BIOSURFACATNTS-TEMPLATED SILICA PARTICLES BY PRECIPITATION: APPLICATION OF SOPHOROLIPIDS IN THE PREPARATION OF HIERARCHICAL MATERIALS

Bejoy Thomas,[a,b,c,d*] Florence Babonneau,[a,b,c] Thibaud Coradin,[a,b,c], Niki Baccile[a,b,c]

a.UPMC Univ Paris 06, UMR 7574, Chimie de la Matière Condensée de Paris, F-75005, Paris, France. b. CNRS, UMR 7574, Chimie de la Matière Condensée de Paris, F-75005, Paris, France. c. Collège de France, UMR 7574, Chimie de la Matière Condensée de Paris, F-75005, Paris, France.
d. Present address: Department of Chemistry, Newman College, 685 585-Thodupuzha, Kerala, INDIA.
*. Corresponding author; kbthomas@gmail.com , bejoythomas@newmancollege.ac.in

ABSTRACT

The synthesis of porous silica-based materials obtained by a bottom-up, sol-gel chemistry-based, process (gels, powders, thin films, fibers) constitutes an exciting challenge for the many applications, like catalysis, sensing and drug delivery, in which high specific surface area constitutes a crucial characteristic. So far, many strategies have been developed to introduce either monomodal micro (< 2 nm), meso (2-50 nm), macro (> 50 nm) or multiscaled porosity at once. Typically, organic or the petroleum derived templates are currently used to obtain micro- or meso-scale porosity with a long-range order. A common point to all these sysnthesis systems is that template removal is a necessary step to provide access to porosity. Removal of the template takes place with soxhlet washing, calcination and other interesting techniques based on the stimuli-driven dissociation of coacervates.

The present work discusses the application of natural compounds sophorolipids (SL), a family of entirely bio-derived glycolipids in the preparation of hierarchical silica materials. These natural compounds can be obtained in large amounts by yeast culture in presence of several carbon sources, like glucose, fatty acids but even alkanes and waxes. Due to their reduced environmental impact biosynthesis, confirmed by a recent life cycle analysis study, sophorolipids (SL) have attracted a fair attention of the home and skin-care industry. Acidic SL are in particular interesting pH-responsive probes whose self-assembly behaviour strongly depends on pH. In particular, in our early work we have shown how pH also affects porous structure of a silica-based thin film using the evaporation induced self-assembly (EISA) process. We discuss the template and porogenic effect of SL in the synthesis of silica powders obtained by the precipitation technique in water. In particular, we show how it is possible to play with the interactions between the inorganic scaffold with sophorolipids to tune the particle shape, its pore size distribution and, interestingly, pore accessibility, which, under specific conditions, can be done without removal of the structuring agent.

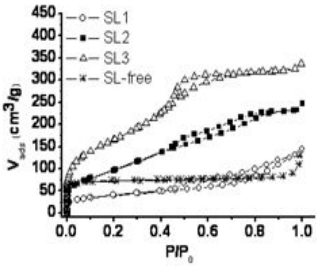

Figure 1. Nitrogen adsorption-desorption isotherms of calcined SL derived silica samples

References

1. Qian, K.K. Bogner, R.H. *J. Pharm. Sci.*, **2012**, 101, 444-463
2. Lee, . J.E. Lee, N. Kim, T. Kim, J. Hyeon, T. *Acc. chem. Res.*, **2011**, 44, 893-902
3. Slowing, I.I. Vivero-Escoto, J.L. Trewyn, B.G. Lin, V.S.Y. *J. Mater. Chem.*, **2010**, 20, 7924-7937
4. a) Kresge, C. T. Leonowicz, M. E. Roth, W. J. Vartuli, J. C. Beck, J. S. *Nature* **1992**, 359, 710; b) Huo, Q. I. Margolese, D. Clesla, U. Feng, P. Gier, T. E. Sieger, P. Leon, R. Petroff, P. M. SchKth, F. Stucky, G. D. *Nature*, **1994**, 368, 317.