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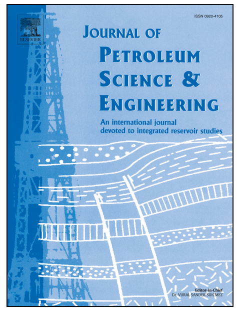

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Intermittent Ultrasonic Wave to Improve Oil Recovery

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Abstract

This paper presents the use of intermittent vibration as a cost-effective and environmentally friendly approach to enhance oil recovery (EOR). Previous research work has focused only on continuous ultrasonic vibration, but the continuous vibration has its limitation of the high cost of the production and maintenance of equipment because of the high energy generated. For this purpose, a 2D micro-model placed inside an ultrasonic bath under an ultrasound vibration was used to determine the effect of viscosity, intensity and the distance between the energy source and the micro-model. Dimensionless parameters were used to reduce the number of parameters to be studied by scaling the miscible and immiscible displacement in the porous media and to predict the fluid flow pattern. A stereo microscope with the camera mounted at the top of the micro-model recorded the displacement process. The snapshot of each time interval was used to give the estimate in percent (%) of the residual oil left in the micro-model. The outcome reveals that the use of intermittent vibration can recover more oil compared with the application using continuous vibration. The oil recovery increased with increase in the dimensionless parameters. The Reynold's number indicated that the flow was dominated by a laminar flow. The combination of intermittent vibration, high viscosity, high intensity and a short distance from the energy source gave the best recovery of oil.

Keywords: Ultrasound; Intermittent Ultrasonic Vibration; Micro-Model; Viscosity; Dimensionless Parameters; Enhanced Oil Recovery

1.0 Introduction

This study proposes the application of intermittent ultrasonic vibration as a cost-effective and environmentally friendly way to enhance oil recovery (EOR). Previous studies have concentrated on the use of methods where continuous ultrasound is applied but, the continuous process has its limitations. The main limits, because of the high energy generated, are the high cost of production and maintenance of the equipment. The continuous application of ultrasound could result to demulsification (Hamidi et al., 2014). Continuous ultrasound can lead to increase in temperature which might affect performance by causing a