UNIVERSITAS
GADJAH MADA
ADSORPTION EXPERIMENTAL STUDY OF SODIUM DODECYLBENZENE SULFONATE (SDBS) ON SANDSTONE FORMATION FOR
ENHANCED OIL RECOVERY (EOR)
Ardika Dhafka Alhaqie, Ir. Muhammad Mufti Azis, S.T., M.Sc., Ph.D., IPM; Uthaiporn Suriyapraphadilok, B.Eng., M.E
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

ABSTRACT

Surfactant flooding in Enhanced Oil Recovery (EOR) is significantly hindered by the adsorption of surfactants onto reservoir rocks, particularly in clay-rich sandstone formations, resulting in substantial chemical loss and reduced flooding efficiency. This study investigated the static and dynamic adsorption behavior of Sodium Dodecylbenzene Sulfonate (SDBS) on Ottawa sandstone, with and without the addition of 5 wt.% Montmorillonite (MMT), to evaluate the influence of clay minerals on surfactant retention. Static adsorption experiments revealed that the incorporation of MMT increased the maximum adsorption capacity by nearly fourfold, from 2.90 mg/g to 11.52 mg/g. Among the adsorption isotherm models evaluated, the Langmuir model provided the best fit for both systems, indicating that SDBS adsorption predominantly follows monolayer adsorption on homogeneous surface sites. The enhanced adsorption observed in the clay-containing system was attributed to the high specific surface area and abundant active adsorption sites provided by MMT. Dynamic sandpack flooding experiments further confirmed the adverse effect of clay minerals on surfactant transport, showing delayed breakthrough and significantly greater surfactant retention. The cumulative adsorption capacity of the MMT-containing sandpack reached 1.25 mg/g, nearly three times higher than that of the pure Ottawa sandpack (0.45 mg/g). To quantitatively describe the adsorption kinetics, breakthrough data were analyzed using the Thomas and Yoon–Nelson models. Non-linear regression produced substantially lower root mean square error (RMSE) values and more reliable parameter estimates than conventional linearized methods, demonstrating its superior capability for modeling dynamic adsorption behavior. These findings highlight the critical role of clay minerals in increasing surfactant loss during chemical flooding and demonstrate that even a small clay content can significantly impair surfactant transport. The results provide valuable insights into clay–surfactant interactions and emphasize the importance of robust non-linear modeling for accurate prediction, scale-up, and economic evaluation of surfactant flooding strategies in sandstone reservoirs.

Keywords: Surfactant Flooding, SDBS, Adsorption isotherms, Kinetic, Clay-Rich Sandstone