ICR0368

Study on new Marangoni mechanism for absorption in a horizontal fluid layer with surfactant

Jake Kim, Chang Kyun Choi

School of Chemical Engineering, Seoul National University, Seoul, 151-744, Korea

Jin Kyeong Kim, Yong Tae Kang*

Yong Tae Kang, Ph.D., Assistant Professor, School of Mechanical and Industrial System Eng., Kyung Hee University, Yong In, Kyung-gi, 449-701, KOREA; Tel and Fax : 82-(0)31-201-2990, Fax : 82-(0)31-202-8106
Email : ytkang@khu.ac.kr

When certain surfactants are added to the solution, absorption rate is greatly enhanced. It is widely believed that the Marnagoni effect plays an important role in the improvement of absorption performance, but from a fundamental view point the Marangoni mechanism is not satisfactorily clarified yet.

The objective of this study is to investigate the effect of surfactant on the Marangoni mechanism for absorption system in a horizontal fluid layer. In this study, the newly proposed Marangoni mechanism considers the surface concentration of surfactant and the surface diffusion coefficient as well as surface tension gradient with respect to absorbate and surfactant concentration as the key factors. The surface cells are to be formed by the movement of the surfactant molecules on the surface.

The propagation theory is adapted to find the critical conditions of the onset of Marangoni convection. In this theory, the solutal penetration depth is chosen as the length scale factor. Relation among characteristic parameters can be obtained by using the scaling analysis.

The results from numerical simulation show that liquid layer becomes more stable with increasing the surfactant concentration and decreasing the surface diffusion coefficient. It is interesting that the cell size decreases with increasing the surfactant concentration, and the re-modified Marngoni number defined by basic concentration gradient instead of difference of concentration is linearly related to the modified Biot number. From these relations we find the critical condition to make liquid layer most unstable.

Key words
Marangoni, absorption, propagation theory, surfactant

* Corresponding author: Tel.:82-31-201-2990: fax: 82-31-202-8106. E-mail: ytkang@khu.ac.kr