

Multifunctional Particulate Systems for Nanomedicine

NanoMedPart



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- Workshop “Nanomedicine in Norway”

Oslo 12th December 2007

ERA-Net ? MATERA ?

ERA-Net

- <http://cordis.europa.eu/coordination/era-net.htm>
- <http://cordis.europa.eu/>
 - **CORDIS (Community Research & Development Information Service):** All information about R&D activities and funding instruments at European level

ERA-Net ? MATERA ?

ERA-Net

- <http://cordis.europa.eu/coordination/era-net.htm>
- <http://cordis.europa.eu/coordination/>
 - Coordination at National level
 - The objectives of Community action in this field is to contribute to the creation of the **European Research Area (ERA)** by stimulating and supporting programme coordination and joint activities conducted at **national** or **regional** level

ERA-Net ? MATERA ?

ERA-Net

- <http://cordis.europa.eu/coordination/era-net.htm>
- <http://cordis.europa.eu/coordination/era-net.htm>
- The objective of the ERA-NET scheme is to **step up** the cooperation and coordination of research activities carried out at **national** or **regional** level in the Member States and Associated States through:
 - the networking of research activities conducted at national or regional level, and
 - The mutual opening of national and regional research programmes

ERA-Net ? MATERA ?

MATERA

- <http://projects.tekes.fi/opencms/opencms/Projects/MATERA/frontpage.html>
- MATERA is one of the ERA-NET projects supported by funding under the 6th Framework Programme of the European Union
 - **Other ERA-NETs working on materials science and engineering**
 - [MNT ERA-NET](#)
From Micro- and Nanoscale Science to New Technologies for Europe
 - [ERA-NET Nanoscience](#)
 - [ERA-Chemistry](#)
 - [ACENET](#)
 - [WoodWisdomNet](#)
 - [SKEP ERA-NET](#)

ERA-Net ? MATERA ?

MATERA

- <http://projects.tekes.fi/opencms/opencms/Projects/MATERA/frontpage.html>
- The main **goal** of the MATERA- ERA-NET Materials project is to create a durable cooperation platform for national and regional policy makers and managers having strategic activities in the **field of materials science and engineering** in Europe

ERA-Net ? MATERA ?

MATERA

- <http://projects.tekes.fi/opencms/opencms/Projects/MATERA/frontpage.html>

- **Partners**



ERA-Net ? MATERA ?

MATERA

- <http://projects.tekes.fi/opencms/opencms/Projects/MATERA/frontpage.html>

- **Partners**



The MATERA - ERA-NET Materials project consists of 18 organisations from **16 countries**. The organisations participating in MATERA are: Tekes (**Finland**, coordinator), AKA (Finland), IWT (**Belgium**, Flemisch), DGTRE (Belgium, Wallone), MIWFT (**Germany**, North Rhine-Westphalia), RANNIS (**Iceland**), EI (**Ireland**), MUR (**Italy**), LCS (**Latvia**), FNR (**Luxembourg**), RCN (**Norway**), MSHE (**Poland**), MHEST (**Slovenia**), madrid (**Spain**), KTI/CTI (**Switzerland**), TÜBITAK (**Turkey**), Invest NI (**UK, Northern Ireland**) and MOST (**Israel**)

NanoMedPart - Consortium

- Institute of Catalysis and Surface Chemistry, Polish Academy of Science (ICSC) - PL - coordination



- SINTEF - NO



- Casali Institute of Applied Chemistry, The Hebrew University of Jerusalem (HU)- IL



- Institute for Cancer Research at the Norwegian Radium Hospital (CRNRH) - NO



- Chemistry Dept. Wroclaw University of Technology (WRUT) - PL



Coordinator: Piotr Warszynski, ncwarszy@cyf-kr.edu.pl

NanoMedPart - THE OBJECTIVE

To develop effective preparation methods for nanoparticles/nanocapsules optimised for anticancer drug delivery and antimicrobial activity

Project starting date 1.04.2007

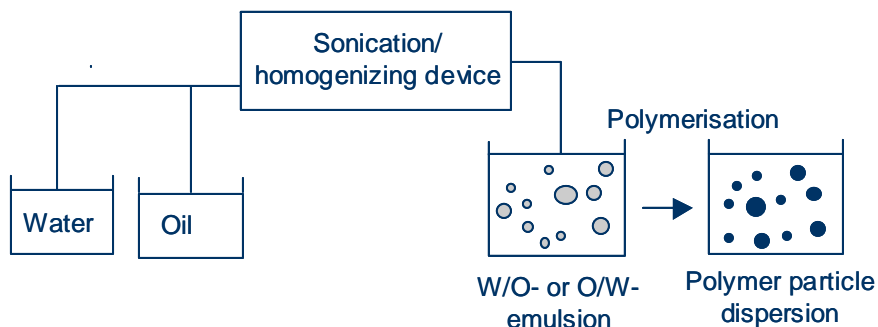
Duration 36 months

Kick-off meeting - 15.05.2007 in Krakow

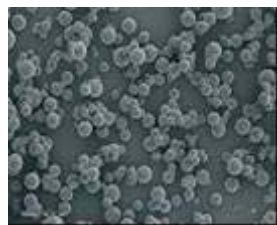
Miniemulsion polymerisation or membrane emulsification and their surface modification - SINTEF

Miniemulsion polymerisation

Principle



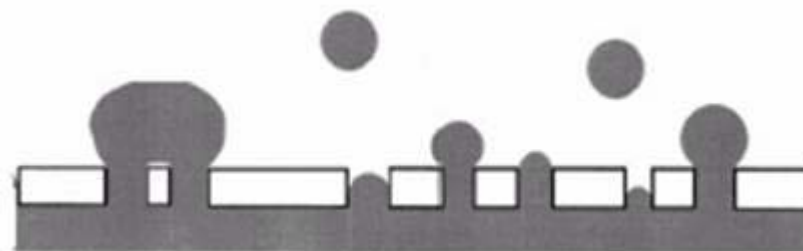
Examples



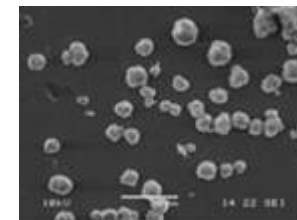
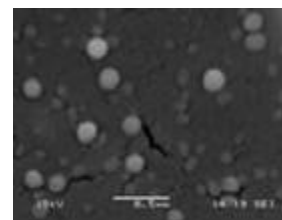
Superparamagnetic silica particles (ferrofluid encapsulated in tetra methoxy silane) (left) and hydrophilic acrylate particles from HEMA/N,N-methylene bis-acrylamide (right)

Membrane emulsification

Principle

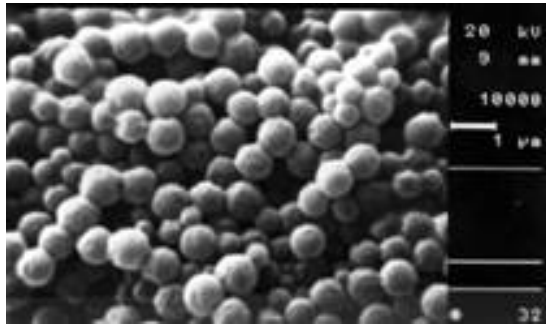


Examples

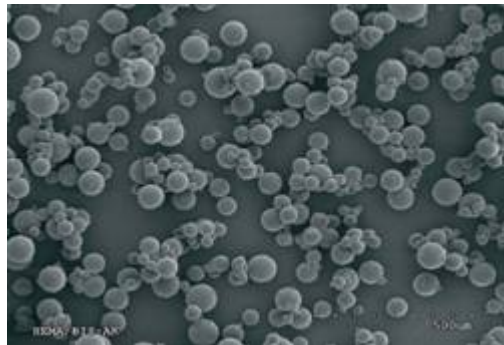


Paraffin oil in gelatine-arabic gum (left) and PAH/PSS/Silica composite nanosized hollow capsules (right)

Some examples



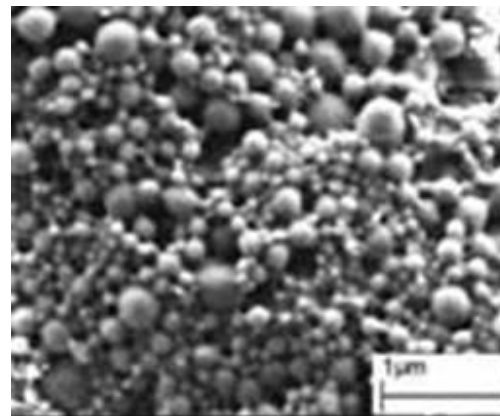
**Oil-in-water emulsions:
Compact hydrophobic particles:
Poly(styrene-co-DVB)**



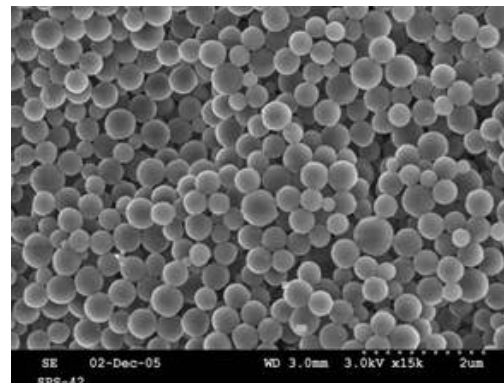
**Water-in-oil emulsions:
Compact hydrophilic particles:
poly(Hema-co-N,NMBAAm)**



Superparamagnetic silica particles (ferrofluid encapsulated in tetra methoxy silane)

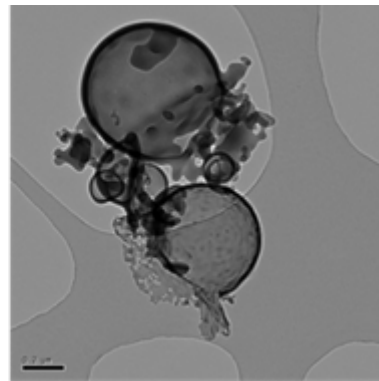
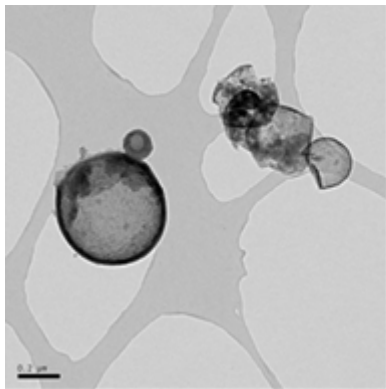
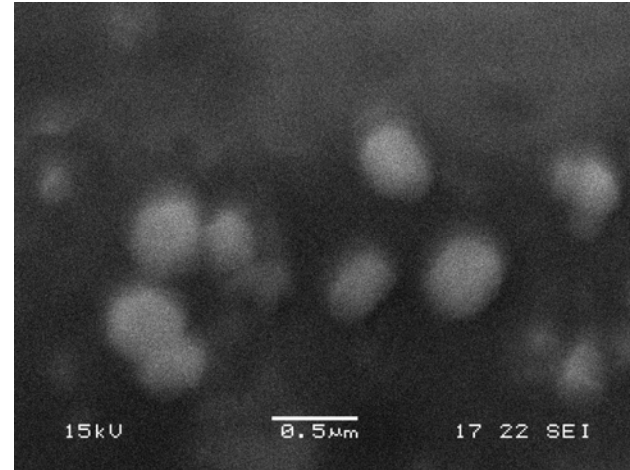
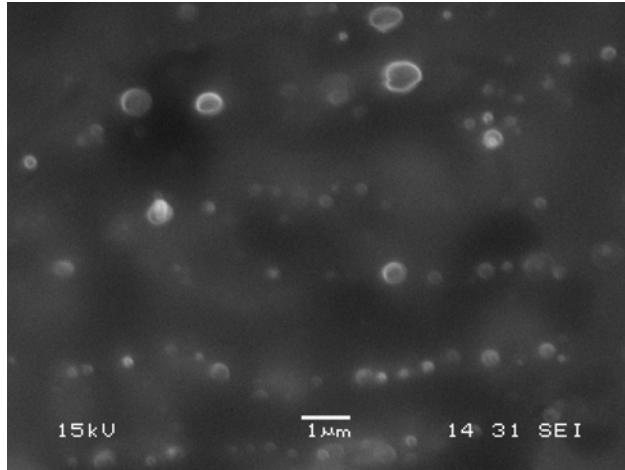


**Crosslinking of macromolecules:
120 nm crosslinked chitosan nanoparticles**



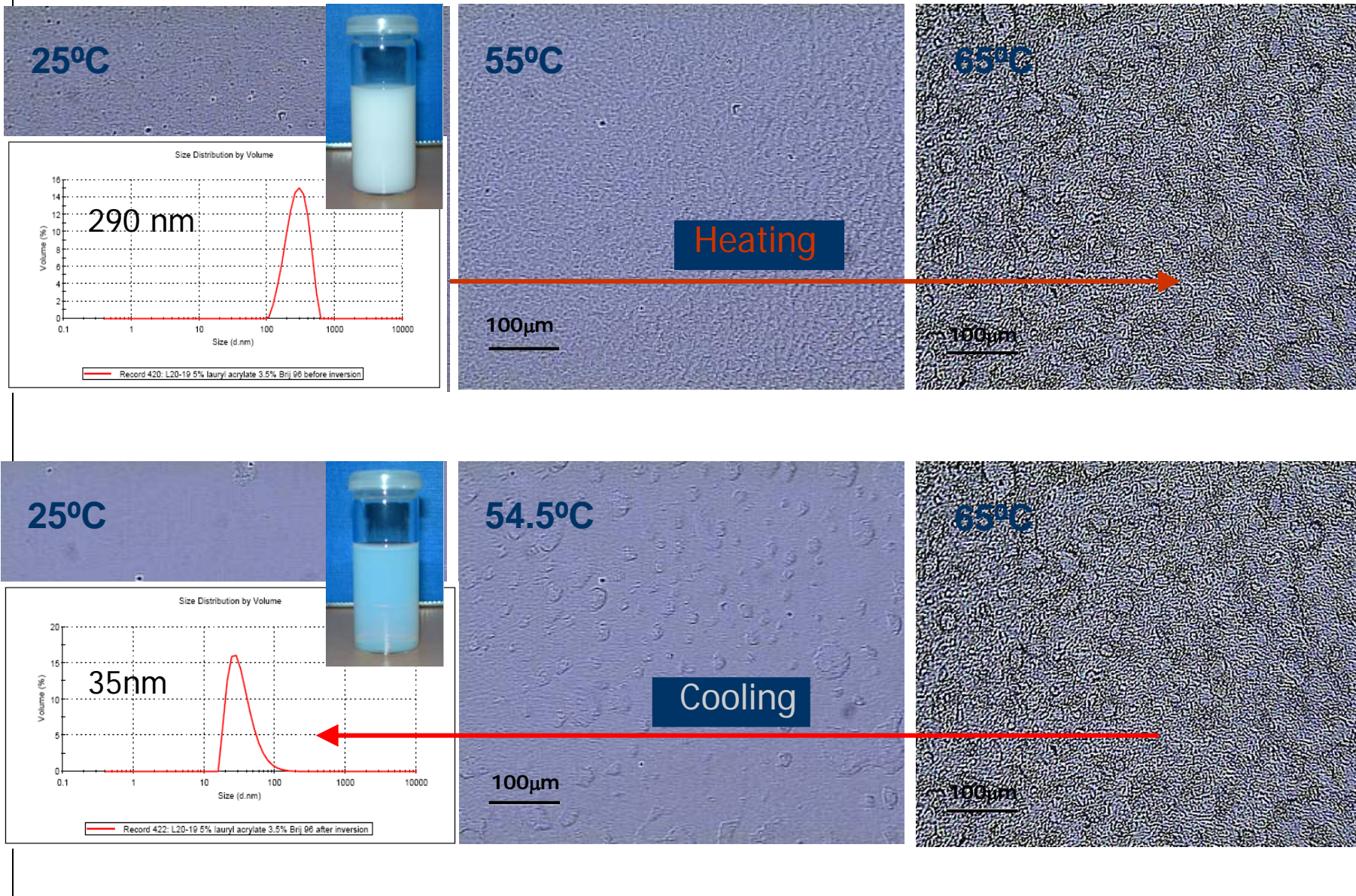
**Interfacial polymerisation:
590 nm polyurethane nanocapsules with 70% theoretical content of encapsulated n-butylacetate**

Preparation of Composite PAH/PSS/Silica Microcapsules by Membrane Emulsification



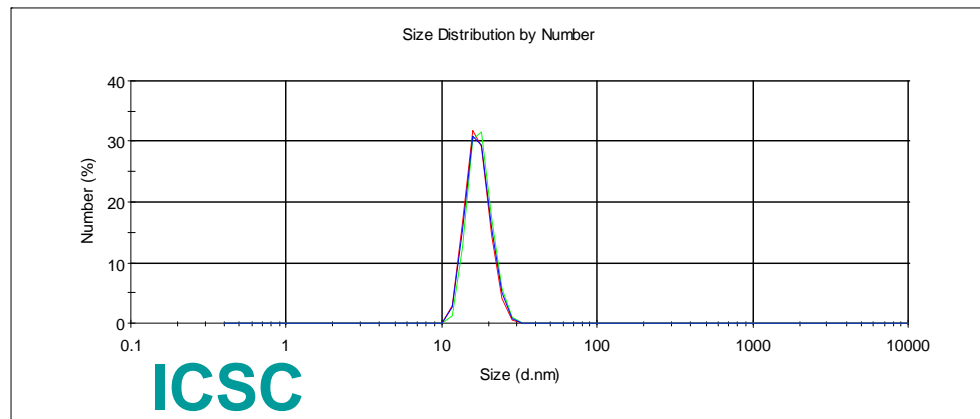
TEM pictures of hollow silica nanosized capsules

Obtaining a nanoemulsion by heating-cooling cycles - HU



Aims of biomedical tests - CRNRH

- Establish sensitive fluorescent detection system applicable to multicolour flow cytometry
- Identify optimal **stealth** procedure suitable for particles to be used in vivo
- Test **targeting** in vitro using leukemia stem cell model (flow cytometry)
- Test efficacy of killing in vitro using drug loaded targeted nanoparticles and nanocapsules (flow cytometry, proliferation, clonogenic growth)



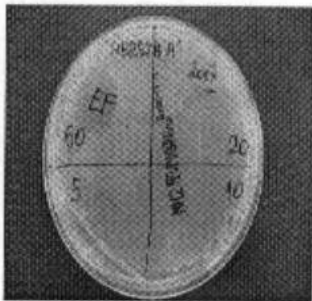
Microbiological tests of silver nanoparticles activity

Strains of bacteria

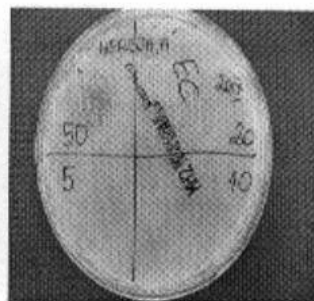
- Enterococcus faecalis – EF
- Staph.epidermis MRSE – MRSE
- Escherichia coli – EC
- Candida Albicans – ALB

Concentration of silver 100 ppm
Concentration of a strains of bacteria 10/3

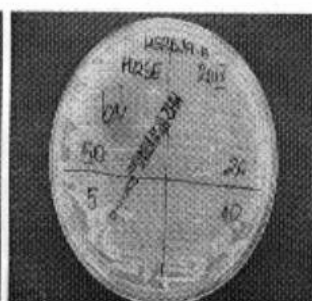
EF



EC

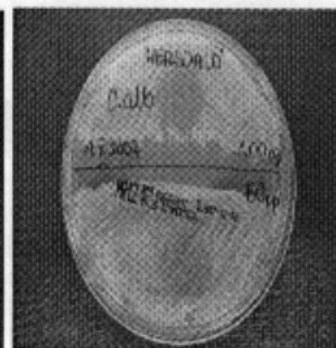
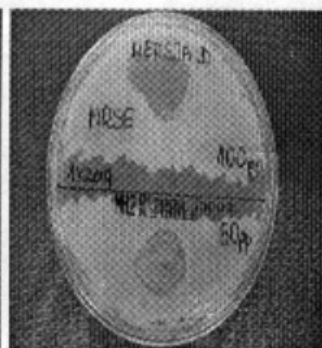
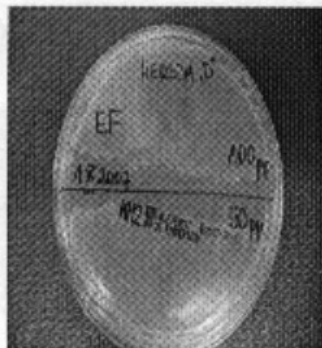


MRSE



Reduction of growth of all bacteria strains was observed

ALB



WRUT