RESULTS OF BIOSTABILITY TESTING OF SOME POLYMERIC ADDITIVES IN THE DRILLING WATER[1]

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The purpose of the research is the biostability estimation of some drilling additives on basis of polyacrylamide, starch reagents and carboxymethylcellulose modification pertaining to association of microorganisms Rh. erythropolis VKM AC-1339D and Fusarium sp. no. 56. The more biostable from researched drilling additives for this microorganisms is the drilling additives on basis of polyacrylamide: sypan, DKS-extender, dk-drill. Choosing the right organic additive to the drilling water as to protect the environment we should take into consideration its experimental data of the biostability.

INTRODUCTION

One of the main problems in gas and petroleum well construction is the pollution of the environment in drilling by the special materials and chemicals with different toxicity level. The hard removed component of drilling waste is organic compound with wide range of chemical reagents. The overwhelming majority of these compounds are gel-forming organic with the expressed stabilizing effect, that in combination with colloidal constituent mineral part of the suspension particles (the clay fraction) gives the high aggregate stability to the drilling waste. Such stabilized colloidal – dispersed systems are less sensitive to physicochemical action. The great energy resources are required to destabilize these systems [1, 2, 3, 4]. However, these additives are ecologically dangerous. Choosing the right organic additive to the drilling water we should take into consideration its biostability, just to protect the environment.

The purpose of the research is the biostability estimation of some drilling additives on basis of polyacrylamide (sypan, DKS-extender, dk-drill), starch reagents (ActiVator I, Aphronizer B, corn starch, fito-R starch and Gabroza EHV) and carboxymethylcellulose (CMC) modification (CMC-Selpol-SL, CMC-Selpol-RX and CMC-Finfix) pertaining to association of microorganisms *Rh. erythropolis AC-1339 D and Fusarium sp. no. 56*.

These three modifications CMC (CMC-Selpol-SL, CMC-Selpol-RX and CMC-Finfix) are white-coloured, slowly water-soluble substances that are forming the viscous colloidal solution.

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The corn starch is the yellow-coloured, slowly cold water-soluble powder that is forming the viscous colloidal solution. Fito-R starch and Gabroza EHV reagent are white-colored powders. Differ from the corn starch by high solubility in cold water.

The ActiVator I is modified starch with specific gravity 3,5-3,6 g/cm^3. The ActiVator I is used for improvement of structured stability of drilling solution APHRON ICS^{TM} and warning the reduction to viscosity under low velocities of shift in consequence of termal decomposition. The Aphronizer B is accompanying starched polymer with specific gravity 0,61-0,67 g/cm^3. The Aphronizer B is used in drilling solutions APHRON ICS^{TM} for stability an aphrons. The ActiVator I and the Aphronizer B is very hygroscopic [5].

The sypan - the polymer is consists of polyacrelate of sodium, the effective fluid loss reducing agent and the solution stabilizer.

The dk-drill is hydrolytic polyacrelamide (PAA) with molecular weight 110 a.u. The DKS-extender is hydrolytic polyacrelamide (PAA) with molecular weight 180 a. u., so the level of hydrolysis is 20-30 %. In amount of 0,002-0,005 are used as flocculating agent; 0,03-0,05 % gives the apparent viscosity properties to the whole solution; 0,3-0,5 % - as the fluid loss reducing agent and the stabilizer.

The active association of the destructors of petroleum and its products *Rhodococcus erythropolis VKM AC-1339D+Fusarium sp. no. 56* [5] were used as the objects of the research.

It is known, that the given association of microorganisms is effectively destructs petroleum, its products and various drilling reagents, such as PAA, condensed sulphide spirituous distillery refuse, CMC-300 [3, 4, 6].

MATERIALS AND METHODS

The research works were held in the mineral medium containing 2.0 g/l $NaNO_3$, 1.0 g/l K_2HPO_4, 0.013 g/l $MnSO_4$, 0.5 g/l $MgSO_4 \cdot 7H_2O$, 0.002 g/l $ZnSO_4$, 0.001 g/l $Fe_2(SO_4)_3$; and a pH range of 6,7-7,0 [7].

The drilling reagent in amount of 1.0 % was the only added source of carbon and energy. There was added the 10% solution of CMC, made by the solution of CMC

in hot distilled water. The starch reagents were put in dry condition into the mineral medium.

The bacteria *Rh. erythropolis VKM AC-1339 D and Fusarium sp. no. 56* in amount of 1.5% were added to the testing reagents for the biodegradation.

The cultivation was held in swing flask on the thermostatting rocking-chair during 8 hours per day. Temperature was 30^0C, speed of rotation was 100 min^{-1}. These flasks were in a thermostat during 16 hours per day.

The control flasks were those with the mineral medium, containing the drilling additives, not subcultured by the bacteria.

The decreasing amount of the starch shows the biodegradation degree of the polymeric additives. The amount of starch was being determined by famous method-using of the Feling's solution after hydrolytic decomposition of the residual starch [6]. The amount of sypan, dk-drill and DKS-extender was being determined by a known gravimetric method [7].

RESULTS

The biodegradation degree of the researched reagents by associated bacteria *Rh. erythropolis VKM AC-1339 D and Fusarium sp. no. 56* in liquid mineral medium is shown in the fig. 1 – 3.

DISCUSSION

According the results as indicated above (see fig.1), the biostability of researched CMC modifications have the following consecution: Selpol-RX CMC-Finfix CMC-Selpol-SL. For example, at initial concentration 0,3 % the biodegradation degree of CMC-Selpol-SL by associated microorganisms *Rh. Erythropolis VKM AC-1339 D and Fusarium sp. no. 56* made 96,8 % on 8 days., that on 4,8 % higher the biodegradation degrees CMC-Finfix and on 12,2 % - higher of CMC-Selpol-RX (fig. 1 - 3).

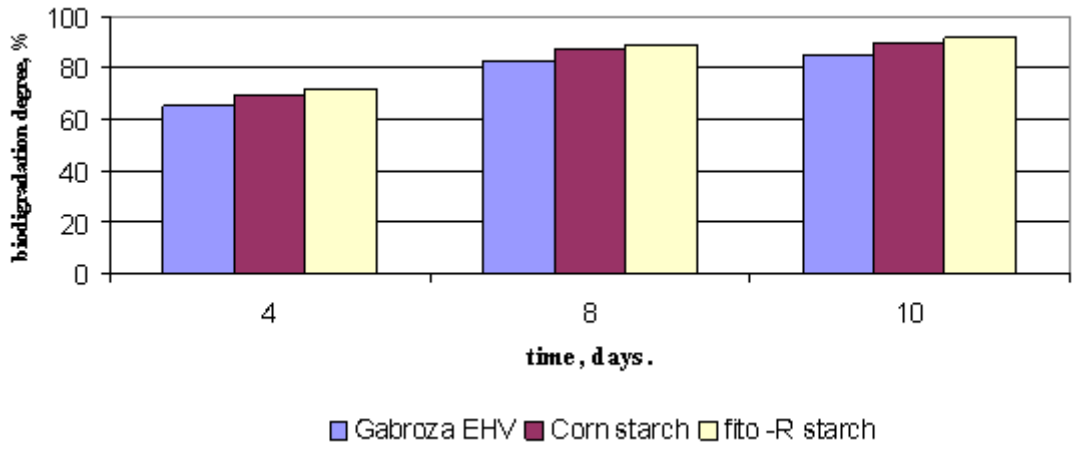

Figure 1. The biodegradation of drilling reagents on base of starch

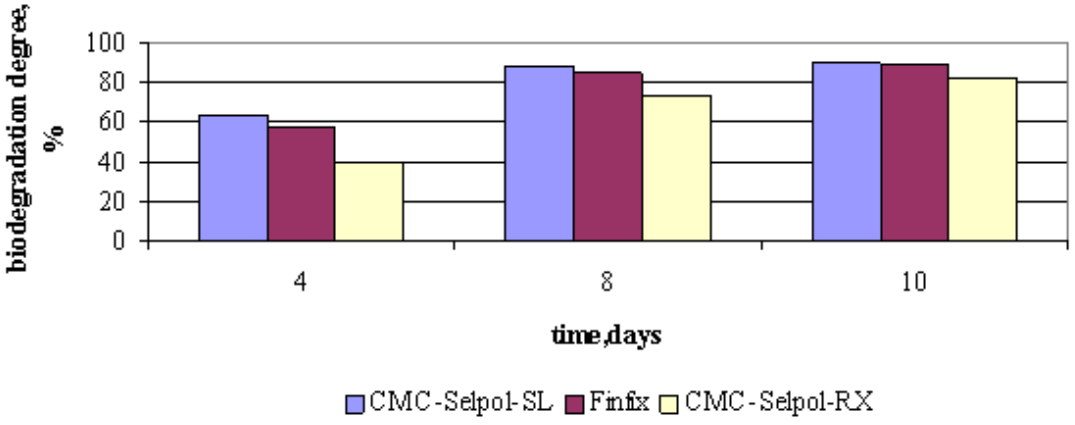

Figure 2. The biodegradation of the modification CMC

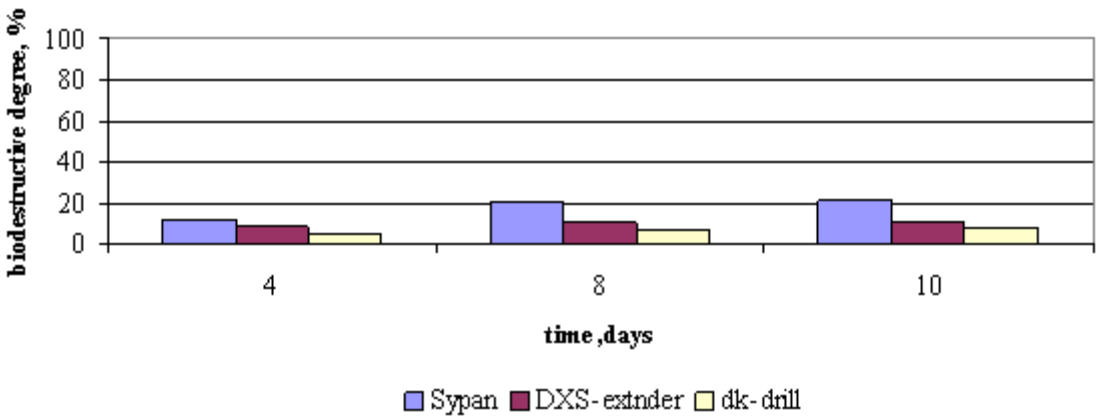

Figure 3. The biodegradation of the drilling reagents
on base of nitrogen-containing polymers

The comparison behavior of the change boistability CMC modifications with its degree of polymerization shows that the biodegradation of CMC by microorganism *Rh. erythropolis VKM AC-1339 D* and *Fusarium sp.56* are in the inverse negative relationship from its degree of polymerization. During 10 days the biodegradation degree for low-viscosity CMC- Selpol-SL (SP=258) - 94,0% was the highest, for the medium - viscosity CMC-Finfix(SP=424) – 92,0% was the medium and the lowest for the high-viscosity CMC- Selpol-RX (SP=788) - 88,6%.

The most biostable starch reagent was Gabroza EHV.

According to the results of the research of the polyacrylamide drilling additives the more stable is sypan that is not formed by hydrolytic polyacrelamide, as in case of dk-drill and DKS-extender, but is formed by polyacrelate of sodium.

CONCLUSIONS

Thus, the polyacrylamide drilling additives of starch and CMC modifications are destructed by the microorganisms *Rh. erythropolis VKM AC-133D and Fusarium sp. 56*. And the more biostable from researched CMC modifications (CMC-Selpol-SL, CMC-Selpol-RX и CMC-Finfix) for the microorganisms *Rh. erythropolis VKM AC-133 D and Fusarium sp. no. 56* is CMC-Selpol-RX. The biostable starch reagent (corn starch, fito-R starch and Gabroza EHV) is Gabroza EHV. Choosing the right organic additive to the drilling water as to protect the environment we should take into consideration its experimental data of the biostability of starch reagents and CMC modifications.

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