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Time-scale estimation of unstirred layer formation in osmotically driven flow. TOMOAKI ITANO, TAISHI INAGAKI, Kansai University, KEITO KONNO, Hitachi Solutions, Ltd., MASAKO SUGIHARA-SEKI, Kansai University — We study the osmotic solvent flow driven by solute concentration difference across a semi-permeable membrane. The concentration difference across the membrane drives the solvent flow penetrating from the low concentration side through pores of the membrane. This spontaneous solvent flow transports solutes away from the membrane in the opposite side, which locally reduces the solute concentration in the vicinity of the membrane. The concentration boundary layer developed locally near the membrane in the case of absence of external stirring process was termed as unstirred layer in the previous studies, which has been recognized as a key of the unfavorable virtual resistance and membrane fouling in the water filtration of the desalination process. In the previous studies, the formation of the unstirred layer was analyzed under the assumption that the thickness of the unstirred layer is steady, which however contradicts the smoothness of the solute concentration at the end of the layer. In the present study, in order to resolve the contradiction, we assume the unsteadiness in the layer development so that the thickness of the unstirred layer may be estimated analytically.

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