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Numerical simulation for the separation process of suspended fine sand from oil and water emulsion in a large-size sedimentation tank

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ABSTRACT

The high sand content of the crude oil produced from some oilfields influences the production efficiency. The fine sand deposits gradually in the three-phase separator during the treatment process of crude oil, which also seriously affects the dewatering treatment. To address the desanding and removal issue in high-sand-content oilfield, the large-size sedimentation tank is applied to enhance the treatment of the desanding process. Therefore, the numerical simulation for the separation process of suspended fine sand from oil and water emulsion in large-size sedimentation tank is implemented. The multiphase flow model of Eulerian and DPM model are chosen to simulate the depositing situation. The full flow field under different operating conditions for desanding is simulated and the applicable emulsion effluent standards under both static and dynamic sedimentation conditions are obtained. Comparing the simulated results to experimental results, a good agreement could be achieved. It was found that, the effluent-recycle process is not recommended if the viscosity-reduction process via heating is adopted to upgrade the desanding efficiency. The time required for desanding was 7~10 hours, and the volume of the large sedimentation tank which meets the current requirement was 3000 m^3. The desanding efficiency can reach 90% when the sand size is larger than 80 μm, which provides guidance for whether to add the next level of desanding equipment or not. The formula for calculating the periodic time of cleaning deposited sand at tank bottom is given. It is also suggested that the sedimentation tank should be directly heated to reduce the liquid viscosity and prolong the sedimentation time, which is the optimum design for the whole desanding process.

Keywords: Suspended fine sand; High sand content emulsion; Large-size sedimentation tank; Desanding; Sand removal frequency

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