



Charles University in Prague

Expression of interest for cooperation in FP7 project/s

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Faculty/institute: Faculty of Science

Department: Department of Organic and Nuclear Chemistry

Collaboration form: Project partner

Size of the research group: 10

Specific programme: Cooperation - Nano-sciences, Nano-technologies, Materials and new Production Technologies

Activity area: NMP-2007-1.1-2: Self-assembling and self-organisation
NMP-2007-4.0-4: Substantial innovation in the European medical industry

Cooperation interest: Preparation of new nanomaterials for utilization in industry and medicine - chemosensors of small molecules for analysis and diagnostics, drug delivery, separation/nanofiltration, molecular nanocontainers, nanoreactors.

Annotation: New materials based on regioselectively substituted derivatives of cyclodextrins (CD) will be synthesized and utilized in several applications. All of these applications are based on the ability of CD derivatives to form stable host-guest inclusion complexes with molecules of suitable shape and size. (a) Cyclodextrin based optical chemosensors can be prepared by coupling of CD with fluorescent materials - either by functionalization of the surface of fluorescent solid phase (already successfully demonstrated on porous silicon) by CD or by incorporation of CD-fluorophore derivative into the non-fluorescent material (on the surface or into the material using sol-gel technique). (b) CD derivatives incorporated into nanofabrics can be used for durable impregnation of the fabrics by active compounds. (c) Self-assembly of CD multiplexes with corresponding multiplexes of suitable guest molecules can form 2D, 3D or spherical structures which can be used for nanofiltration/separation or as nanocontainers or nanoreactors.

Expertise offered for the FP7 project:

NMP-2007-1.1-2: Synthesis of structurally well defined cyclodextrin oligomers - homo and hetero CD dimers, trimers, tetramers, connected at wide or narrow sides of the CD molecular cone. Self-assembly with suitable multiguest molecules will create 2D, 3D or globular structures usable as membranes with very narrow pore size distribution, specific sorbents, nanocontainers or nanoreactors.

NMP-2007-4.0-4: Preparation of optical chemosensor elements (for diagnostics of small organic molecules) based on regioselectively modified cyclodextrin derivatives and fluorophores bonded to solid phase (porous silicon, sol-gel materials)



Number of Ph.D. students: 3

Major international publications:

Jelinek, I.; Chvojka, T.; Vrkoslav, V.; Jindrich, J.; Lorenc, M.; Niznansky, D.; Nemeč, I.; Kral, V.; Dian, J., Nanostructured porous silicon - Optical properties, surface modification and sensor applications. *Chimia* 2005, 59, (5), 222-225.

Jindrich, J.; Tislerova, I., Simple preparation of 3(l)-O-substituted beta-cyclodextrin derivatives using cinnamyl bromide. *Journal Of Organic Chemistry* 2005, 70, (22), 9054-9055.

Valasek, M.; Pecka, J.; Jindrich, J.; Calleja, G.; Craig, P. R.; Michl, J., Oligomers of "extended viologen", p-phenylene-bis-4,4'-(1-aryl-2,6-diphenylpyridinium), as candidates for electron-dopable molecular wires. *Journal Of Organic Chemistry* 2005, 70, (22), (2), 405-412.

Previous participation in international research projects: Kontakt (Collaboration of Ministry of Education of Czech Republic with National Science Foundation USA)

Available research infrastructure: Standard equipment for organic synthesis, HPLC. NMR, MS, IR, UV spectrometers and AFM, STM, MALDI-TOF.

Major research interest/focus: Development of methods for synthesis of regioselectively substituted cyclodextrin derivatives (1) Synthesis of cyclodextrin derivatives (a) for chemosensor applications (b) as modifiers of surface of nanofabrics (2) Synthesis of organic compounds for moletronic (molecular electronics) applications (a) acceptors (pyridinium wires) (b) insulators (carborane, bicycloalkane based) (c) donors (cyclobutadiene cobalt complexes) (3) Self-assembled 2D, 3D and globular nanostructures based on cyclodextrins and hosts star molecules

Www pages of the research group: <http://supra.orgchem.cz>

Existing international collaboration partners: none

Notes: