Novel Approach to Enhance Oil Recovery Using Superhydrophobic/Oleophilic Self-Cleaning PP/MWCNT/WO3 Material

AlSinan, Jana (School: Dhahran Ahliyya School)

According to the International Energy Agency, the oil demand in 2019 was approximately 4,474 million tonnes. Current enhanced oil recovery (EOR) methods include gas, thermal, and chemical. However, these methods have detrimental effects on the environment. Thermal recovery emits greenhouse gases, while gas injection can become incredibly expensive and inefficient. Chemical recovery creates fine emulsion and becomes uneconomically beneficial. The aim of this study is to create a practical, efficient, ecologically safe, and affordable EOR method using polypropylene (PP), tungsten oxide (WO3), and multi-walled carbon nanotubes (MWCNTs). To synthesize the composite, WO3 and MWCNTs were mixed, diluted in ethanol, then homogenously mixed with polypropylene. The oil recovery of the composite was tested using a combination of two tubes; a punctured one where water and emulsified mixture of hydrocarbons representing the crude oil are pumped; and another bigger tube encasing it filled with the composite. Each tube was attached to a pipe leading to a beaker to collect the recovered oil and water. After 15 cycles, it was proven that the composite's superhydrophobic/oleophilic characteristics will eliminate the emulsion. It was proven that a 100g of the composite was able to recover hydrocarbons at a flow rate of 6,535 L/m2/h from the water. Regeneration was conducted on different types of hydrocarbons, alkanes, alkenes, and alkynes for 10-cycles/each proving that the composite does not lose its properties, while still able to separate oil/water emulsions. This method may be applied on a larger scale to create a new efficient, environmentally-friendly, low-cost EOR.

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