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Biofuels For The Oil Industry-Modern Status-Current Issues And Development Prospects

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ABSTRACT

Despite predictions that the fuel industry will supposedly be out of business in the near future, experts predict that minerals such as oil and gas will be around for a long time and will not go down fast yet. However, a paradigm shift in the energy complex is bound to happen - for example, blue fuel (aka natural gas) is expected to become several times more popular with the public than black gold (oil), which currently has a significant influence on the global economy. Many enhanced oil recovery methods include the use of microbial surfactants and biopolymers. These compounds can be obtained by exploiting the potential properties of microorganisms to produce them. The following article focuses on effective oil recovery methods using bio products.

KEYWORDS

Oil, oil production, thermal method, oil recovery, seismic data, polymer, bio products.

INTRODUCTION

The development of oil wealth is gradually leading to its expansion, increasing the share of hard-to-recover oil reserves (TOR) and the lower part of the products. The average estimated kinetic field of sediments is now about 30% and gradually decreasing. New reagents-products of biotechnology are promising solutions to the problems of enhanced oil recovery. Microbiological methods of oil production process support increase, because they are convenient for small capital investments, highly effective, safe for the living environment, can be used in oil fields with different geological and chemical parameters and technologies in the field of oil industry [1]. Oil production is performed in two ways. The first is the production of biomass and metabolic products of microorganisms at the surface, followed by the introduction of biotechnology reagent products into the reservoir. These methods are based on improving the oil displacement properties of hydropower by using compounds such as surfactants, surfactants, polymers, solvents, acids and gases. The second trend, which has become widespread in Russia's oil regions, involves activation of microbiological processes and the formation of robotic metabolites directly in the reservoir, either through robotic reservoir activities or by injecting them into the reservoir. Microorganisms can affect oil displacement through several mechanisms: the formation of acids, which dissolve host rocks and increase porosity values; the formation of gas, which reduces oil viscosity, increases pressure and dissolves the matrix; formation of solvents, which are medically involved in oil production or as auxiliary surfactants, imposing interfacial tension and increasing oil mobility; the formation of biopolymers and other compounds that emulsify oil, reducing its tension at the oil-displacing fluid interface; and the formation of microbial biomass that causes oil emulsification, changing the number of rocks. New strains producing bioproducts for oil production are therefore of great interest to researchers. These substances are highly diverse, often with a unique composition and structure. All this expands the scope of their potential application in the oil and gas industry. The synthetic polyacrylamide-based polymers currently used as water flooding thickeners are insufficiently effective, and the breakdown products they contain are environmentally hazardous.

Most of the industry's oil fields have entered a late stage of development; the proportion of hard-to-recover reserves is steadily increasing. Progressive watering of wells and reservoirs, the retirement of wells from the existing stock due to limited watering and physical deterioration, reduction of the efficiency of geological and technical measures taken, reduction of oil production - these are visible difficulties in developing oil fields with hard-to-recover reserves. Traditional methods do not allow to extract residual oil reserves from deposits, methods of oil recovery enhancement (EOR) and production enhancement (PE) are topical. The use of EOR in the development of waterflood centers involves the following tasks:

First, an increase in the hydrodynamic component of the water flood method because of the cyclic injection process, changing the direction of filtration flows, the organization of new water flood centers,

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optimization of the density of wells, forced withdrawal, etc. This is the task of hydrodynamic improvement of oil recovery. Second, the reduction of the difference in physical and chemical properties of formation oil and displaced water by adding to the latter surface-active agents, thickeners, alkalis and other chemical reagents, which reduce interphase tension at the oil-water interface, increase water viscosity and improve its detergent properties; this is the task of physical and chemical EOR. Thirdly, a certain role is assigned to thermal, gas and microbiological EOR. The following classifications of EOR and MFTs are known in the industry: thermal methods: Steaming; in situ combustion; hot water oil displacement; cyclic steam treatment of wells [2].

Gas methods: Air injection; hydrocarbon gas exposure; carbon dioxide exposure; nitrogen, flue gas exposure, etc.

Chemical methods: oil displacement with aqueous surfactant solutions; oil displacement with polymer solutions; oil displacement with alkaline solutions; oil displacement with acids; oil displacement with chemical reagents compositions; microbiological effects.Hydrodynamic methods: Drilling, HF; involvement in the development of undrained reserves; barrier flooding in gas and oil fields; non-stationary cyclic flooding; forced diversion of fluids; step-thermal flooding.

Combined Methods Group: Combined hydrodynamic and thermal methods; hydrodynamic and physical-chemical methods; thermal and physical-chemical methods; other similar methods.

Physical Methods to Increase Well Flow Rate: Hydraulic fracturing; electromagnetic action; wave action; other similar methods. There are currently more than a hundred modifications of relevant technologies. The existing variety of classifications and terms associated with enhanced oil recovery methods requires a clear explanation in each case. This applies to bottomhole stimulation techniques, which in many cases are unjustifiably included in EOR reporting. The same applies to hydraulic fracturing techniques that are designed to stimulate oil production and have no significant impact on ultimate oil recovery. The use of microbial exopolysaccharides (EPS) is promising because it yields highly viscous solutions over various physical and chemical environmental factors. The first EPS, xanthium, has been used in the oil industry for four decades, and BP-92 emulsion has also been used there, but the list of EPS reagents is short. The search for EPS bio products is still relevant, especially because of the wide variety of oilfield conditions and the consequent need for various high-tech reagents. Surfactants produced by chemical synthesis are used in various sectors of agriculture, medicine, industry, including oil production and refining, as well as for bioremediation of oil-polluted ecosystems [3]. Compared to chemically derived surfactants, bio surfactants have better environmental compatibility, high foaming, selectivity and specific activity at elevated temperatures, pH and salinity. Moreover, they are biodegradable and nontoxic. The isolated strains of producers of these compounds can be cultured in both industrial reactors and oil reservoirs. It is important to seek out and study environmentally friendly biological bacterial products such as exopolysaccharides and surfactants for use in oil drilling and production processes and for bioremediation of oil-contaminated ecosystems. The ability of microorganisms to synthesize polymeric compounds has long been known. Indeed, most microbial cell components are polymers. While there is a wide variety of polymers that can be produced by microorganisms, only some of them are economically viable for industrial use. Biopolymers are high-molecular-weight compounds synthesized by many microorganisms. They are often synthesized when carbon compounds are not a growth limiting factor. Among biopolymers, polysaccharides are the most interesting for oil production. The ability of polysaccharides to alter the rheological properties of water by causing the gel formation and affecting the properties of aqueous solutions in flow has led to increased interest in these compounds for use in oil production. Microorganisms synthesize many polysaccharides in the form of extracellular capsules or slides that are not bound to the cell wall. They contain a small set of monosaccharides (neutral hexoses, methylpentoses, ketosaccharides, aminosaccharides, iron acids), but their various combinations yield polymers with different physical properties. Microorganisms that form polysaccharides are found in a wide variety of environments. Polymers are synthesized in both aerobic and anaerobic cultures of microorganisms. Both hemophilic microorganisms and psychrophilic microorganisms produce polysaccharides most intensively. At present in industrial. Many microbial polysaccharides - dextran, xanthan, gellan gum, zanflo and polytran - are produced on a large scale. The gradual increase in hard-to-recover oil reserves unrecovered after waterflooding, in areas where large material resources have already been invested, has for a decade predetermined the need to pay more attention to new enhanced oil recovery methods: physico-chemical, thermal and gas. To a large extent, the reasons for using physico-chemical methods are objectively related to the structure of residual oil reserves, a significant part of which is concentrated in watered fields, in low-permeability reservoirs. Compared to water-soluble synthetic polymers traditionally used in oil production, particularly polyacrylamide (PAC), biopolymers have several significant advantages, including those that allow their use in harsh environments where the use of synthetic polymers is ineffective. Of all biopolymers, natural and plant polysaccharides are used in oil production. The most widely used plant polysaccharides are cellulose ethers and starches, including modified ones in drilling, guar as a foam stabilizer and gelling agent in hydraulic fracturing (fracking), cellulose in the form of ethers and wood flour in diversion technologies. The main advantage of natural plant polysaccharides is their low cost; however, their technological parameters are low, which narrows the field of application. Therefore, chemically modified derivatives of cellulose, starch and guar are used, which have many technological properties.

CONCLUSIONS

One of the main priorities of the state policy in oil production industry is to increase the oil recovery factor and to reduce the energy consumption and the cost of the produced oil. Recently a great emphasis has been placed on energy-saving resource and technology. The application of oil production intensification techniques is relevant. Although microbiological methods of oil recovery enhancement have been known for a long time, they became widely applied only relatively recently.

Biosurfactants of rhamnolipid nature have been widely used in oil production processes. Their application is promising in waterflooding of oil reservoirs. Microbial biosurfactants (biosurfactants) have the advantages over synthetic ones are enormous, due to their better degradation and usage, which excludes environmental pollution, less sensitivity to extreme temperatures, pH and salinity, as well as various biological activities and non-toxicity. However, MB is not widely produced and used at present due to its high cost and insufficient study of the issue. Microorganisms produce many potentially important surfactants (glycolipids, lipoproteins, lipopeptides, phospholipids, neutral lipids and fatty acids). The physiological role of most microbial biosurfactants remains unclear. In this regard, the use of microbial surface active producers to reduce the viscosity of heavy oils and remove sulfur from oil is promising. Therefore, understanding the relationship between the structure and activity of biosurfactants and studying their properties open up the possibility of a successful search for new unknown biosurfactants for use in the oil industry. Thus, on the basis of the literature review given in the article, it is possible to conclude that the development and application of new methods of enhanced oil recovery on the basis of environmentally safe biosurfactants can significantly reduce the number necessary capital investments for obtaining the desired economic effect.

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