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Recovery of acetaminophen from aqueous solutions using a supported liquid membrane based on a quaternary ammonium salt as ionophore

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A flat sheet-supported liquid membrane (FSSLM) system, consisting of an ionic liquid, tricaprylmethylammonium chloride (Aliquat 336®) in octan-2-ol, is proposed as a means of recovering acetaminophen (Ac) from aqueous solutions; Ac is an active ingredient widely used in many pharmaceutical preparations. Several parameters which could affect the transport efficiency were examined, i.e., the strippant nature and concentration in the receiving solution, the diluent nature, carrier concentration, initial acetaminophen concentration in the feed solution, and the polymeric support type. A facilitated transport was obtained by impregnating the polymeric support with 10 vol. % of Aliquat 336® in octan-2-ol, 1 M NaOH as a receiving solution, and a feed solution of Ac dissolved in ultrapure water. The study was completed by using the FSSLM thus developed for extracting Ac from some drugs in frequent use in Tunisia (Analgan®, Doliprane®, and Fervex®).

Keywords: supported liquid membrane, Aliquat 336®, acetaminophen extraction, drugs

Introduction

Nowadays, a great deal of interest is accorded to environmental issues, especially the occurrence of pharmaceuticals as emergent pollutants. Commonly used pharmaceuticals have been found in reject water, surface water, and in potable water (Kosjek et al., 2005; Koutsouba et al., 2003). The major sources of these substances in the environment are treated wastewater effluents, the disposal of unused or expired drugs, household, human and animal effluents, and the residues of veterinary drugs (Jørgensen & Halling-Sørensen, 2000). Their concentrations in water vary from nanograms to micrograms per litre (Kolpin et al., 2002; Calamari et al., 2003). That these substances occur in the environment indicates that they are not completely eliminated in the course of the treatment process. The processes applied to eliminate pharmaceuticals from waters include: advanced oxidation processes (AOP) particularly the ozonation process (Andreozzi et al., 2005), photodegradation (Matamoros et al., 2009), membrane filtration using nanofiltration (NF) or reverse osmosis (RO) (Kimura et al., 2003), and adsorption on activated carbon (Westerhoff et al., 2005).

There also exists the supported liquid membrane (SLM) system based on a three-phase system with an organic phase sandwiched between two aqueous phases (Vilt & Winston Ho, 2011). The organic phase is obtained by impregnating a microporous solid support with the liquid containing the carrier molecules. The liquid is immobilised in the support by the capillary sorption forces of the pores. The SLM system has been used for the recovery of various metals (Peydayesh et al., 2013; Zaghbani et al., 2007), organic molecules (Koter & Szczepański, 2011), and molecules of biological importance (Zidi et al., 2011). The major drawback of SLMs is their instability due to loss of

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