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INVESTIGATION OF WATER INJECTION RATE AND OIL VISCOSITY PARAMETER IN THE SAND COLUMN (ARTIFICIAL OIL RESERVOIR) DURING WATERFLOODING

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ABSTRACT

Waterflooding is a secondary oil recovery process that commonly utilized. However, there are several factors affecting the efficiency of water-flooding. Current research focused on the effects of injection rate and oil viscosity on the sweep efficiency where it is key factor on determining waterflooding efficiency. Computational Fluid Dynamics simulation is utilized to predict the effect of the injection rate and oil viscosity towards waterflooding. Computational Fluid Dynamics simulation is utilized to overcome the disadvantages of radiotracer commonly used to determine waterflooding efficiency. Volume of fluid and Realizable k- ε models are utilized in this research. Ergun's equation is also utilized in this research for estimation of permeability and inertial loss within the porous medium. Species transport model is used for Residence Time Distribution simulation to predict the flow behaviour within the porous medium. Further analysis of Residence Time Distribution reactor model determination is done using software from International Atomic Energy Agency. Validation between the simulation and experimental studies is done to validate the accuracy of the simulation results. The validations show the simulation has similar result with the experimental studies thus simulation can be utilized for further study. The research found as injection rate and viscosity ratio increase; viscous fingering predominantly seen within the porous medium. Viscous fingering occurred when the mobility ratio is more than unity and instability number more than 1000. The phenomenon of viscous fingering is directly affected by injection rate and viscosity ratio. The phenomenon directly affects sweep efficiency during waterflooding process thus affecting oil recovery process. Research also found injection rate of 1.0 ml/min is the best injection rates for various viscosity ratio due to no or minimal occurrence of viscous fingering within the porous medium. Based on the Residence Time Distribution simulation, perfect mixers in parallel is selected as the best Residence Time Distribution model based on the sum of square of error value to interpret the waterflooding process occurred within the porous medium.

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