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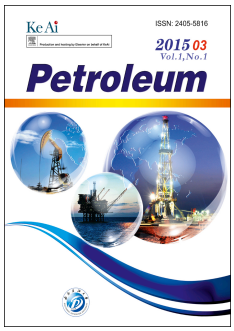

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Hu Jia, James J. Sheng

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Discussion of the feasibility of air injection for enhanced oil recovery in shale oil reservoirs

Hu Jia*[a, b] and James J. Sheng[a, b]

a. State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu, Sichuan 610500, China

b. Bob L. Herd Department of Petroleum Engineering, Texas Tech University, Lubbock, TX 79409, USA

Summary Air injection in light oil reservoirs has received considerable attention as an effective, improved oil recovery process, based primarily on the success of several projects within the Williston Basin in the United States. The main mechanism of air injection is the oxidation behavior between oxygen and crude oil in the reservoir. Air injection is a good option because of its wide availability and low cost. Whether air injection can be applied to shale is an interesting topic from both economic and technical perspectives. This paper initiates a comprehensive discussion on the feasibility and potential of air injection in shale oil reservoirs based on state-of-the-art literature review. Favorable and unfavorable effects of using air injection are discussed in an analogy analysis on geology, reservoir features, temperature, pressure, and petrophysical, mineral and crude oil properties of shale oil reservoirs. The available data comparison of the historically successful air injection projects with typical shale oil reservoirs in the U.S. is summarized in this paper. Some operation methods to improve air injection performance are recommended. This paper provides an avenue for us to make use of many of the favorable conditions of shale oil reservoirs for implementing air injection, or air huff 'n' puff injection, and the low cost of air has the potential to improve oil recovery in shale oil reservoirs. This analysis may stimulate further investigation.

1 Background

People may be confused by the two fossil fuel terminologies "shale oil" and "oil shale." Shale oil is more accurately termed "oil-bearing shale" or "tight oil", while "oil shale" is the rock that contains a solid organic compound known as kerogen (Fig. 1). Heating is needed to generate liquid oil synthetically from oil shale. Unlike oil shale, oil-bearing shale contains oil (some gas or condensate) trapped in relatively low porosity and permeable rock, usually shale, tight siltstone limestone, or dolomite. These rocks have been buried deeply enough to convert part of their kerogen into oil and gas. Because the hydrocarbons are locked in place so tightly that they cannot be released in economic quantities simply by drilling, shale-hosted oil plays are considered unconventional[1-2].