Removal of Thiophenic Sulfurs Using Extractive Oxidative Desulfurization Process with Three New Phosphotungstate Catalysts

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SUPPORTING INFORMATION

Table 1s Comparison of the reactivity between the present ECODS system and other literatures

References	Present work			(10)	(19)	(23)	(26)
S-removal rate (%)	99.8	99.7	99.8	99.2	98.6	99.0	100
m(oil)/*m*(IL)[c]	4:1	4:1	4:1	2.57:1[b]	1.56:1[b]	3.13:1[b]	2.87:1[b]
$n(H_2O_2)/n$(S)[c]	3:1	3:1	3:1	4:1	10:1	4:1	4:1
n(S)/*n*(Catalyst)	100:1	100:1	100:1	10:1	25:1	20:1	120:1
Temperature (°C)	40	40	40	70	70	70	30
Time (h)	1.5	1	1.5	3	3	3	1
Ionic Liquid	$[Bmim]PF_6$	$[Bmim]PF_6$	$[Bmim]PF_6$	$[Bmim]PF_6$	$[Bmim]BF_4$	$[Bmim]BF_4$	$[Omim]PF_6$
Catalyst [a]	I	II	III	IV	V	VI	VII
S-content (ppm)	1000	1000	1000	1000	1000	1000	500

[a] Catalyst I = $[C_5H_5NH]_3PW_{12}O_{40}$, II= $[C_4H_6N_2H]_3PW_{12}O_{40}\cdot 3C_4H_6N_2$, III = $[(C_4H_9)_4N]_3PW_{12}O_{40}$, IV = $MoO(O_2)_2\cdot C_2H_5NO_2$, V = $WO(O_2)_2\cdot Phen\cdot H_2O$, VI = Na_2MoO_4, VII = $[MIMPS]_3PW_{12}O_{40}$ (MIMPS = 1-(3-sulfonic group) propyl-3-methyl imidazolium); [b] The calculated results of mass ratio of *m*(oil)/*m*(IL) are based on the densities of *n*-octane (0.70 g/cm^3)[1], $[Bmim]PF_6$ (1.36 g/cm^3)[2] $[Bmim]BF_4$ (1.12 g/cm^3)[2], and $[Omim]PF_6$ (1.22 g/cm^{-3})[2]; [c] *m* means mass and *n* means mole.

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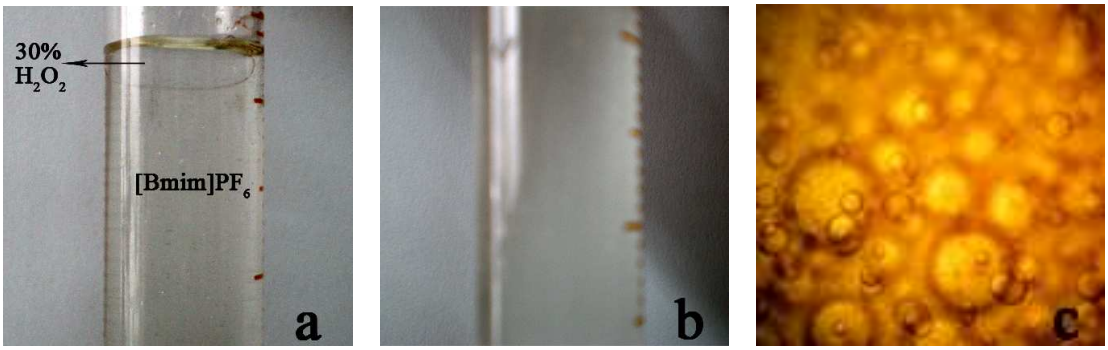

Figure 1s. The photographs of formed water-in-IL emulsion system. (a): 30 % H_2O_2 liquid film suspended on [Bmim]PF_6 IL with dissolved catalyst $[C_5H_5NH]_3PW_{12}O_{40}$; (b): the emulsion system formed under vigorous stirring; (c) optical micrograph of the water-in-IL emulsion system.

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