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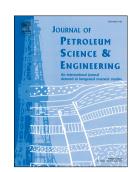
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ACCEPTED MANUSCRIPT

1	Intermittent Ultrasonic Wave to Improve Oil Recovery
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7 8 9	*Correspondence: <u>r-razuan@utm.my</u> Abstract
10	
11	This paper presents the use of intermittent vibration as a cost-effective and environmentally
12	friendly approach to enhance oil recovery (EOR). Previous research work has focused only
13	on continuous ultrasonic vibration, but the continuous vibration has its limitation of the high
14	cost of the production and maintenance of equipment because of the high energy generated.
15	For this purpose, a 2D micro-model placed inside an ultrasonic bath under an ultrasound
16	vibration was used to determine the effect of viscosity, intensity and the distance between the
17	energy source and the micro-model. Dimensionless parameters were used to reduce the
18	number of parameters to be studied by scaling the miscible and immiscible displacement in
19	the porous media and to predict the fluid flow pattern. A stereo microscope with the camera
20	mounted at the top of the micro-model recorded the displacement process. The snapshot of
21	each time interval was used to give the estimate in percent (%) of the residual oil left in the
22	micro-model. The outcome reveals that the use of intermittent vibration can recover more oil
23	compared with the application using continuous vibration. The oil recovery increased with
24	increase in the dimensionless parameters. The Reynold's number indicated that the flow was
25	dominated by a laminar flow. The combination of intermittent vibration, high viscosity, high
26	intensity and a short distance from the energy source gave the best recovery of oil.
27 28	Keywords: Ultrasound; Intermittent Ultrasonic Vibration; Micro-Model; Viscosity;
29	Dimensionless Parameters; Enhanced Oil Recovery
30 31 32	1.0 Introduction
33	This study proposes the application of intermittent ultrasonic vibration as a cost-effective and
34	environmentally friendly way to enhance oil recovery (EOR). Previous studies have
35	concentrated on the use of methods where continuous ultrasound is applied but, the
36	continuous process has its limitations. The main limits, because of the high energy generated,
37	are the high cost of production and maintenance of the equipment. The continuous
38	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

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