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RESULTS OF MULTICOMPONENT ANALYSIS OF PRODUCED WATER, SELECTED WELL № 12 OF THE MINGBULAK FIELD

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A B S T R A C T	K E Y W O R D S
The main purpose of the water supply system while maintaining reservoir pressure is to extract the required amount of water suitable for injection into the reservoir, distribute it between injection wells and pump it into the reservoir.	Water supply, recycling, highly mineralized, calcium content, formation water, concentration.

Introduction

The designed water supply system must provide for an increase in water cut in well production and the need to dispose of all so-called industrial wastewater, including storm water, associated water, water from oil treatment plants, etc.

In order to comply with measures to protect nature and the environment, the water supply system in any case must provide for 100% wastewater recycling and operation of the entire water pressure maintenance system in a closed technological cycle.

This complicates and somewhat increases the cost of the water supply system, since there is a need for special treatment of wastewater, purification from oil products and suspended matter, and combating the increasing corrosion of process equipment and water pipelines. However, wastewater, as a rule, containing surfactants introduced at oil dehydration and desalting plants, has improved washing and oil-displacing abilities, which should lead to increased oil recovery.

The results of a multicomponent analysis of the composition of formation water from selected well №12 of the Mingbulak field are shown in Table No. 1.

Table 1

Sampling date	Ions, mg/l						Jcom, mol/l	Miner-ya, mg/l	pH	Density, g/cm^3
	Cl^-	SO_4^{2-}	HCO_3^-	Ca^{2+}	Mg^{2+}	Na^++K^+				
03/31/2024	292545,0 8252,3	2781,3 57,94	2225,7 3,7	7414,8 370,0	1851,3 152,37	186998,0 7791,6	522,37	591083,0	6,2	1,198
14/04/2024	239355,0 6751,9	438,4 9,13	183,0 3,0	360,0 17,96	118,2 9,73	161672,3 6736,34	27,69	479948,7	5,7	1,208
24/04/2024	224249,0 6325,78	607,0 12,65	231,8 3,8	6613,2 330,0	2102,1 173,0	140141,2 5839,22	503,0	450169,5	5,8	1,201

According to the results of the analysis, the produced water is highly mineralized (591.1 g/l), the prevailing concentrations of chloride ions and alkali metals (292.5 g/l and 187.0 g/l), the calcium content (7.4 g/l) significantly prevails over magnesium (1.85 g/l).

In terms of chemical composition, water is hard (522.4 mol/l), the reaction of water is slightly acidic (pH 6.2).

The values of the coefficients r(Na+/Cl-) <1 and r (Cl- - Na+)/Mg2+> 1 show that the water belongs to the calcium chloride type (according to the classification of V.A. Sulin), the value of the sulfate-chlorine coefficient is low (r(SO42-·100/Cl-) <1). Produced water belongs to brines r (Ca2+/Na+) <0.2, r (Ca+Mg/Na) <0.2.

After flushing, the produced water remains highly mineralized (479.9 g/l), prevailing concentrations of chloride ions and alkali metals (239.4 g/l and 161.7 g/l), the calcium content (0.36 g/l) significantly prevails over magnesium (0.12 g/l). The water is hard (27.69 mol/l), the reaction of the water is slightly acidic (pH 5.7).

According to hydrochemical indicators, produced water belongs to the chlorocalcium type r(Na+/Cl-) <1 and r(Cl- - Na+)/Mg2+ > 1 (according to V.A. Sulin), the value of the sulfate-chlorine coefficient is low (r(SO42-·100/Cl-) < 1) and the water belongs to brines r(Ca2+/Na+) < 0.2, r(Ca2++Mg2+/Na+) < 0.2.

The produced water taken on 24.04.2021 is highly mineralized (450.0 g/l), prevailing concentrations of chloride ions and alkali metals (224.2 g/l and 140.1 g/l), the calcium content (6.6 g/l) significantly prevails over magnesium (2.1 g/l).

A comparative analysis of the composition of river water and water of well №5 of the Mingbulak field, selected on 04/24/2021, was carried out. The results of the multicomponent analysis are shown in Table No2.

Table 2

Sampling site	Ions, mg/l/ mg/I						Jcom, mol/l	Miner-ya, mg/l	pH	Density, g/cm^3
	Cl^-	SO_4^{2-}	HCO_3^-	Ca^{2+}	Mg^{2+}	Na^++K^+				
Water from Well№5	4521,2 127,54	165,8 3,44	253,2 4,15	37,6 1,88	129,1 10,63	2943,4 122,64	12,51	9880,4	7,5	1,000
Syrdarya River	452,1 12,75	193,0 4,02	274,5 4,5	75,2 3,75	91,1 7,5	240,6 10,02	11,25	1839,2	7,5	1,000

According to the results of the analysis, the water from well №5 is moderately mineralized (9.9 g/l), the prevailing concentrations of chloride ions and alkali metals (4.5 g/l and 2.9 g/l), the content of magnesium ions (0.13 g/l) significantly prevails over calcium ions (0.04 g/l).

The water of the Syrdarya River is slightly mineralized (1.8 g/l), with prevailing concentrations of chloride ions and alkali metals (0.5 g/l and 0.2 g/l), the content of magnesium ions (0.09 g/l) prevails over calcium ions (0.075 g/l).

In terms of chemical composition, both water samples are hard (12.5 mol/l and 11.25), the reaction of the waters is slightly alkaline (pH 7.5).

The values of the coefficients r(Na+/Cl-) <1 and r (Cl- - Na+)/Mg2+ <1 show that the water from well No 5 and the Syrdarya River belongs to the chlorinated-magnesium type (according to the classification of V.A. Sulin), the value of the sulfate-chlorine coefficient is high (r(SO42-·100/Cl-) >1).

Conclusions

1. The flushing effect is visible in all respects. Mineralization decreased (from 591.1 g/l to 479.9 g/l and 450.0 g/l), chloride content (from 292.5 g/l to 239.4 g/l and 224.2 g/l), alkali metal ions (from 187.0 g/l to 161.7 g/l and 140.1 g/l).The content of sulfate ions (from 2.78 to 0.44 g/l and 0.6 g/l) and bicarbonates (from 2.23 to 0.18 g/l and 0.2 g/l) decreased significantly.

2. In all cases, formation water refers to highly mineralized brines, calcium chloride type. The water reaction is slightly acidic (pH 6.2, pH 5.7 and 5.8). Highly mineralized brines significantly influence the formation of poorly soluble salts.

3. As can be seen from Table 2, the use of river water is much more effective than water from a well. It must be taken into account that in weakly acidic solutions, sulfate ions are in a dissolved state; an increase in the pH of the medium can shift the ionic equilibrium of the formation water towards the precipitation of sulfate salts.

Recommendations

1. It is recommended to use low-mineralized, slightly acidic (pH 5-6.5) water for injection.

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