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Short Communication

Influence of Clay Content on Surfactant- Polymer Flooding

Atef Abdelhady[1*]

[1] Department of Petroleum, Head of Petroleum Department the British University, Egypt.

Abstract

This work deals with the study of oil displacement by surfactant slug driven by a protective slug of a polymer solution against the driving water. The study is performed on a dimensionally scaled laboratory model. The used porous medium consists mainly of packed sand, but with variable percentages of clay. The results indicated that the recoverable oil is generally affected by both the surfactant slug concentration and clay content. It is directly proportional to the surfactant slug concentration and inversely to the clay content. An optimum value of surfactant slug concentration at each clay content was also determined. The Tertiary oil recovery of a sandstone reservoir, like that of the Rudeis formation pay zone in July oil field can by increased with increasing the surfactant slug concentration according to their considerations: (1) In the case where the clay content is less than 10%, it is more efficient to use a large pore volume of surfactant slug with low concentration 4–5%. (2) For clay content greater than 15%, it is recommended to use a small pore volume of surfactant slug, with high concentration (greater than 5%) to compensate for the surfactant loss and consumption. (3) When clay content exceeds 20%, it is not recommended to use the surfactant polymer flood method.

Introduction

Enhanced oil recovery can be defined as the recovery oil which cannot be produced economically from oil reservoirs by primary or secondary methods. Enhanced oil recovery with surfactant polymer flooding is being pursed as a means of increasing energy supply to the oil reservoir supply. Laboratory and field work is under way on both- and high-concentration Processes to optimize the method if injecting surfactant and polymer.

This paper describes the effect of surfactant polymer flood method on tertiary oil recovery with respect to clay contents and surfactant concentrations.

Currently viscosities of order 10 to 100 cp are obtained.

Polyacrylamides, which is used in this work, appear to be the only polymer used in the field in a large scale as a mobility control.

Reduction of interfacial tension between the displaced phase and displacing phase is probably the main recovery mechanism of surfact polymer flooding. Thus, the capacity forces that entrap oil as blobs in the pore spaces are weakened enough to allow its mobilization by viscus and gravitational forces.

Surfactant / polymer flooding screening criteria

The process and reservoir geology parameters were developed as screening criteria for use in assessing the potential suitability of oil reservoirs for surfactant flooding. Future developments that will extend the applicability of the surfactant flooding process will largely affect the range of conditions under which the chemical slug may be effective. To account for these improvements, the screening criteria incorporate changes with time.

A successful MP flood must achieve three things for effective oil recovery

1- The MP slug should propagate at optimal conditions.

2- Surfactant concentration should be big enough so that some of it is not retained by permeable surfaces.

3- The active surfactant should sweep a large portion of the reservoir without excessive due to dispersion or channeling.

The laboratory experiments are mainly designed to determine:-

1. Microscopic sweep characteristics, 2. Residual oil saturation, 3. Adsorption, dispersion, 4. Degradation of injection products.

Reach in with formation water. Many surfactant / Polymer have failed or performed for below expectation:-

1. Inadequate to balancing well patterns, 2. Lack of area or vertical confinement,

3. Poor or unknown reservoir characteristics including.

- Clay content, - Fractures, - Channels, - Bottom water, Unsuitable well completions, Poor infectivity profiles.

Surfactant – Polymer Flooding Process Design

Fundamental requirements for a successful surfactant / polymer flood are:-

1. The surfactant must mobilize the residual oil and reduce its saturation essentially to zero by lowering the interfacial tension.

2. The retention of the surfactant must be sufficiently low that it can propagated across the entire oil reservoir using only a small amount of injected surfactant.

3. The mobility control must be sufficiently good that high sweep efficiency occurs in the reservoir so that the mobilizes oil will be banked up and efficiently displaced and captured by the producing wells.

4. The reservoir characterization nut take into account the reservoir characteristics by appropriate

Corresponding author: Atef Abdelhady, Department of Petroleum, Head of Petroleum Department the British University, Egypt, Tel: +202 26300013; Fax: +202 26300013; E-mail: calil@sc.usp.br

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- Well spacing.

- Well control.

5. Core floods should be conducted in reservoir cores to evaluate the oil recovery performance and surfactant retention.

Cost Of different chemical flooding

As the oil prices rise, so does the cost of chemicals, but not in the same proportion

Typical Costs: Polymer - $3/lb, Surfactant- $1.20/lb, Crude oil - $60/bbl, Caustic - $0.60/lb, Isopropanol - $20/gallon, Micellar slug- $25/bbl

Process Efficiency: volume of oil recovered per unit volume (or mass) of chemical slug injected, General Reservoir Parameters for Surfactant/polymer flooding

Geologic Criteria: - Only sandstone reservoirs.

Minor variations in uniformity, if good well- to- well correlations exist.

Exclude reservoirs with extensive faulting, conglomerate rock, or lenses – type deposits interceded with shale, Carbonate reservoirs excluded.

Other Considerations: - No bottom water – drive reservoirs, No thin oil column overlain with gas, No reservoirs where fluid movement is primarily through fractures.

Conclusion

The Tertiary oil recovery of a sandstone reservoir, like that of the Rudeis formation pay zone of Egyptian July oil field can be increased with increasing the surfactant slug concentration according to the following consideration:-

1- In case of clay content greater than 10% , it is more volume efficient to use a large pore of surfactant slug with low concentration (4- 5 %).

2- For clay content small pore volume of Surfactant slug, with high concentration greater than 5% to compensate the surfactant loss and consumption.

3- When clay content exceeds than 20%, it is not recommended to use the Surfactant-polymer flood method.

Recommendation The results indicate that the recoverable oil is generally affected by both:-

1- The surfactant slug concentration

2- Clay content it is directly proportional to the surfactant slug concentration and inversely to the clay content.

3- An optimum value of surfactant slug concentration at each clay content was also estimated.

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