

## Nanochemical and Nanobiotechnology

### Ordered mesoporous silica materials as nanocarriers for selected anti-hypertensive drugs

A. Kiwilsza<sup>1,2</sup>

<sup>1</sup> Faculty of Physics, Adam Mickiewicz University, Umultowska 85, 61-614 Poznan, Poland.

E-mail: [annamk@amu.edu.pl](mailto:annamk@amu.edu.pl)

<sup>2</sup> Nanobiomedical Center, Umultowska 85, 61-614 Poznan, Poland.

Since 2001, when hexagonally ordered mesoporous silica material MCM-41 was for the first time used in drug delivery [1], this kind of systems has been developed worldwide. Their high biocompatibility and low cytotoxicity combined with well-defined narrow pore size distribution (controllable during the synthesis) and very good sorption properties, allowed them to be successfully implemented in many branches of biomedicine [2].

In my current study I concentrate on application of hexagonally arranged mesoporous silica materials for drug delivery of selected anti-hypertensive drugs. The role of such nanocarriers strictly depends on the physicochemical properties of the drug itself. As model APIs to be loaded I chose three different channel blockers: acebutolol, nimodipine and lacidipine, They are representatives of II, III and IV class in BCS, respectively, so – described by different solubility and permeability. The encapsulation procedure was performed using modified solvent method with water, dichloromethane and chloroform.

After drug loading, a thorough interdisciplinary study has been conducted including: thermoanalysis (DSC and TGA), spectroscopy (FTIR), diffractometry (XRPD), electron microscopies (SEM and TEM), molecular dynamics investigation (NMR), analysis of pharmacokinetics (releasing profiles). The results obtained so far clearly show that – as a result of nanoconfinement – drug inside mesoporous matrix exhibit different structure, dynamical and pharmacokinetic behavior from its bulk form. Furthermore, its releasing profile is strongly related to crystallinity level as far as to drug load.

1. Vallet-Regi M., Ramila A., del Real R.P., Perez-Pariente J., A New Property of MCM-41: Drug Delivery System // Chem.Mat.-2001.-**13**.-P. 308-311.
2. Li Z., Barnes J.C., Bosoy A., Fraser Stodart J., Zink J.I. Mesoporous silica nanoparticles in biomedical applications // Chem.Soc.Rev.-2012.-**41**.-P. 2590-2605.