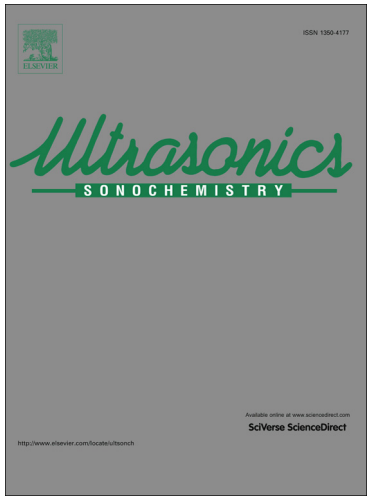

Application and Mechanism of Ultrasonic Static Mixer in Heavy Oil Viscosity Reduction

Chunwei Shi, Wei Yang, Jianbin Chen, Xiaoping Sun, Wenyi Chen, Huiyong An, Yili Duo, Mingyuan Pei

PII: S1350-4177(17)30078-0
DOI: http://dx.doi.org/10.1016/j.ultsonch.2017.02.027
Reference: ULTSON 3564

To appear in: *Ultrasonics Sonochemistry*

Received Date: 14 October 2016
Revised Date: 17 February 2017
Accepted Date: 17 February 2017

Please cite this article as: C. Shi, W. Yang, J. Chen, X. Sun, W. Chen, H. An, Y. Duo, M. Pei, Application and Mechanism of Ultrasonic Static Mixer in Heavy Oil Viscosity Reduction, *Ultrasonics Sonochemistry* (2017), doi: http://dx.doi.org/10.1016/j.ultsonch.2017.02.027

Application and Mechanism of Ultrasonic Static Mixer in Heavy Oil Viscosity Reduction

Chunwei Shi[1,2], Wei Yang[1], Jianbin Chen[2],Xiaoping Sun[1], Wenyi Chen[1], Huiyong An[1], Yili Duo[1],Mingyuan Pei[3]

1.Liaoning Shihua University, Fushun 113001,China

2. Administration Center of the Yellow River Delta Sustainable Development Institute of Shandong Province, Dongying 257001, China

3.Department of Applied Organic Materials Engineering, Inha University, 100 Inharo, Nam-gu Incheon 402-751, Korea.

Abstract: In the present study, heavy oil viscosity reduction in Daqing oil field was investigated by using an ultrasonic static mixer. The influence of the ultrasonic power on the viscosity reduction rate was investigated and the optimal technological conditions were determined for the ultrasonic treatment. The mechanism for ultrasonic viscosity reduction was analyzed. The flow characteristics of heavy oil in the mixer under the effect of cavitation were investigated using numerical modeling, and energy consumptions were calculated during the ultrasonic treatment and vis-breaking processes. The experimental results indicated that the ultrasonic power made the largest impact on the viscosity reduction rate, followed by the reaction time and temperature. The highest viscosity reduction rate was 57.34%. Vacuole was migrated from the axis to the wall along the fluid, accelerating the two-phase transmission and enhancing the radial flow of the fluid, which significantly improved the ultrasonic viscosity reduction. Compared to the vis-breaking process, the energy consumption of ultrasonic treatment process was 43.03% lower when dealing with the same quality heavy oil. The optimal process conditions were found to be as follows: ultrasonic power of 1.8 kW, reaction time of 45 min and reaction temperature of