drilling fluid, its function and effect on the drilling speed are studied. Development of the composition of the drilling fluid, which can prevent bending of the solution in the well body and create an anti-cracking modification, a modified one that replaces imported regents researches were conducted on the procedures for the creation of new compositions of drilling compounds based on carboxymethyl starch polymer composites. regentin research results, conclusions and proposals are presented.

**Keywords:** drilling fluid, chemical reagent, rheological properties, complications, technological parameters, oil and gas.

**Introduction**. Currently, drilling companies spend up to 30% of their budget on combating differential adhesion well wall buckling. The development of drilling fluids that help reduce differential adhesion is an urgent task. It is known that nanodispersed particles have a positive effect on the technological process of drilling wells, and the development of nanostructured drilling fluids for drilling is a key issue for companies. In this regard, Tashkent State Technical University, Tashkent Institute of Chemical Research and "Hisor Oldi Neftgaz" LLC conducted experimental research together with organizations. As a result of developments and scientific research, drilling fluids with a high concentration of up to 4% and particle sizes from 40 to 80 nm were developed based on carboxymethyl starch polymer composites [1].

**Main part.** The following practical laboratory work was carried out as a result of the creation of new compositions and research of properties of drilling mixtures based on carboxymethyl starch polymer composites

The process of obtaining carboxymethyl starch consists of a simple technology and has the properties of forming a viscous paste in cold water. This modified starch is considered one of the economically and environmentally effective products that is stable to heat and biological effects. Carboxymethyl starch is obtained as a result of the etherification reaction of hydroxyl groups of monochloroacetic acid or its sodium salts in an alkaline medium. In the first stage of the reaction, an equal amount of NaOH and hydroxyl groups in starch react. In the second stage, the reaction process continues by replacing the carboxymethyl group with sodium monochloroacetate.

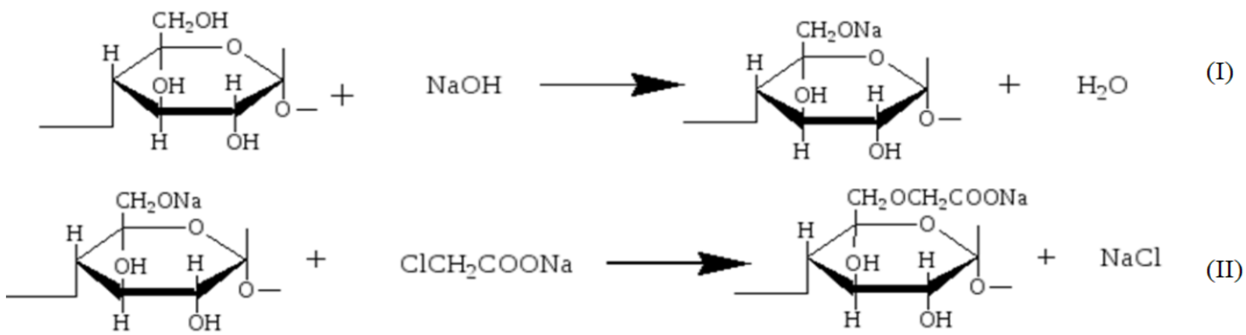


**Figure 1. Reaction of sodium carboxymethyl starch**

CMKNa (sodium carboxymethyl starch) is a biopolymer with high viscosity and flowability, the characteristic frequencies of which can be analyzed by IR spectroscopy. [2].

Figure 2 shows the IR spectroscopy of starch, where peaks mainly associated with hydroxyl groups were detected in the region of 3365 cm-1. In addition, frequencies associated with the C-H group were observed in the range of 2950-2900 cm-1. It can be seen that the frequencies in the region of 1100-1000 cm-1 are characteristic of the CH2-O-CH2 group, indicating valence-valence shifts.

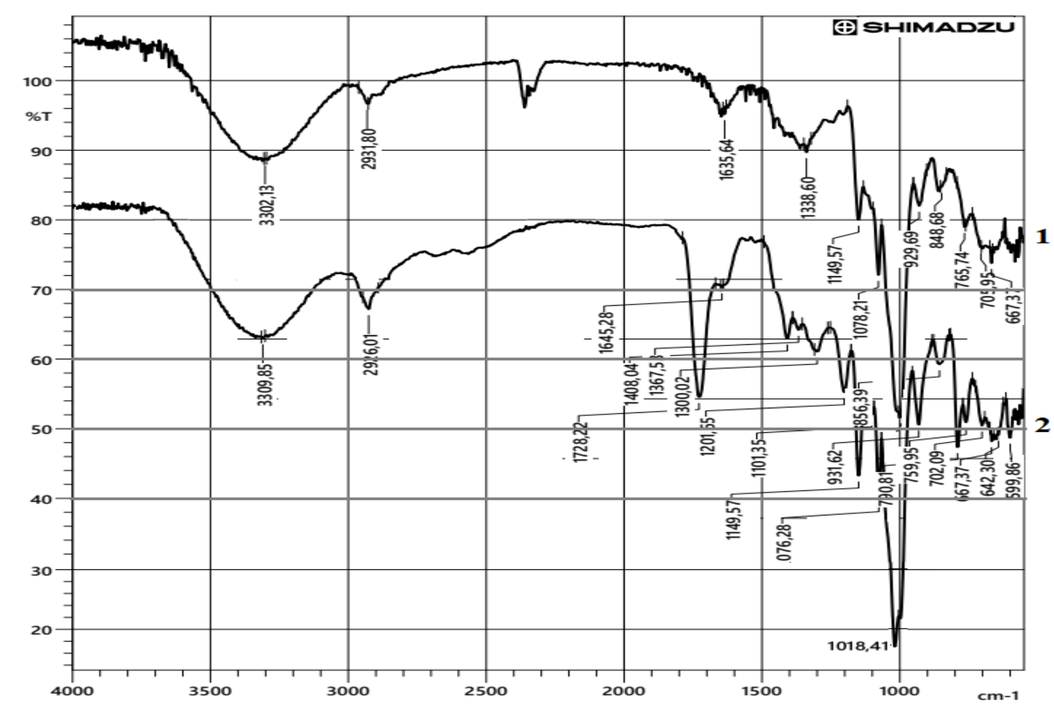


**Figure 2. IR spectrum of starch (1) and modified starch (2).**

In IR spectroscopy of sodium carboxymethyl starch and starch, frequencies in several different regions were determined. According to it, in sodium carboxymethyl starch, a hydroxyl group in the region of 3300 cm-1 and two new peaks at 1600 - 1400 cm-1 were found to be associated with the COO- group. In addition, there is an absorption band at 1750-1700 cm-1 corresponding to the vibrations of the carboxyl group.

In addition, the physicochemical properties of polyelectrolyte solutions differ from those of other types of polymers (containing electrolytes). In polyelectrolytes, the formation of ionic bonds in the polymer structure greatly affects the viscosity of the solution, regardless of whether the solution is concentrated or diluted. In this process, the ionization structure causes a significant change in the polymer conformation in solution.

The result shows that the viscous flow of polymers deviates from a straight line depending on the solution concentration

**ud/s=f(s).** (1-form.)

The IR spectra of the initial and synthesized compounds were obtained on IRAffinity-1S (SHIMADZU) spectrophotometers. Fig. 2.1. [5;].

Electron microscope (EM) [1.,6.]. The study of the morphology of the hydrated phase and the change in the structure of the composition depending on the hardening conditions and the type of additive was carried out using an electron microscope of the company Jeol Interactive Corporation, Japan JSM-6460LA, which has the following technical parameters.

**Resolution:** 4.0 nm (at 30 kV); Voltage acceleration: from 0.1 to 4.9 kV (with a step voltage of 10 V), from 5 to 30 kV with a step voltage of (100 V); Increase: from x8 to x 300,000;

**3 – Fig. IR-spectrum. IRAffinity-1S (SHIMADZU)**

For testing the samples, the metallization was performed by vacuum sputtering a 10-20 nm thick platinum layer in an electron microscope.

To analyze the images, sources from the literature and data from an Oxford X-ray microanalyzer were used, which provides an accuracy of 0.5% for the elemental composition of the composite phase.

**Differential-thermogravimetric method 2.2 - fig. Differential-thermogravimetric method DTG-60/(SHIMADZU).**

Synthesized [74; 45 – 47 - p.]. compounds were analyzed by differential thermogravimetric method, determined on a derivatograph operating in the DTG-60/(SHIMADZU) system. This method is based on the change in thermal effects of the compounds in the temperature range of 293-793 K, with a temperature increase rate of 2-5 K/min.

Calculation of the effective kinetic indicators of the destruction of stabilized samples was carried out according to the Freeman and Carroll method based on TGA data. The polymer decomposition rate is equal to:

$dW/dt = (Ao/RH)e-E/RTWn$ (2-for)

where:

RH- heating rate, (min)

W- polymer size, (gr),

Ao- preexponential product,

n- reaction composition efficiency,

E- effective activation energy of polymer thermodestruction.

The reaction order n is found from the equation of the tangent angle of the deviation of the dependence graph in logarithmic coordinates, and the effective activation energy of thermal destruction is determined from the section intersected by the ordinate axis.

Figure 4 shows the dependence of the decrease in the viscosity of aqueous solutions of the sodium salt of carboxymethyl starch on the polymer concentration, and it was found that when the solutions were diluted, the viscosity of the solution changed sharply. This property is characteristic of polyelectrolytes and can be analyzed as a sharp difference from starch.

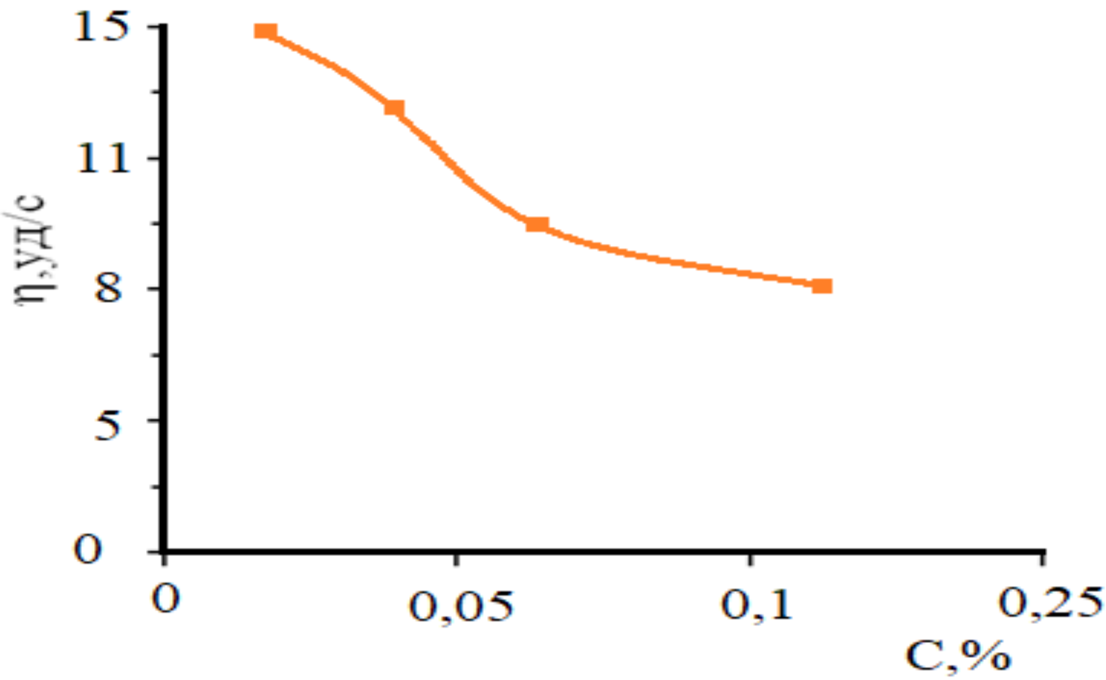


**Figure 4. Dependence of the viscosity of aqueous solutions of sodium salt of carboxymethyl starch on concentration**

**Research methods.** Carboxymethyl starch-based drilling fluids allow for the use of various temperatures in oil and gas wells. Carboxymethyl starch (KMK)-containing drilling fluids are stable to mineralization and temperature, and their composition is in the following proportions, wt.%.

No. 1 Drilling fluid KMK+KK

2 kg of caustic soda:

3 kg of calcined soda:

60 kg of mineral powder (calcium carbonate):

15 kg of carboxymethyl starch (KMK)-based binder polymer:

60 kg of Polyans (K-4 or K-9):

2 kg of Sulfanol:

10 kg of graphite (lubricating additives):

50 kg of UDS-BR (lubricating additives):

The results of the study of the properties and characteristics of the proposed drilling fluid are presented in Table 1.

Table 1

Properties of drilling fluid based on carboxymethyl starch (CMK).

No. t/r Name of indicators Unground mixture Ground mixture

1. Appearance powder powder
2. Color Light yellow Light yellow
3. Odor odorless odorless

4. Density 10.8 10.8
5. Environment, pH 7.0 7.0
6. Solubility, 22oC Soluble in water

Therefore, the experimental research was focused on obtaining a drilling fluid treated with carboxymethyl starch using highly mineralized water extracted from the formation for the Bukhara-Khiva oil and gas region. The use of mineralized water from the formations excludes the introduction of inhibitory additives into the drilling fluid, since these additives are present in sufficient quantities in the formation water.

The indicators of the modified carboxymethyl starch-treated drilling fluids used for drilling wells in the Bukhara-Khiva field (region) fully met the technological requirements under experimental conditions.

Some portions of the oil emulsion drilling fluid were tested in the 100-2150 meter intervals of the Alan field.

In terms of the geological structure of well No. 202 of the Alan gas field in the Bukhara-Khiva field (region), the oil-bearing intervals are located in the lower and middle Jurassic strata. The depth of the project is approximately 2,750-3,500 meters (Mesozoic). Formation water is used as a drilling fluid for drilling to a depth of 100 meters below the surface.

A 426 mm guide column was lowered to a depth of 180 meters and reinforced with cement. The drilling fluid up to a depth of 180 meters, before being treated with modified Dextrin and Carboxymethyl Starch, had the following parameters:

- specific gravity - 1200 kg/m3;
- viscosity - 50 sec;
- water separation - 17 cm3/30 min;
- plaster (cork) thickness - 6.0 mm;
- hydrogen indicator (pH). - 7.0.

According to the technological regime, the drilling fluid treatment from 100 meters to 1600 meters with the following chemical reagents and components has been considered or proposed:

- coal-alkaline reagent - 10÷17%;
- caustic soda - 1.0÷1.5%;
- soda ash - 3÷5%;
- K-9 reagent - 2÷4%;
- petroleum product - 5÷12%.

During drilling of well No. 202 in the Alan gas condensate field of the Bukhara-Khiva area for a 324 mm conductor, approximately 30-35 m3 of drilling fluid was observed to penetrate into the formation. In order to ensure full circulation of the drilling fluid, approximately 40-50 m3 of drilling fluid was prepared by adding the above reagent.

The prepared drilling fluid was re-treated with a 10% aqueous reagent of Dextrin and Carboxymethyl starch, making 100 m3. Dextrin and Carboxymethyl starch were added to the circulating solution without stopping the drilling process (circulation). The parameters resulting from sufficient addition provided the following indicators:

- specific gravity - 1120 kg/m3;
- viscosity - 55 sec;
- water separation - 20 cm3/30 min;
- plaster (cork) thickness - 4.0 mm;
- hydrogen indicator (pH). - 8.0.

Due to the increased penetration of the drilling fluid into the formation and the instability of the rocks, it was decided to lower the 299 mm diameter pipe to a depth of 910 meters. During this period, the parameters of the drilling fluid did not change, the column was lowered freely and did not cause any complications.

During the test work in well 202 of the Alan gas condensate field in the Bukhara-Khiva region, 120 m3 of modified dextrin and carboxymethyl starch were used to prepare a drilling fluid without the use of caustic and calcium soda, and the consumption of K-9 reagent was slightly reduced. It should be noted that clay was not used to prepare the drilling fluid, but instead clay rocks extracted during drilling were used.

No expansion and re-diametering work was carried out for cementing the conductor with a depth of 360 meters and a diameter of 324 mm, only measurement work was carried out. The cementing process of this interval was consistent, the cement mixture was fully raised to the top of the well, and as a result, high-quality cementing work was carried out.

The solution prepared by adding modified dextrin to the drilling fluid showed good results in the wells consisting of industrial saline intervals, without causing any complications or problems. As a result, the physicochemical parameters of the prepared drilling fluid remained unchanged, maintaining all the parameters specified in the geological and technical report.

During the drilling operations at the well No. 202 of the Alan gas condensate field in the Bukhara-Khiva region, many reagents were used and good results were not achieved.

**Conclusion.** We can reduce the cost of drilling fluid by saving the following reagents that should be added to the drilling fluid prepared by the proposed modified dextrin and carboxymethyl starch. This situation is more pronounced in areas far from the supply base of oil and gas wells, as a result of which 2420 kg of caustic soda, 2985 kg of soda ash, 5975 kg of K-4 reagent, 36315 kg of clay and 1873 kg of oil are saved.

Taking into account the good results of the conducted studies, it is proposed to widely use the drilling fluid with this proposed reagent composition in the fields of “Uzbekneftegaz” JSC.

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