Supplementary Material

Multifunctional Amphiphilic Ionic Liquid Pathway to Create Water-Based Magnetic Fluids and Magnetically-Driven Mesoporous Silica

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Fig. S1 IR spectrum of 1-alkyl-3-methylimidazolium chloride (Cn,mimCl). n is the number of carbon atom in alkyl chain of ionic liquid, n = (a) 16, (b) 14, (c) 12 (d) 10, respectively.

Fig. S1 presents 1-alkyl-3-methylimidazolium chloride (Cn,mimCl). n is the number of carbon atom in alkyl chain of ionic liquid, n = (a) 16, (b) 14, (c) 12 (d) 10, respectively. For the analysis of C16,mimCl (Fig. S1a), the bands at 3471 cm⁻¹ and 3412 cm⁻¹ can be attributed to the antisymmetric ν3 and symmetric ν1 stretching modes of water, where the water interacts with the anion via H-bonding in a symmetric complex Cl−...H−O−H...Cl−(ref. L. Cammarata, S. G. Kazarin, P. A. Salter and T. Welton, Phys. Chem. Chem. Phys. 2001, 3, 5192.). Next to
that, the two characteristic bands around 3155 cm$^{-1}$ and 3142 cm$^{-1}$, which can be assigned to the symmetric $\nu_s$ CH(4, 5) and asymmetric $\nu_{as}$ CH(4, 5) stretch of in positions four and five of the imidazolium ring (ref. B. D. Fitchett, J. C. Conboy, J. Phys. Chem. 2004, 108, 20255.). The peaks around 3060 cm$^{-1}$ are contribution from the asymmetric stretching $\nu_{as}$ N-CH$_3$ of the methyl group bound to the imidazolium ring. The next strong bands at 2915 cm$^{-1}$ and 2853 cm$^{-1}$ can be assigned to the antisymmetric $\nu_{as}$ CH$_2$ and symmetric $\nu_s$ CH$_2$ stretching modes of the alkyl chain. The analysis of other vibration mode assignment can be seen in our early work.$^{26}$ Therefore, the results allow conclusion that the C$_{16}$mimCl with imidazolium ring and alkyl chain was synthesized. For other C$_{14}$mimCl (Fig. S1b), C$_{12}$mimCl (Fig. S1c) and C$_{10}$mimCl (Fig. S1d), analogous results can be obtained. However, the intensity of these peaks decreased with decreasing the value of $n$.

![Figure S2](image_url)

**Fig. S2** Digital photographs of (a) natural sedimentation of Fe$_3$O$_4$/C$_{10}$mimCl, (b) magnetically separable state of Fe$_3$O$_4$/C$_{10}$mimCl and (c) Fe$_3$O$_4$/C$_{10}$mimCl/C$_{16}$mimCl dispersion at different time.
**Fig. S3** Wide-angle XRD patterns of Fe₃O₄/C₁₀mimCl/C₁₀mimCl and Fe₃O₄/C₁₆mimCl/C₁₆mimCl.

**Fig. S4** (A) Wide-angle XRD pattern and (B) magnetization curve of calcined sample prepared using C₁₆mimCl as template in the Fe₃O₄/C₁₆mimCl/C₁₆mimCl magnetic fluid with an initial molar ratio \( n(\text{Fe}_3\text{O}_4/\text{C}_{16}\text{mimCl}/\text{C}_{16}\text{mimCl})/n(\text{TEOS}) \) of 0.05.

**Fig. S5** Linear relation fitted by Freundlich isotherm equation for (A) RhB and (B) MB solutions adsorbed on Fe₃O₄/MCM-41.
**Fig. S6** Digital photographs of separated effect of (A) rhodamine B and (B) methylene blue solutions (100 mg L$^{-1}$) after adsorption on Fe$_3$O$_4$/MCM-41 at different time interval, and a permanent magnet was placed next to the solution.