

ENHANCED OIL RECOVERY USING ONE-DIMENSIONAL NANOPARTICLES

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Enhanced Oil Recovery (EOR) is based on three stages; primary, secondary, and tertiary oil recovery processes. In the primary oil recovery process, the natural pressure of the reservoir is used, and in the secondary process, water or gas is injected to enhance the oil recovery. The injection of nanofluids into the oil reservoirs is a recent approach to chemical flooding in the tertiary process. Unlike conventional EOR techniques used in the primary and secondary stages, it has the potential to produce an extra portion of oil. Aluminium oxide, magnesium oxide, silicon dioxide, carbon nanotubes, bacterial cellulose nanocrystals, graphene oxide, and clay materials can potentially be used in nano flooding. This study was carried out to compare the performance of selected one-dimensional nano powders (metallic oxides) for EOR, which are aluminium oxide, magnesium oxide, and silicon dioxide, by dissolving 0.4% of each nano powder into the brine (salted water: since it helps to reduce the dynamic interfacial tension) separately. A new mathematical model was built to find the saturation of nanofluids in the fingering phenomenon for the inclined oil layer. The fingering phenomenon occurs during the second and third oil recovery processes when a fluid contained in a porous medium is displaced through some other of lesser viscosity, as opposed to normal displacement of the entire front. Second-order approximate solutions for saturations of nanofluids for inclination angles 0^0 and 10^0 were obtained when the least squared residual error occurs using the Method of Directly Defining the inverse Mapping (MDDiM), which is a novel technique to solve nonlinear differential equations. The results revealed the highest saturation from the brine mixed with aluminium oxide compared to others and also noted that the mixture with magnesium oxide gives the lowest saturation. Since the oil recovery factor is directly proportional to the saturation of the injective fluid, we can conclude that the brine with aluminium oxide benefits the EOR.

Keywords: Aluminum oxide, Enhanced oil recovery, Magnesium oxide, Method of directly defining the inverse mapping, Silicon dioxide