Adsorption of anionic surfactant sodium dodecyl sulfate on alpha alumina with small surface area

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We report the results of adsorption of anionic surfactant sodium dodecyl sulfate (SDS) on α-Al_2O_3 with small surface area as a function of pH and ionic strength. The interfacial properties of α-Al_2O_3 were characterized by streaming potential and chromatographic charge density methods [1]. Streaming potential was used to obtain electrokinetic potential and identify isoelectric point (iep) of α-Al_2O_3. The surface charge density of α-Al_2O_3 was evaluated by chromatographic method from measuring pH breakthrough curves in 0.001M NaCl and 0.01M NaCl background solutions (Fig. 1).

Experimentally obtained adsorption isotherm of SDS on positively charged α-Al_2O_3 at several pH values and two salt concentrations was analyzed by using 2-step adsorption model. The calculated curves from 2-step adsorption model can reasonably represent experimental curves of SDS adsorption on α-Al_2O_3 (Fig. 2). As can be seen, the maximum adsorption density is strongly dependent on pH. The maximum adsorption density increases with decreasing pH. The surface charge of α-Al_2O_3 changes by the uptake of protons when SDS adsorbs, indicating that SDS molecules have their head group close to the surface of α-Al_2O_3. This finding is in good agreement with the hemimicelle concept. Although the surface charge of α-Al_2O_3 adjustment upon SDS adsorption, the adsorption isotherms at different salt concentrations have a common intersection point (cip) corresponding to surface charge neutralization [2].

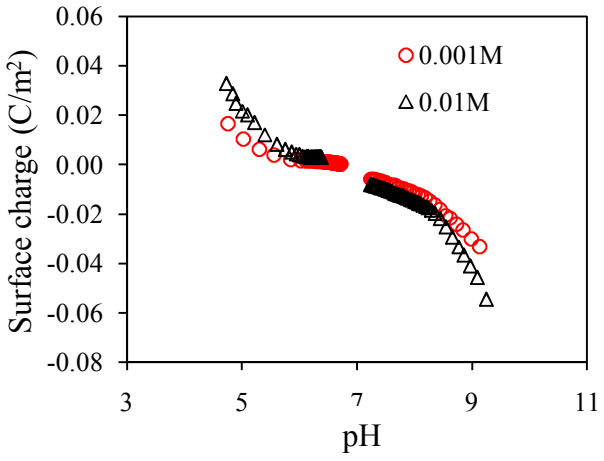

Fig 1. Surface charge of α-Al_2O_3 as a function of pH. The results are calculated from chromatographic charge density method

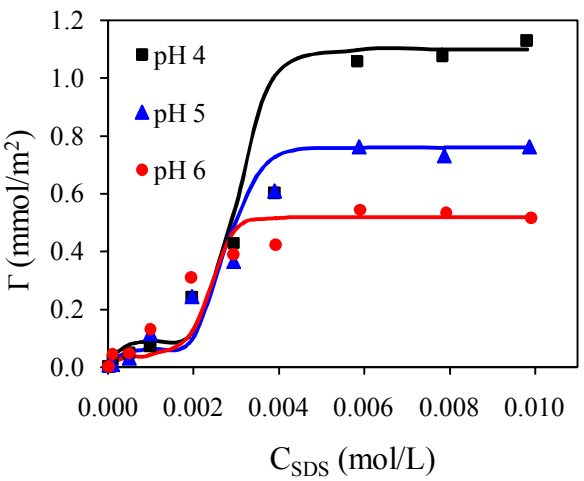

Fig 2. Adsorption isotherm of SDS on α-Al_2O_3 in 0.01M NaCl. The points are experimental data, the solid lines are the theoretical results of 2-step adsorption model

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[1]. P.T. Duc, M. Kobayashi, Y. Adachi, Colloids Surfaces A (2013), http://dx.doi.org/10.1016/j.colsurfa.2013.06.026

[2]. M.R. Bohmer, L.K. Koopal, Langmuir, 8 (1992) 2649-2659