Biochips: Future of Medicine

Jan Petr et al.

Regional Centre of Advanced Technologies and Materials,
Department of Analytical Chemistry, Palacký University in Olomouc,
17. listopadu 12, 77146 Olomouc, Czech Republic
E-mail: jan.petr@upol.cz
RCPTM: established in 2010; ESF, OP Research and Development for Innovations; ~140 scientists/16 countries

Chemistry / Nanotechnologies / Physics / Optics

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**Biomedicine**

**Iron Oxide for MRI**

Superparamagnetic maghemite nanoparticles from solid-state synthesis – their functionalization toward peroral MRI contrast agent and magnetic carrier for trypsin immobilization.

**Nanosilver Based Antimicrobial Technologies**

Polymer (PEI, chitosan) acts simultaneously as a reducing agent and substrate for covalent immobilization of nanoAg – no release to environment, no need of additional reducing agents => High antibacterial and antifungal activities, magnetically separable and reusable NPs
Environmental technologies

Fe(0) for Water Treatment

Large-scale production and stabilization. Full scale remediation. In-situ application for degradation of organic and inorganic species. NANOREM (2013-2016): Taking Nanotechnological Remediation Processes from Lab Scale to End User Applications for the Restoration of a Clean Environment (7. FP, 10.4 mil. €)
Carbon nanostructures

Graphene and its derivatives

- Graphene functionalization; interactions with metals, biomolecules, discovery of fluorographene – world thinnest insulator; chemistry of halogenated derivatives, biosensing, ...

Carbon Dots for Cell Labeling and Bioimaging

- Cell labeling, photoluminescence, control toxicity, theranostic applications, LED diodes
Unique Infrastructure

Laboratory of Techniques for Analyses in External Magnetic Fields

Microscopic Laboratory

X-ray Laboratory for Structural and Phase Analysis
RCPTM PRODUCTS IN WORLD

Mössbauer Spectrometers

Boroscope Inspection Cameras

All Sky Cameras

Nano Iron
Microfluidics & RCPTM
Configuration
Lab-on-a-chip or Chip-in-a-lab?
Basic setup
PDMS chips for ITP
PDMS chips for ITP
Low-cost microfluidics
Screening tests
Screening tests
„Wax technology“

- Wax printing on a filter paper (nitrocellulose membrane)
- Channels are formed due to elevated temperature
Elevated temperature...
„Wax technology“
„Origami“ devices
Laminating foil
Laminating foil
Laminating foil
Laminating foil-based devices

100 µm

150 µm

175 µm
Applications
Bioanalysis

- Water quality
- Toxic metals
- Liver function
- Connection to smart-devices
- Enzymes
- Biorecognition elements
Microorganisms
Microorganisms

- ECD MUG Agar
- *E. coli*

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Conclusions

• PDMS chips -> many applications -> high investment costs (~ mil. EUR) -> „chip-in-a-lab“

• Low-cost devices -> ~ 0.03 EUR/chip + investment ~ 1500 EUR

• Many applications, heavy metals, origami devices, point of care testing, great potential for the future (separation, extraction, electrochemistry etc.)
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Thank you for your attention