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Ionic Liquid Templated Mesoporous Silica Nanoparticles with Tunable Morphologies

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Abstract. Ionic liquids (ILs) can be defined as salts with melting point below boiling point of water. ILs are mostly famous in the field of green chemistry due to their properties such as essentially zero vapour pressure, high thermal stability and nonflammability which minimize air pollution compared to organic solvents. However, the reports on usage of ionic liquid as template in development of mesoporous materials are relatively less. ILs as template in production of mesoporous silica nanoparticles (MSNs) is beneficial due to variety of ILs present. Different combination of cations and anions will generate different properties of ILs. As reported, short chain ILs are commonly used and the anions are being manipulated to produce various morphology of MSNs which suited for specific applications. In this work, a series of pyridinium based ILs with different anions, 1-hexadecylpyridinium bromide, 1-hexadecylpyridinium tetrafluoroborate, 1-hexadecylpyridinium nitrate, 1-hexadecylpyridinium perchlorate and 1-hexadecylpyridinium trifluoroacetate, were used as template in MSNs synthesis under basic condition via condensation reaction. The MSNs obtained were characterized by X-ray diffraction, transmission electron microscopy and nitrogen adsorption-desorption. Based on the result of analysis, it was found that different anions affect the morphology of the MSNs where some of them exhibit spherical, distorted spherical, raspberry and anomalous morphology. Interestingly, nitrogen sorption analysis indicates that the surface areas of MSNs are also affected by the changes in anions whereby the data obtained were ranging from 92.65 m²/g to 494.96 m²/g.

Keywords: mesoporous silica nanoparticles, ionic liquid