The American Journal of Engineering and Technology
(ISSN – 2689-0984)
Published: May 17, 2021 | **Pages:** 9-16
Doi: https://doi.org/10.37547/tajet/Volume03Issue05-02

IMPACT FACTOR
2021: 5. 705
OCLC - 1121105677

Increasing The Efficiency Of Acid Impact On The Bottom-Hole Zone Of The Formation In The Conditions Of Formation Of Water-Oil Emulsion

Mahmudov Nazirilla Nasimxonovich
Doctor Of Technical Sciences, Professor, Karshi Engineering Economics Institute, Karshi, Uzbekistan

Mustafaev Alisher Sayfullaevich
Independent Researcher, Tashkent State Technical University, Tashkent, Uzbekistan

Khaitov Odiljon Gafurovich
Candidate Of Geological-Mineralogical Sciences, Associate Professor, Department Of Mining, Tashkent State Technical University, Tashkent, Uzbekistan

ABSTRACT

The main lithological characteristics of reservoir rocks of the Upper Jurassic carbonate deposits are presented. The main reasons for the low efficiency of hydrochloric acid treatments of wells in the late stage of the development of oil and gas condensate fields have been established. Technologies for hydrochloric acid treatments are proposed in conditions of a decrease in reservoir pressure below the well-flowing pressure and the formation of water-oil emulsions.

KEYWORDS

Horizon, reservoir, rock, lithology, limestone, acid, solution, pressures.

INTRODUCTION

The main residual oil reserves of the developed fields of the Mubarek oil and gas production department are concentrated in the horizons XV-P (reef) and XV-NR (nadriff) of the Upper Jurassic carbonate deposits [1, 2].

The following lithological varieties of rocks have been identified along horizons XV-P and XV-HP: coral, coral-algal, algal, oncolytic, lumpy algal, lumpy, organogenic-detrital, detritus, oolitic, micro-grained, carbonate-argillaceous, limestones, breccias, dolomites, dolomites. Limestone grey, beige-grey biomorphic porous, strongly cavernous, intensely leached.

MATERIALS AND METHODS

The rocks are loose, of weak strength. Often, the core is represented by sludge, in which thin-platy fragments are noted. The main part of the section is composed of three structural varieties of biomorphic limestones: algal - 29%; organogenic-detrital - 23% and coral-algal - 18% with coral interlayers - 7.5%.

There are interlayers of lumpy algal and detritus limestones. The productive horizons are characterized by the following features:

1. The section of the deposits of the productive horizons of the deposits is composed of the same lithological varieties of biomorphic limestones but in different quantitative proportions.
2. Algal limestones are predominant in the section of productive strata deposits.
3. In horizon XV-P, along with algal limestones, organogenic-detrital and coral-algal limestones with coral interlayers are widely developed.
4. Chemogenic and biochemogenic limestones are of limited distribution, both in the area of the deposit and in the section.
5. The pore space of reservoir rocks is formed due to the presence of voids between the shaped elements, as well as inside the latter.
6. The pore space was transformed due to the leaching process and somewhat reduced due to the development of crucifying calcite, bitumen, and, in isolated cases, celestine and fluorite.
7. Dolomitization is manifested unevenly. In porous limestones, it is weak, about 5%, developed in structural components and does not affect the size of the pore space. Its intensity increases in dense limestones at the top of the productive horizon.
8. Interlayers of chemogenomic finely porous impermeable dolomites are noted in horizon XV-P.
9. Bitumen develops along cracks and to a lesser extent its smears are noted in the pores.
10. The admixture of clay matter is noted constantly.

But its amount varies widely, both in the area of the deposit and in the section, reaching a maximum in dense impermeable rocks in the lower part of the section.

11. Horizon XV-P is represented by reef formations, in which the porous-cavernous type of reservoir is predominantly developed.

Horizon XV-HP is characterized by an alternation of dense and porous limestone varieties.

The reservoirs here are also carbonates, in terms of the structure of the pore space, tending to the pore type.

Naturally, with such characteristics of productive horizons, one of the widely used methods of influencing the bottom-hole zone of wells in the fields of the Bukhara-Khiva oil and gas region is treatment with acid compositions.

To implement the process, hydrochloric, hydrofluoric, acetic and other similar (benzoic) acids are usually used. Hydrochloric acid interacts with carbonates:

with limestone

$$CaCO_3 + 2HC1 = CaC1_2 + H_20 + C0_2; \tag{1}$$

with the dolomites:

$$CaMg(C0_3)_2 + 4HC1 = CaC1_2 + MgCl_2 + 2H_20 + 2C0_2 \tag{2}$$

Hydrofluoric (hydrofluoric) acid interacts mainly with terrigenous deposits:

with sand

$$Si0_2 + 4HF = SiF_4 + 2H_20 \tag{3}$$

with clays

$$H_4Al_2Si_20_9 + 14HF = 2A1F_3 + SiF_4 + 9H_20. \tag{4}$$

During double-solution treatment, when hydrochloric acid and then clay-acid solutions are sequentially fed to the bottom hole, there is an intense impact on both carbonate and terrigenous components of the rocks.

Two-solution treatment is effective in terrigenous reservoirs with a carbonate content of at least 0.5% [3].

When implementing any of the described methods of influencing the bottom-hole formation zone to stimulate the inflow of formation fluids, reagents of the main and auxiliary purposes are used. The largest number of chemicals is used when carrying out hydrochloric acid treatments. Typically, this kit includes the actual acid, water, corrosion inhibitors, stabilizers, reaction retardants and other additives. With the use of one or another measure and the accumulation of experience in its application, the problem of optimizing the implemented technology arises, taking into account the peculiarities of the bottom hole and remote zones of the formation.

First of all, given the mineralogical composition and structural features of the pore space, the above applies to various options for the physicochemical impact of hydrochloric acid treatment. However, despite the significant success achieved in increasing the productivity of wells, the experience of using hydrochloric acid treatment has shown that its effectiveness in the traditional version has recently begun to decline. Analysis of the causes of this phenomenon shows that they are, as a rule, complex, complex [4].

It should be noted that at present the technologies of hydrochloric acid treatments are mainly of a non-systemic nature. At the same time, it must be admitted that, in practice, a large and valuable experience has already been accumulated in the application of acid stimulation in various modifications and combinations in relation to various geological conditions. The applied methods of hydrochloric acid treatments are effective at high reservoir pressures and the rate of the ascending flow of gas or other hydrocarbon fluid, which ensures the removal of liquid and mechanical particles from the bottom of the gas well.

But with a decrease in reservoir energy, the effectiveness of these methods decreases, and at low reservoir pressures, at which the hydrocarbon fluid cannot overcome the hydraulic resistance of the formation and the wellbore, they are completely inoperative [3, 4].

When developing oil and gas condensate fields, especially with gas injection through gas injection and water injection through water injection wells, in the process of oil and gas withdrawal, both the water-oil contact and the gas-oil contact progress.

At the same time, as a rule, the oil part of the reservoir is taken most intensively and in the process of developing the reservoir pressure decreases, the flow rate of wells decreases and by a certain period the flowing of the oil well may stop.

In addition, due to the mixing of injected water with a temperature of 10-30 °C with oil, an oil-water emulsion is formed, both in the formation and in the bottom hole zone, the viscosity of the fluid increases, and therefore it becomes difficult to extract oil from the formation, and production is practically stopped.

Therefore, in the wells where there was a decrease in oil production or a stop of flowing, the energy of the gas-bearing layer of this well was used in order to lift the oil. For this purpose, perforation of the gas-condensate part of the formation and separation of the gas-condensate part from the oil packer was performed in such a well.

A special thickened branch pipe was connected to the pump-compressor pipes, in which special holes were made to communicate the pipe and annular space for gas flow from the annular space to the pipe space, while the holes were made in such a way that the degassing and lifting of oil was carried out by a vortex (rotating) gas flow entering the tubular space with a closed annulus at the wellhead, while the holes in the tubing (special thickened pipe) are made above the packer and holes in the casing and below the hydrostatic level of the liquid in the well at different heights.

To create a rotating gas flow, the holes in the tubing (special thickened pipe) were made at an angle of 20-40 °C to the horizontal axis of the well, and the holes themselves are located at different heights and shifted relative to each other sequentially by 90 °C, the number and area of holes are calculated with the condition of the possibility of lifting oil by a gas flow to the surface.

If the gas product contains hydrogen sulfide to exclude possible corrosion of the inner surface of the casing strings and the outer surface of the tubing, during operation periodically: temporarily close the pipe space and open the annular space for oil bypassing into the annular space, which creates a film and protects against corrosion. The disadvantage of this technology is that the perforation of the gas condensate formation is required, as a result of which the required amount of gas entering the annulus is not controlled, as a result of which the well can only be operated with gas.

In addition, the installation of packers is required, which sharply complicates both the development and operation of the wells.

The main disadvantage is that when the emulsion is formed, production practically stops due to the impossibility of raising it to the surface.

In addition, with the formation of an oil-water emulsion, the viscosity of the liquid sharply increases, the pore space becomes clogged, and the removal of the product practically stops.

The proposed technology for the operation of wells in oil and gas condensate fields in the conditions of the formation of an oil-water emulsion includes perforating an oil reservoir, running tubing (tubing) with a shoe on which a saddle and a ball are installed, making holes in the tubing and pumping gas into the tubing space, when closed casing, the shoe (tubing) is lowered to the top of the aquifer, between the top of the aquifer and the bottom of the oil-bearing strata, holes are made in the tubing and the destruction of the oil-water emulsion is carried out by displacing the formation water into the oil-bearing stratum through the annular space with gas through the holes in the tubing, after the destruction of the oil-water emulsion, open annular space and carry out oil production.

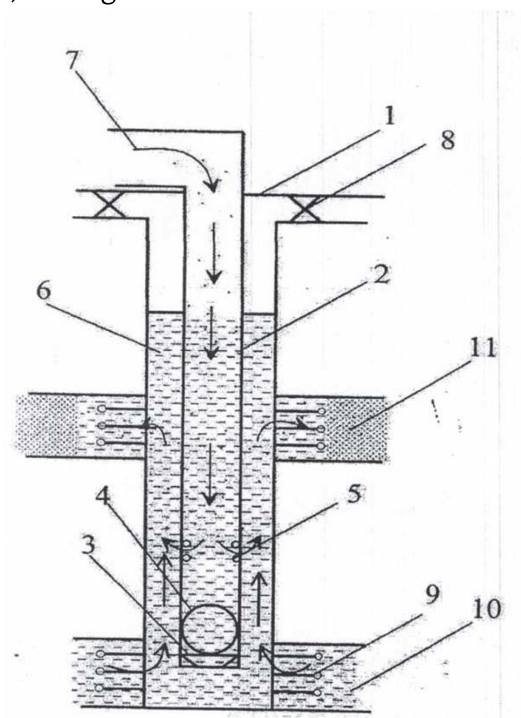

Fig. 1. Scheme of water and gas injection into the oil-bearing reservoir.

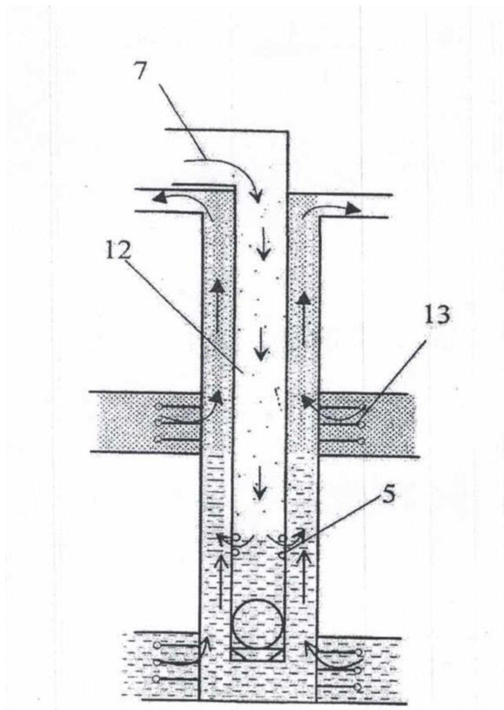

Fig. 2. Scheme for the implementation of oil production.

To increase the efficiency of hydrochloric acid treatments in the conditions of formation of a water-oil emulsion, a technology is proposed that includes the injection of a reagent for treating a well, forcing it with air into the formation in portions in two stages, hydrochloric acid is used as a reagent for treating a well; in the wellbore, pushed into the formation with air, between the injection of the first and second portions of hydrochloric acid into the well, caustic soda is injected and forced into the formation with air, after the injection of the second portion of hydrochloric acid, the well is left alone under pressure for at least two hours, then the well master [6].

In this case, the following reactions occur in the formation. The reaction of rock with acid according to (2). The interaction of hydrochloric acid solution with carbonates occurs in the release of heat in the reservoir and carbon dioxide. The results of the interaction of the acid solution with carbonates and sodium hydroxide occur in the following reaction:

$$CaC1_2 + MgCl_2 + NaOH = NaCl + Mg(OH)_2 + Ca(OH)_2 \quad (5)$$

All these reactions occur with the release of heat, with the destruction of the water-oil emulsion, which increases the productivity of the well. The implementation of this technology at several wells in the fields of the Mubarek oil and gas production department has shown fairly high efficiency. For example, in well No. 53 of the Kokdumalak field, the aerated fluid in the wellbore was forced into the formation. Then, 24% hydrochloric acid (HC1) with a volume of 2 m3 was pumped through the annulus, then sodium hydroxide (NaOH) was pumped in a volume of 0.130 m3. After injection of caustic soda, hydrochloric acid was re-injected and technical water in a volume of 28 m^3 was pushed through the pipe space, and gas was injected through the annular space at a pressure of P_g = 50 atm and the well was left alone. Before the start of the operation, the well worked with the following parameters: liquid flow rate -10.6 m3/day, water cut -35%, oil flow rate -6.1 tons/day. After carrying out work on the proposed technical solution, the well began to operate with the following parameters: liquid flow rate -23 m3/day, water cut -28%, oil flow rate -14.6 t/day, oil density -0.878 g/cm^3.

REFERENCES

1. Akhmedov P.U, Ubayhodzhaeva Z.S. (2014). Development of sedimentation-volumetric models of productive horizons of Jurassic and pre-Jurassic deposits of new exploration areas and fields in the Bukhara-Khiva and Ustyurt regions. - Tashkent: JSC "IGIRNIGM". P.229.
2. Akhmedov P.U, Ubayhodzhaeva Z.S. (2012). Development of sedimentation-reservoir models of new prospecting areas and fields in order to increase the efficiency of geological exploration in the Bukhara-Khiva and Gissar regions. Tashkent: JSC "IGIRNIGM", P.277.
3. Irmatov E.K. (2016). Hydrochloric acid treatments are a problem. Uzbek Journal of Oil and Gas. Tashkent. No. 3. pp. 47-50.
4. G'ofurovich, K. O., & Abdurashidovich, U. A. (2020). Justification of rational parameters of transhipment points from automobile conveyor to railway transport. World Economics and Finance Bulletin, 1(1), 20-25.
5. E.K. Irmatov, G.S. Abdullaev, A.Kh. Agzamov et al. (2017). Acidic impact on rocks. Tashkent: Fan va technology. P.316.
6. Patent of the Republic of Uzbekistan No. IAP 04106. Sh.Zh. Shamsiev, I.I.Diveev, A.S. Mustafaev and others (2008). Method for the development of oil and gas condensate fields.
7. Patent of the Republic of Uzbekistan No. IAP 04816 dated 20.07.2011 Sh.Zh. Shamsiev, II.Diveev, A.S. Mustafaev and others. Method of developing oil and gas condensate fields in conditions of formation of water-oil emulsion.
8. G'ofurovich, H. O., Abdurashidovich, U. A., O'g'li, I. J. R., & Ravshanovich, S. F. (2020). Prospects for the industrial use of coal in the world and its process of reproducing. Prospects, 6 (5).
9. Akramov, B. S., & Khaitov, O. G. (2015). Oil displacement by water in an electric field. Europaische Fachhochschule, (11), 38-39.
10. G'afurovich, K. O. (2020). Modern State And Methods Of Enhancing The Productivity Of Field Progress In The South-Eastern Part Of Bukhara-Khiva Region. The American Journal of Social Science and Education Innovations, 2(09), 423-432.
11. Khayitov, O. G. (2020). Evolution Of Petroleum Stratum Efficiency By-Multi-Factor Regression Analysis. The American Journal of Engineering and Technology, 2(08), 79-84.
12. G'afurovich, K. O., Abdurashidovich, U. A., & Ogli, B. A. O. (2020). Small Torch Progress In Prospects Gold Mining In Improving Countries. The American

Journal of Interdisciplinary Innovations and Research, 2(09), 65-72.

13. Akramov, B. S., & Khaitov, O. G. (2017). Oil displacement by water in an electric field. Austrian Journal of Technical and Natural Sciences, (3-4), 20-22.
14. Razzakov, S. J., Rakhmanov, B. K., & Akhmedov, J. D. (2021). Study Of The Influence Of Light Weather On The Mechanical Properties Of Para-Aramid Filaments. The American Journal of Engineering and Technology, 3(04), 35-41.
15. G'afurovich, K. O. (2020). Current State And Ways To Improve The Efficiency Of Field Development In The South-Eastern Part Of The Bukhara-Khiva Region. The American Journal of Applied sciences, 2(09), 194-206.
16. Khayitov, O. G. (2019). On the formation of abnormally high and abnormally low reservoir pressures. In VI International Scientific And Practical Conference.«Global science and innovations (pp. 82-86).
17. Abdullaev, I. N., Akhmedov, Z. D., Rakhmanov, B. K., & Zhurabaeva, R. T. (2020). State and prospects of production and operation of synthetic woven belts (table) for load-handling devices (hd) in the Republic of Uzbekistan. Journal of Tashkent Institute of Railway Engineers, 16(4), 106-109.
18. Khayitov, O. G., Nabieva, N. K., & Makhmudov Sh, N. (2013). Estimation of the degree of influence of the grid density of wells on the oil recovery coefficient of sub-gas oil deposits. Ural. Proceedings of universities. Mining journal, (6), 46-50.
19. Shafievich, A. B., Gafurovich, K. O., & Charcoal, N. J. F. (2017). Oil displacement by water in an electric field. Austrian Journal of Technical and Natural Sciences, (3-4).
20. G'afurovich, K. O. (2020). Modern State And Methods Of Enhancing The Productivity Of Field Progress In The South-Eastern Part Of Bukhara-Khiva Region. The American Journal of Social Science and Education Innovations, 2(09), 423-432.
21. Hayitov, O. G. (2013). NabiyevaN. To., Mahmudov Sh. N. The evaluation of the impact of well spacing on oil recovery factor oil of oil deposits. Izvestiya vuzov. Mining journal". Uralsky, (6), 46-50.
22. Zikirov, M. C., Qosimova, S. F., & Qosimov, L. M. (2021). Direction of modern design activities. Asian Journal of Multidimensional Research (AJMR), 10(2), 11-18.
23. Shafievich, A. B., & Gafurovich, K. O. Section 5. Mechanics. Austrian Journal of Technical and Natural Sciences, 20.
24. Avazovna, A. H., & Gafurovich, K. O. Section 4. Technical science. Austrian Journal of Technical and Natural Sciences, 16.