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APPLICATION OF SUPERCRITICAL FLUIDS IN THE OIL INDUSTRY

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Hard-to-recover oil reserves (HTR) play an important role in the modern oil industry. Their extraction is complicated by high density and viscosity, high sulfur content and low permeability of reservoir rocks. Due to the depletion of traditional oil reserves, the development of technologies that make HTR extraction possible and economically viable is becoming increasingly important. One of these technologies is the use of supercritical fluids (SCF). The use of SCF is a promising area in the oil industry, which is only beginning to be implemented in it; at the moment, research and practical implementation of this technology are actively being carried out. Supercritical water (SCW) and supercritical carbon dioxide (SC CO_2) have great prospects for practical application.

SCW is water at a temperature above 374 °C and a pressure of 221 atm. The use of SCR is ideal for developing deposits of high-viscosity and heavy oil, which is classified as hard-to-recover oil. Its use allows changing the properties of oil, making them more favorable for extraction and processing. For example, when SCR with a temperature of 440°C was applied to oil with unfavorable parameters for its extraction, the density of the oil decreased by 8%, viscosity by 99.9%, and sulfur content by 42.3%. These transformations will facilitate the lifting of oil to the surface due to the reduction of density and viscosity, reduce the cost of oil refining by reducing the sulfur content in it, and make the development of previously unprofitable deposits or impossible to develop deposits profitable. Another advantage of this technology is its environmental friendliness. During its use, the soil and atmosphere are not polluted, which makes this technology safe for the environment [1].

SCF are also promising for processing oil sludge. Oil sludge can be toxic, in addition, they may contain up to 50% of oil products that could be extracted, and significant funds are spent on their disposal. At the

moment, units are being developed that are capable of extracting up to 95% of hydrocarbons, which will allow to obtain up to 21.5 thousand tons of oil per year from one unit with a capacity of 6 m^3/hour.

Thus, this technology will improve the environmental friendliness of the oil industry, as well as increase economic indicators, due to a decrease in the cost of burying oil sludge and due to obtaining additional funds due to obtaining additional oil of almost commercial quality during the processing of oil sludge.

The next promising area of the use of SCF is hydraulic fracturing (HF). The development of HF technologies plays an important role, since a significant part of the hard-to-recover reserves is characterized by reservoir rocks with low permeability. For HF with the help of SCF, HF CO_2 is used. One of its advantages is that it is more environmentally friendly than traditional hydraulic fracturing technologies, and this technology avoids problems associated with clay swelling. In addition, studies have shown that CO_2 SC has a 4.4 times greater ability to form cracks than water-based hydraulic fracturing. Another advantage of this technology is that when using it, the required fracturing pressure is 50% less than with water hydraulic fracturing. Thus, being more environmentally friendly, efficient and cost-effective, this technology can allow for the development of oil, the occurrence of which is characterized by low-permeability reservoir rocks [2].

Based on the information provided, we can deduce that utilizing Supercritical Fluids (SCF) in the oil industry offers new possibilities, including the exploration of previously unexploited fields, the environmentally friendly processing of oil sludge, and improving the ecological sustainability of the oil sector. This makes the technology a crucial aspect for the industry's advancement.

References

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