3 Tier Technologies Environmental

STABILITE (CARBOXX) DRILLING FLUID FIELD STUDY

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OBJECTIVE OF THE STUDY: Experimental evaluation of the STABILITE (CARBOXX) quality in the composition of drilling solutions for building bore-wells in conditions of the Far North.

ANALYSIS OF RESULTS OF THE EXPERIMENT: Technological parameters of suspensions from the clay powder with the yield 6.2 m^3/t and additives of 2-15% STABILITE (CARBOXX) as well as water solutions of STABILITE (CARBOXX) are presented in Table 1. Examination of these experiments shows: presence of STABILITE (CARBOXX) in concentrations starting from 2% and up reduces filtration of the clay-like suspension by two times. Gradual increase of the STABILITE (CARBOXX) additives up to 15% results in further reduction of filtration without considerable change of viscosity of the suspension. After the introduction of 15% STABILITE (CARBOXX) into the clay-like solution, this solution has a structure with static tension at the offset =4/5 dPa and extremely low filtration according to device VM-6 (filtration =1.8 cm^3 over 30 min), as well as filtration according to device UIV-2 at 70 C and 50 atmospheres (6 cm^3/over 30 min). This solution does not change its technological parameters during 2 hours at 150 C. Aqueous STABILITE (CARBOXX) systems in 5% and 10% concentrations without clay also have low filtration according to the device VM-6 (5.4 cm^3/30 min). Similar influence on clay-like solution is characteristic also for a number of lignosulfonates (for example, KSSB, positions 12, 13); however, very strong foam generation is observed when working with the latter compounds. The foam in solution with STABILITE (CARBOXX) is generated on the surface and is rapidly quenched and does not require introduction of foam-extinguishing additives. Solutions with STABILITE (CARBOXX) have good lubricating and anti-“wear and tear” properties similar to those of greasy lubricants (table 2). Swelling of the clay with the yield 2.4 m^3/t in the medium of 5% STABILITE (CARBOXX) is very slow, it is considerably slower than in lignosulfonates (1% solutions). Data are presented in Table 3. Coming to maximum swelling for all considered reagents takes place after 5-6 days.

Recommendations for application

The best application of STABILITE (CARBOXX) at drilling deep bore-wells is to use it as a thermally stable agent to reduce filtration; it does not disperse clay sediments, i.e., it acts as an agent reducing viscosity. Taking into account the low filtration value application of the reagent in solution for opening up the layers and in liquids to conserve the bore-wells may be very promising.

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STABILITE-δ DRILLING FLUID FIELD STUDY

NOTE: STABILITE- δ IS REFERENCED AS HMC IN THE TABLES BELOW.

TABLE 1

Technical paramaters of the clay suspension	ρ (density, kg/m3)	T (fluidity or specific viscosity, sec)	CHC (static tension of the offset after 1 min and after 10 min, dPa)	F (filtration, cm3/30 min)	K (thickness of the filtrating crust on the walls of the bore-well, mm)	φ (friction)	η (plastic viscosity, mPa/sec)	τ (dynamic tension of the offset, dPa)	pH (negative logarithm of the hydrogen ion concentration in solution)	n ()	Filtration Presure 50kg/cm Temp. 70C
1. Control – clay-like suspension from clay species with the yield 6.2 m3/t	1060	17	15/30	17.6	/	0.5	4.5	20.8	10.2	0.6	>40
2. Control + 2% HMC	1063	18	0/0	8.4	1.2	0.5	5	14.4	9.33	0.7	23
3. Thermostating at +150oC, 2 hr	1064	28	0/1.3	14	3	/	17	62.3	7.78	0.77	
4. Control + 5% HMC	1064	18	0/0	6.8	1.1	0.5	6	9.6	9.3	0.8	15
5. Thermostating at +150oC, 2 hr	1070	24	0/0	11.5	2	/	14	33.5	7.87	0.73	
6. Control + 10% HMC	1090	18	0/1.2	2	0.6	0.35	7	9.6	9.12	0.82	6
7. Thermostating at +150oC, 2 hr	1092	22	0/0	5	1	/	12	19.2	7.58	0.8	
8. Control + 15%HMC	1104	21	3.7/4.9	1.8	0.5	0.2	12	24	9.13	0.77	6
9. Thermostating at +150oC, 2 hr	1096	22	0/0	2	0.8	/	12	24	7.69	0.77	
10. 5% aqueous solution of HMC	1000	15	0/0	5	0.2	/	/	/	/	/	
11. 10% aqueous solution of HMC	1028	15	0/0	4	0.2	/	2	4.8	9.58	0.73	
12. Control + 5% KSSB (lignosulfonate) + foam extinguisher	1043	19	22.4/32.4	3.8	1.2	/	6	34	8	0.54	18
13. Thermostating at +150oC, 2 hr	1067	18	18.7/27.4	10	1.5	/	8	14.4	7.22	0.78	
on the device UIV-2 at 50 atm and 70oC.											

TABLE 2

Anti-"wear-and-tear" characteristics of the clay-like suspension from clay powder with the yield 6.2 m3/t and HMC (friction machine MT-2)

Speed of the "wear-and-tear" of a steel sample, mm/hr under the specific pressure load, MPa;
φ (average friction factor)

	4	8	12	14	18	22	Coefficient of Friction
K (control)	0.24	0.72	1.8	3.24	9.6	19.2	0.0066
K (control) + 2% HMC	0.12	0.12	0.18	0.24	0.24	1.8	
	0.0072	0.0048	0.004	0.0039	0.0036	0.0038	0.0045
K (control) + 5% HMC	0.12	0.36	0.6	0.84	1.08	1.8	
	0.0066	0.0042	0.0036	0.0036	0.0036	0.0038	0.0042
K (control) + 10% HMC	0.12	0.12	0.24	0.24	0.36	1.44	
	0.0078	0.0042	0.0034	0.0033	0.0028	0.0027	0.004
K (control) + 15% HMC	0.12	0.12	0.12	0.24	0.36	0.48	
	0.006	0.0036	0.003	0.0027	0.0024	0.0023	0.003

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TABLE 3

Volume increase of clay								
	5%hmc		1%lignosulfonate		1% carboxyl lignosulfonate		1% lignatine	
	vol. Clay x 10-2/mm3	K	vol. Clay x 10-2/mm3	K	vol. Clay x 10-2/mm3	K	vol. Clay x 10-2/mm3	K
1 min	0.05	0.008	1.18		0.82		0.61	
5min	0.66	0.11	3.04		2.19		1.62	
10 min	0.98	0.16	3.25		2.64		2.35	
15 min	1.03	0.17	3.41		2.87		2.56	
20 min	1.08	0.18	3.48		2.97		2.66	
25 min	1.08	0.18	3.53		3.01			
30 min	1.08	0.18	3.58		3.08		2.87	
60 min	1.11	0.19	3.7		3.16		3.08	
2 hr	1.16	0.2	3.86		3.39		3.32	
3 hr	1.2	0.21	3.91		3.46		3.5	
4 hr	1.28	0.23	3.93		3.51		3.53	
5 hr	1.37	0.24	3.96		3.53		3.55	
6 hr	1.45	0.25	3.98		3.58		3.58	
1 day	1.84	0.31	4.05		3.65		3.79	
2 day	1.16	0.37	4.1		3.72			
3 day								
4 day							3.95	
5 day	3.43	0.58	4.14		3.81		4	
6 day	3.72	0.63	4.16		3.81		4.02	
7 day	3.82	0.65	4.16		3.83		4.07	

Additional Research Findings and Comments about CARBOXX:

- We are conducting additional research of CARBOXX applications in various oil and gas industry applications. One of them is using CARBOXX as surfactant for frac liquid. Frac liquid is a water with added synthetic surfactant which reduces a water surface tension resulting in less water viscosity, less energy consumption by the pumps and higher rate of oil/ gas deposits fracturing and oil/ gas release. Our approach is based upon CARBOXX chemistry that allows activated humics to work as a surfactant. Once added to frac water, CARBOXX reduces water surface tension and it allows synthetic additives, expensive and toxic surfactants, to be replaced by organic Humics which are environmentally friendly.
- In addition to the above research findings, the addition of Carboxx in the same applications has provided additional benefits with a rising problem – salt management from drilling mud and drilling by-products. 3 Tier has many years of salt management experience using CARBOXX for the regeneration of hurricane damaged soils in Louisiana and is currently used in the extensive Gulf coast restoration programs to protect plantings from the high salt environment. The addition of CARBOXX to the drilling mud will also work within that environment to mitigate the salt development and related environmental issues.

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