

Nanoparticles Could Improve Oil Production

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A team of scientists from Siberian Federal University together with their colleagues from Novosibirsk studied the effect of nanoparticles on oil production efficiency. When added to the water that displaces oil from a reservoir, nanoparticles improve the separation of oil drops from mine rock and their washing to the surface. The work received a grant from the Russian Science Foundation, and an article about it was published in the Journal of Molecular Liquids.

The oil and gas industry is one of the main sectors of the Russian economy and its sustainable development equally depends on the discovery of new oil fields and rational utilization of the existing ones. Efficiency could be increased through new methodologies that would improve oil production, and one of the ways to reach this goal is to use nanotechnologies.

Nanomaterials possess many unique properties that make them useful in different areas of the oil and gas industry. They are small in size and have high chemical and thermal stability. Because of these characteristics, low-concentration suspensions of nanoparticles can be pumped into an oil well to improve oil recovery. Nanoparticles increase the wettability of oil-bearing strata, making it easier to separate oil from mine rock.

Another factor that affects the efficiency of oil production is interfacial tension: a force that occurs at an interface between two liquids. Oil in mine rock is subject to the capillary force that keeps it in place. To weaken it, interfacial tension has to be reduced, and this is exactly what nanoparticles do.

A team of researchers from [Siberian Federal University](#) and the [Kutateladze Institute of Thermophysics](#) of the Siberian Department of the Russian Academy of Sciences [studied](#) the effects of the size, concentration, composition, and surface of nanoparticles on the wettability and interfacial tension of crude oil. The goal was to develop a liquid with special recovery-improving additives. Before the experiment, the team prepared nanoliquids based on distilled

water and used silicon dioxide (SiO₂) and aluminum oxide (Al₂O₃) powders as nanoparticles.

To measure the wettability and interfacial tension, the team used an automatic tensimeter: a device that measures the geometrical parameters and therefore the surface tension of liquid drops. The study showed that even the smallest amounts of nanoparticles added to the liquid dramatically changed rock wettability characteristics which led to increased oil recovery.

"Systemic research on the use of nanosuspensions and nanoemulsions in oil and gas field development technologies is extremely important for the industry. However, our project is also relevant from the point of view of fundamental knowledge it provides. Although the properties of nanosuspensions remain largely understudied, it is clear that they are dramatically different from regular coarse suspensions," said Andrey Minakov, a Candidate of Physics and Mathematics, the head of the RSF project, and an assistant professor at the Department of Thermal Physics, SFU.

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