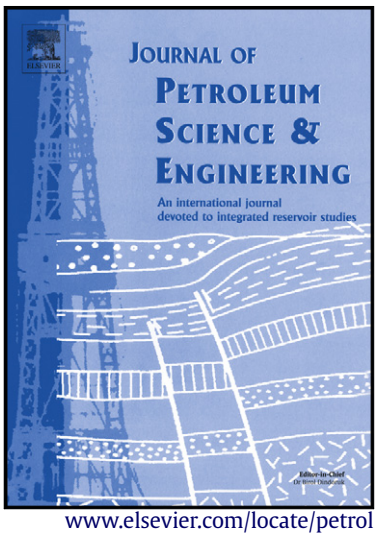

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Large Scale Applicability of the SOS-FR (Steam-Over-Solvent Injection in Fractured Reservoirs) Method: Optimal Operating Conditions through Numerical Simulation

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Abstract

Heavy oil reserves are considered to be the upcoming hydrocarbon resource. Yet, more efficient methods are needed as there are substantial economic and environmental drawbacks to the sole injection of steam and solvents. A combined application of these methods yielded promising results in the laboratory experiments. But optimal application conditions and cost lowering options need to be determined.

Steam-over-solvent injection in fractured reservoirs (SOS-FR) is a recently proposed method, which consists of an alternate injection of steam and hydrocarbon solvents to improve oil recovery over steam injection and to accelerate the solvent retrieval rate. This method was suggested to take advantages of sole thermal and solvent recovery methods in a staged technique and also to reduce the drawbacks of such methods using a hybrid one. For simplicity, the initial tests were done for hot-water conditions instead of steam and liquid solvents (Al-Bahlani and Babadagli, 2008; 2009a-b; 2011b). In our modification to this method, we introduced CO_2 as an alternative to hydrocarbon solvents for only one pressure and temperature condition (Naderi and Babadagli, 2012a and 2012b). The initial results of this study showed a moderate recovery of 50% OOIP on average for unfavorable matrix conditions (oil wet).

In the present study, the SOS-FR applications with CO_2 were tested at various conditions numerically and with different timings to improve recovery. First, the effect of different parameters was studied to obtain the best match between the simulation and experimental results. This exercise not only provided data for field scale simulations

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