Fabrication and Characterization of Cellulose-based Hydrophobic Absorbents derived from Banana Trunks for Separation of Cyclohexane from Cyclohexane/Water Mixture

Sittipong Khongtanachalotorn [1], Nagahiro Saito [2], and Ratana Rujiravanit [1]

[1]*The Petroleum and Petrochemical College, Chulalongkorn University, Bangkok, Thailand*

[2]*Department of Chemical Systems Engineering, Graduate School of Engineering, Nagoya University, Japan*

Cyclohexanewhich is a starting chemical for caprolactam, a nylon 6 precursor, has been reported more often on spills and leakages to waste water reservoir of industrial plants due to an increase in demand of nylon 6. Up to the present time, a lot of attempts have been put into fabricating environmentally friendly hydrophobic absorbents from natural fibers in order to replace the recently used ones that are made from synthetic polymers in which they will cause a secondary pollution after use. In this study, cellulose fibers were derived from banana trunks on the particular purpose of fabricating cellulose-based hydrophobic absorbents for separating and absorbing cyclohexane contaminant from cyclohexane/water mixture. Cellulose fibers were undergone surface modification through solution plasma process to obtain rough surface created by the deposition of ZnO nanostructures. ZnO-containing cellulose fibers would be constructed into 3D structures by freeze drying method and then subjected to surface coating with hexadecyltrimethoxysilane (HDTMS) to get lower surface energy that turned cellulose-based absorbents hydrophobic. After surface modification,cellulose-based absorbents were characterized by SEM-EDX, FTIR, XRD, TGA, wettability and cyclohexane absorption test. The results revealed that ZnO nanostructures could be *in situ* synthesized on cellulose fiber surface through solution plasma process by which the obtained ZnO contents relied on concentrations of Zn^{2+} precursor used in the process and played a role in different water contact angles. HDTMS concentration was also investigated for its impact on degree of hydrophobicity of cellulose-based absorbents. To the best of this study, the highest water contact angle of the as-prepared absorbents was 150^{o} and the maximum capacity of cyclohexane absorption was 19 times of its dry weight. According to the results, the as-prepared absorbents have the potential to be used as hydrophobic absorbents for the application of separating contaminated cyclohexane from industrial waste water.

1.) The Petroleum and Petrochemical College, Chulalongkorn University, Bangkok, Thailand 2) Center of Excellence on Petrochemical and Materials Technology, Chulalongkorn University, Bangkok, Thailand 3.) NU-PPC Plasma Chemical Technology Laboratory, Chulalongkorn University, Bangkok, Thailand