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Numerical Modelling of Microbial Enhanced Oil Recovery under the Effect of Environment

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Considering the sensitivity of microorganisms to the different environment, the microbial growth kinetics equation was improved, and a 3D two-phase five-component mathematical model which could fully reflect the microbial flooding process in the reservoir medium was established. The components of the model involve oil, water, microbe, nutrient and metabolite. The model integrates the effects of microbial growth / death, nutrient consumption, metabolite production, chemotaxis, convection, diffusion, oil viscosity reduction, adsorption, desorption, oil-water interfacial tension change and other properties. Taking into account the effect of environmental factors on the microbial growth model and inconsistent growth rate of microbes on the ground and underground, the microbial growth kinetics equation was improved which was based on the Monod model. In this paper, the microbial growth models, mixed solution and maximum specific growth rate were analyzed. The results showed that the metabolite concentration calculated by the Khan model is lower than that of the Monod model, but the difference in the metabolite concentration of the two models is not sufficient to have a significant effect on the recovery factor. With the increase in the amount of nutrient mixed solution and the injection time, this difference will gradually become apparent.

References

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