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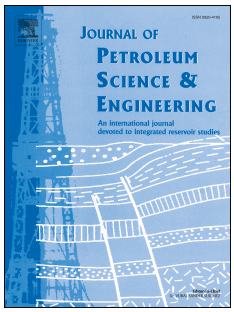

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Study on Pressure Interval of Near-miscible Flooding by Production Gas Re-injection in QHD Offshore Oilfield

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Abstract: Near-miscible flooding has gained increasingly more attention as it obtains the comparative recovery factor with the reduction of gas source expense and operating cost. It is much more promising for the reservoirs which the miscible flooding is considered unsuitable. However, the determination of the near-miscible pressure interval is a key question for the screening of near-miscible flooding. In this paper, oil and gas samples from QHD offshore oilfield are taken as an example. Firstly, PVT parameters of reservoir fluids, such as saturation pressure, volume factor, gas oil ratio, viscosity and density, were tested. Besides, with the fitting of experimental data, both empirical formulas, slim tube test and slim tube simulation were applied to obtain the minimum miscible pressure (MMP) under the conditions of different CO_2 contents (0%, 24%, 40%, 55%, 70%, 80%, 85%, 100%). On this basis, displacement efficiency and interfacial tension at different pressures were introduced and compared to establish a new method to divide the pressure interval of near-miscible flooding. Results show that the minimum near-miscible pressure (MNMP) is about (0.8-0.86) MMP. In addition, Lower limit of the CO_2 content in re-injection gas for achieving near-miscible flooding of the well QHD 29-2E-5 was determined. CO_2 content higher than 64% are estimated to be able to achieve near-miscible flooding, which can obtain comparable recovery and economy benefits. The wide range of CO_2 content (43.63-90.61%) of the re-injection gas provides big potential for the implementation of CO_2 near-miscible flooding in QHD oilfield. To our own knowledge, this is the first time that the interval of near-miscible pressure has been defined so explicitly.

Key words: Near-miscible flooding; production gas re-injection; Interval of near-miscible pressure; Empirical formula; Lower limit of CO_2 content

1. Introduction

The QHD 29-2 block, located at 173 km northeast of Tanggu, is an offshore oilfield of China with an average water depth of 27.6 m, covering approximately 2300 km^2. The main characteristics of the oilfield are thick oil zone, complex lithology, and strong heterogeneity. Conventional waterflooding cannot be implemented due to the small pores and