Accepted Manuscript

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PII: S1004-9541(17)30389-0
DOI: doi:10.1016/j.cjche.2017.04.003
Reference: CJCHE 805

To appear in:

Received date: 28 March 2017
Accepted date: 1 April 2017

Please cite this article as: Jierong Yang, Wangliang Li, Qingfen Liu, Huizhou Liu, Dissolution of antibiotics mycelium in ionic liquids: Performance and mechanism, (2017), doi:10.1016/j.cjche.2017.04.003

Dissolution of antibiotics mycelium in ionic liquids : Performance and mechanism

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A B S T R A C T Antibiotics mycelium, byproduct of pharmaceutical industry, contains high percentage of proteins, polysaccharides and lipids, while, the low solubility in traditional solvents limits its utilization. The dissolution process of penicillin mycelium was investigated using ionic liquids (ILs) as solvent. Quantitative correlation of solubility and ILs structure and dissolution mechanism were determined. About 91.45 % of penicillin mycelium was dissolved in 1-butyl-3-methylimidazolium acetate ([Bmim]Ac) under the condition of 120.0 ºC and [Bmim]Ac/mycelium (m/m) ratio of 3.90:1. Synergistic effect of ILs and DMSO was confirmed with the DMSO/[Bmim]Ac (v/m) ratio in the range of 0.0-1.0. At 25.0 ºC, the dissolution of penicillin mycelium increased from 69.74 % to 94.50 %, with the ratio of DMSO to [Bmim]Ac (v/m) as 1:1. The room temperature dissolution of mycelium provides a novel and energy-saving process for its high-valued utilization. The NMR and FT-IR spectra showed that hydrogen bonds are the dominant driving force for the dissolution in ILs. Quantitative study on the effects of anions and cations of ILs on dissolution using Kamlet-Taft model showed that there was a linearly positive correlation between solubility of penicillin mycelium and β parameter of the ILs. The solubility of mycelium increased with increasing hydrogen bond accepting ability of anions and donating ability of cations.