World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:19, No:02, 2025

Computational Investigation of the Performance of Oil and Water Separation Tanks

Authors : Deng-Jr Peng, Deborah Ibrahimi, George E. Varelis

Abstract : The separation of oil and water is essential for oil production, as high separation efficacy benefits the commercial value of the production asset while reducing the impact of effluent disposal on the environment. Gravity separation tanks play a crucial role in achieving the required water specifications before disposal. The water specification is typically assessed based on two key parameters: Salt-in-Crude (SIC) and Oil-in-Water (OIW), which serve as practical measures. Since SIC and OIW are related to the oil particle size distributions within the separation tank, computational fluid dynamics (CFD) techniques are employed to determine SIC and OIW across various separation tank configurations, aiming to optimise separation performance efficiency. This approach leverages computational power to reduce costly separation trials in practice, thereby saving capital expenditures (CAPEX) and minimising waiting times. Advanced CFD models are generated to simulate the separation process in a single tank, utilising the population balance model (PBM) and interfacial area transport equations (IATEs) and accounting for particle coalescence and breakup mechanisms. The CFD predictions are initially benchmarked against historical field measurements and are found to be in close agreement. Such comparisons enhance the confidence in the CFD predictions. Subsequently, further analyses are conducted to evaluate the performance of the separation tank under both parallel and sequential configurations. The results identify the optimal configuration for separation tank performance based on the relationships between SIC/OIW and particle size distributions.

Keywords : CFD, separation tank, oil and water, particle size distribution
Conference Title : ICSPT 2025 : International Conference on Separation and Purification Technology
Conference Location : Barcelona, Spain
Conference Dates : February 10-11, 2025