Compositional Grading and its Effects on Optimization of a CO_2 Injection Project; A Case Study

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Abstract

In any comprehensive reservoir study the first step is an accurate assessment of the spatial distribution of the fluid components in both horizontal and vertical directions. Compositional grading, which refers to variation in fluid composition with depth, has been observed in many reservoirs. In most cases, the oil density and heavy components composition increase with depth while methane and other light components composition decrease with depth. Such a compositional grading can have a significant influence on various aspects of reservoir development. When considering gas injection, one must be aware that compositional effects (such as the development of miscibility) change with depth.Although there are numerous studies about compositional grading and all authors emphasized that variation of composition makes variation of miscibility condition, but all of them try to formulate this phenomenon based on the thermodynamic approach to reach to a proper model in order to predict composition and other reservoir fluid properties along the reservoir column, and there is a lack of attention to its effects on gas injection.In this work one of the southwest Iranian oil reservoirs was selected. The reservoir under study was a low shrinkage undersaturated oil reservoir with the oil API gravity of 30. Two simulation models of CO_2 injection for enhanced oil recovery (EOR) process were prepared, one with considering compositional grading, and the other for uniform fluid condition. Two models were compared and the effect of compositional grading on optimum injection rate and recovery factor was studied. Considering compositional grading results in a more realistic but more complex simulation model, and simulation run time would increase, but because of the drastic difference between the results of the two cases, it cannot be ignored.

Keywords:compositional grading, enhanced oil recovery, carbon dioxide, optimization, fielddevelopment, reservoir simulation

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