

Application of supported ionic liquid membranes using a flat sheet and hollow fibers to lactic acid recovery

Michiaki Matsumoto^{a*}, Wataru Hasegawa^a, Kazuo Kondo^a, Takashi Shimamura^b, Masao Tsuji^b

^aDepartment of Chemical Engineering and Materials Science, Doshisha University, Kyotanabe, Kyoto 610-0321, Japan
Tel./Fax +81 774 656655; email: mmatsumo@mail.doshisha.ac.jp

^bBiotechnology Laboratory, Toyota Central R&D Labs, 41-1, Nagakute-Yokomichi, Nagakute-cho, Aichi 480-1192, Japan

Received 24 June 2009; Accepted 15 November 2009

ABSTRACT

Application of supported ionic liquid membranes using a flat sheet and hollow fibers has been studied for the separation and recovery of lactic acid, which is the raw material of biodegradable polylactic acid. We optimized the supported ionic liquid membrane system for recovering undissociated lactic acid. Ionic liquids having a hydrophobic cation and a chloride anion, such as quaternary ammonium salt (Aliquat 336) and phosphonium salt (Cyphos IL-101), were shown to be able as membrane solvent from the viewpoints of membrane stability and the permeability of lactic acid. Lactic acid in the feed phase actively permeated through the supported ionic liquid membrane to the stripping phase containing hydrochloric acid. The permeation of lactic acid was improved by keeping the pH of the feed phase constant. For separation of a realistically high concentration of lactic acid, Aliquat 336 was superior to Cyphos IL-101 due to its higher capacity for extracting lactic acid under the condition of a constant pH. Aliquat 336 was successfully impregnated in polypropylene hollow fibers with a thinner membrane thickness and larger specific area than a flat sheet. Lactic acid permeated through the hollow fiber membrane impregnated with Aliquat 336, and the permeation flux was higher than the estimated value from the flat sheet membrane. The results indicate that the supported ionic liquid membrane system is promising for lactic acid recovery from fermentation broth.

Keywords: Lactic acid; Supported liquid membrane; Ionic liquid; Hollow fiber; Separation

* Corresponding author.