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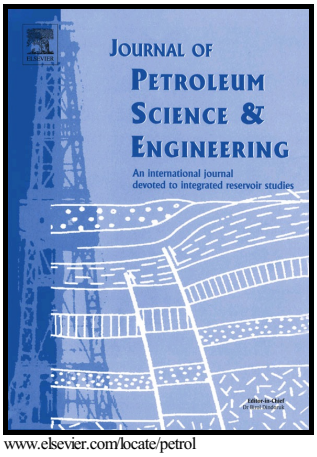

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Modified shape factor incorporating gravity effects for scaling countercurrent imbibition

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Abstract

Imbibition is the main oil (or gas) production mechanism in water invaded naturally fractured reservoirs (NFRs). Scaling laboratory imbibition results is important in studying imbibition in actual case of NFRs. Different scaling equations have been presented in the literature for countercurrent imbibition. Important parameters such as gravity effects are required to be considered in the scaling process. Gravity effects are important in field scale where Bond Number, the ratio of gravity to capillary forces, is large enough to influence the fluid exchange between matrix and fracture system. In this study by a theoretical approach, a modified shape factor accounting for the gravity effects is presented by extension of the well-known Kazemi-Gilman-Elsharkawy (KGE) shape factor and can be used in existing countercurrent imbibitions scaling equations. To validate the presented shape factor in scaling countercurrent imbibition results, the fine grid numerical simulation technique has been used to produce a wide range of experiments. Results show that the new shape factor works well when gravity effects are considerable in comparison to capillary forces.

Keywords: Countercurrent imbibition, shape factor, gravity, scaling, Kazemi-Gilman-Elsharkawy (KGE)