ENERGY INDUSTRY INSIDER

Advanced Drilling Technology

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BULLETIN

FutureBridge

WHAT'S INSIDE!

- **Novel nanoparticles for EOR process - (graphene oxide (N-(1-naphthyl) ethylenediamine)) (G-NEA)**
- **High molecular weight nanostructured polymers (NSPs) (including copolymer of acrylamide and 2-acrylamido-2-methylpropanosulfonic acid in combination with chromium (III) acetate**
- **Aluminum oxide nanoparticles - highest recovery factor, displacement efficiency, and interfacial tension reduction**
- **Fe_3O_4/eggshell nanocomposites and its effect in EOR process**

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Islamic Azad University, Iran and Research Institute of petroleum Industry, Iran experimenting the effects of a novel nanoparticle on enhanced oil recovery process

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Sahand University of Technology, Iran and Ilam University, Iran investigating high molecular weight polymeric nanoparticles for application in fractured oil reservoirs

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Federal University of Technology, Nigeria experimenting with metallic oxides nanoparticles

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Petroleum University of Technology, Iran, Soran University, Iraq, Cihan University -Erbil, Iraq and Edith Cowan University, Australia experimenting with Fe_3O_4/eggshell nanocomposites and its effect in EOR process

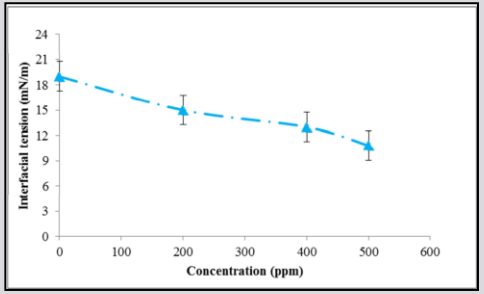

Fig1: IFT diagram at different concentrations of G-NEA nanofluids

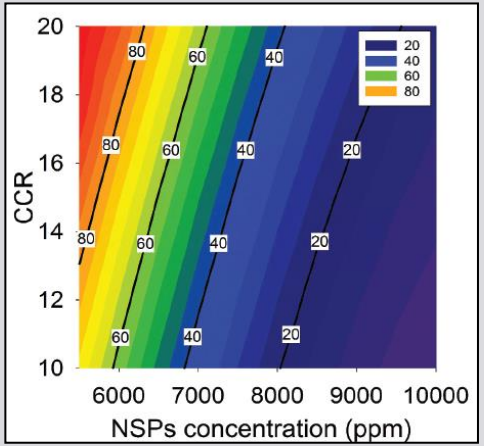

Fig 2: Isogram of gelation time at 90°C and DW as gelant solvent

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Islamic Azad University, Iran and Research Institute of petroleum Industry, Iran experimenting the effects of a novel nanoparticle on enhanced oil recovery process

- Nano-graphene oxides were synthesized using Hummer's method and then they were subjected to surface modifications. The new compound is (graphene oxide (N-(1-naphthyl) ethylenediamine)) (G-NEA), where G stands for graphene oxide.
- The interfacial-tension (IFT) measurement and rock angle measurement in the presence of nanofluid were investigated.

The results showed that when the G-NEA nanofluid concentration increased, the IFT value of 19.34 (mN/m) for deionized water changed to 10.8 (mN/m) for 500 ppm GNEA and the contact angle decreased from the initial value of 166º to 40º, indicating the tendency of the wettability alteration of the rock to a water-wet conditions.

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Sahand University of Technology, Iran and Ilam University, Iran investigating high molecular weight polymeric nanoparticles for application in fractured oil reservoirs

- Gelation kinetic of high molecular weight nanostructured polymers (NSPs) (including copolymer of acrylamide (AAm) and 2-acrylamido-2-methylpropanosulfonic acid (AMPS) in combination with chromium (III) acetate was studied by bottle test and rheology measurements.
- The potential of the NSPs gel to block harsh condition fractures was investigated by performing core flow experiments.

The results of core flow experiments showed that the NSPs gel has strong blocking capacity to reduce fracture permeability by two orders of magnitude. Gel blocking efficiency was found to be depended on both the fracture opening and salinity difference between gel solvent and produced water.

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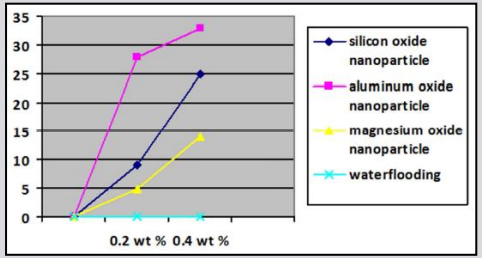

Fig 3: Comparison of 0.2 and 0.4 wt% recovery factor for some metallic oxide nanoparticles

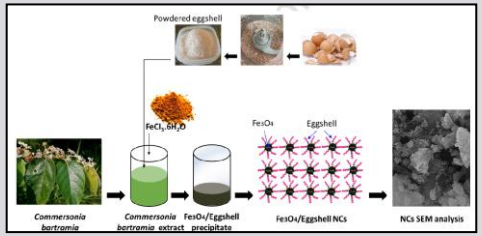

Fig 4: Schematic illustration of the procedural steps of NC synthesis

17 July 2020

Federal University of Technology, Nigeria experimenting with metallic oxides nanoparticles

- The recovery efficiency of three metallic oxides nanoparticles and their different characteristics were investigated.
- It was found that aluminum oxide nanoparticles reduced interfacial tension and viscosity with a very high recovery factor, silicon oxide nanoparticles rapidly reduced wettability with a high recovery as well as magnesium oxide nanoparticle with the least. Each of the metallic oxide particle experimented and analyzed in a core flooding system have their very peculiar property uniquely suitable for EOR at low cost and high recovery.

Aluminum oxide nanoparticle is the best compared to the other metallic oxide nanoparticles experimented on. It has the highest recovery factor, displacement efficiency, and interfacial tension reduction etc.

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Petroleum University of Technology, Iran, Soran University, Iraq, Cihan University -Erbil, Iraq and Edith Cowan University, Australia experimenting with Fe3O4/eggshell nanocomposites and its effect in EOR process

- The performance of CTAB (cetyltrimethylammonium bromide) and TR-880 surfactants was improved using a synthetic Fe3O4/eggshell nanocomposite (NC). This NC was synthesized in an environmental-friendly manner from the extract of the Commersonia bartramia plant.
- The performance of these surfactants in EOR was evaluated—in terms of the wettability of the carbonate rock and decreased IFT—under the influence of dissolved sodium chloride (NaCl) and the synthesized NC.

The prepared nanofluid from the Fe_3O_4/eggshell NC decreased the IFT from 29.1 to 13.238 mN/m and CA from 136.3° to 70.28°. A hybrid chemical solution comprising NC and surfactant gave the best performance, decreasing the IFT and CA to 0.18 mN/m and 60.7°, respectively.

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Fe_3O_4/eggshell nanocomposites and its effect in EOR process

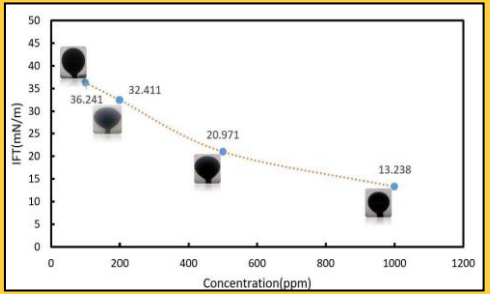

Fig 5: IFT of crude oil / nanofluids systems at different NC concentrations, at ambient temperature and pressure

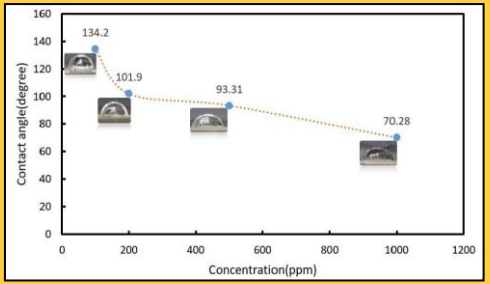

Fig 6: CAs of crude oil droplets on the surface of carbonate rocks in the presence of nanofluids with different NC concentrations, at ambient temperature and pressure

- The objective of the experiment was to improve performance of CTAB (cetyltrimethylammonium bromide) and TR-880 surfactants was improved using a synthetic Fe3O4/eggshell nanocomposite (NC).
- This NC was synthesized in an environmental-friendly manner from the extract of the Commersonia bartramia plant.
- The performance of these surfactants in EOR was evaluated—in terms of the wettability of the carbonate rock and decreased IFT—under the influence of dissolved sodium chloride (NaCl) and the synthesized NC.
- The prepared nanofluid from the Fe_3O_4/eggshell NC decreased the IFT from 29.1 to 13.238 mN/m and CA from 136.3° to 70.28°.
- Fe_3O_4@eggshell NC was more effective in reducing the IFT and changing the wettability to water-wet when dispersed with CTAB surfactant compared with distilled water or TR-880 surfactant.

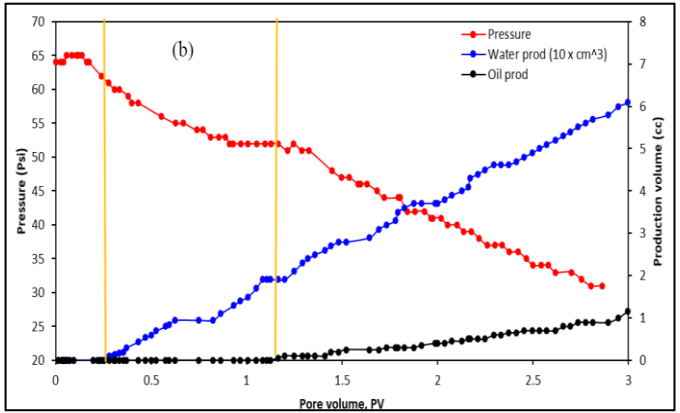

Fig 7: Oil production, water production and pressure drop during the flooding stages: a) secondary recovery using brine injection (30,000 ppm); b) tertiary recovery using nano-hybrid flooding (500 ppm Fe_3O_4@eggshell NC + 1000 ppm CTAB surfactant)

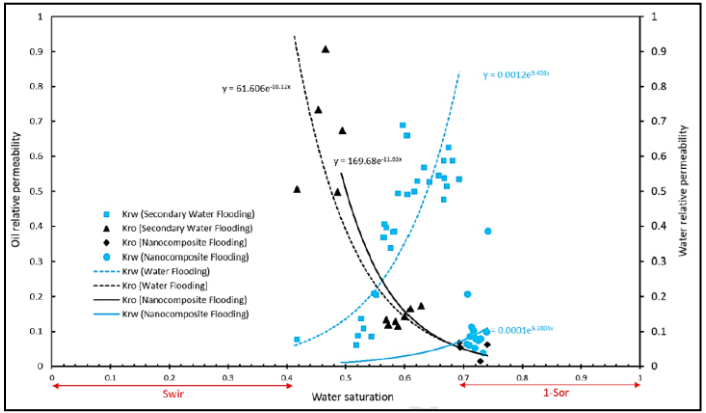

Fig 8: Relative permeability curves of water and oil of the oil-wet carbonate rock during the brine (30,000 ppm) injection and nano-hybrid (500 ppm Fe_3O_4@eggshell NC + 1000 ppm CTAB) flooding estimated using the JBN method

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