OPPORTUNITÀ TECNOLOGICHE NEL SETTORE DELLA COSMECEUTICA

Laura Morelli

Nanoparticelle polimeriche per il rilascio controllato

Topics

- Filarete overview
- (Nano/micro)particle-based cosmeceuticals: state of the art
- Filarete R&D activities on Nano/micro-particles for controlled delivery
- Previous experiences: our relationship with personal care industries

FONDAZIONE FILARETE

About *Fondazione Filarete*

Fondazione Filarete was founded in **2008** as a public-private partnership to play a leading role in innovation, entrepreneurship and technology transfer in the fields of **healthcare, biomaterials and advanced technologies.**

Its headquarter is located in Milan in Viale Ortles 22/4 in a **6000 sqm** building with **R&D structures** and **startup incubation facilities**.

Founders

UNIVERSITÀ DEGLI STUDI DI MILANO

fondazione cariplo

INTESA SANPAOLO

Mission

- **Support** the **research** and **development activities of SMEs** through value-added research services, partnership, and technology transfer, while accelerating the time to market of fundamental research by bridging the gap between academia and industry.
- **Encourage** the creation of new companies and **high-tech startups** by hosting and supporting them in their early stages of development.

Co-Founder

CAMERA DI COMMERCIO MILANO

www.fondazionefilarete.com

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(Nano/Micro)-PARTICLE-BASED COSMECEUTICALS

The global cosmeceuticals market will reach $42.4 billion by 2018

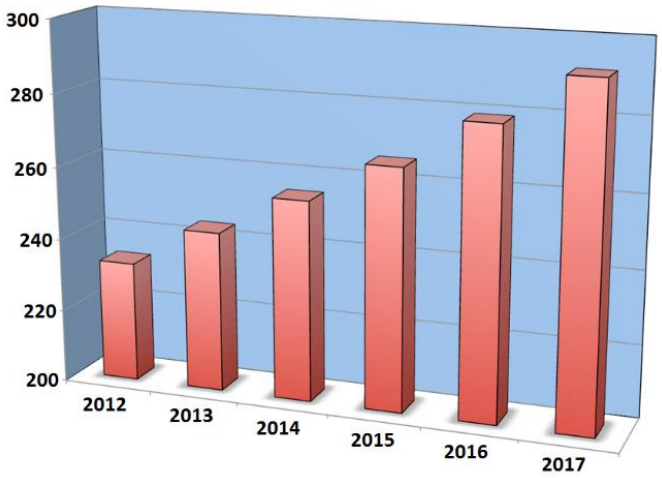
REPORT: The global cosmeceuticals market 2018

Teeth care

Skin cleanser

Lip care

Market size in billion $



Moisturizers

Antiaging products

Sunscreens

Hair care

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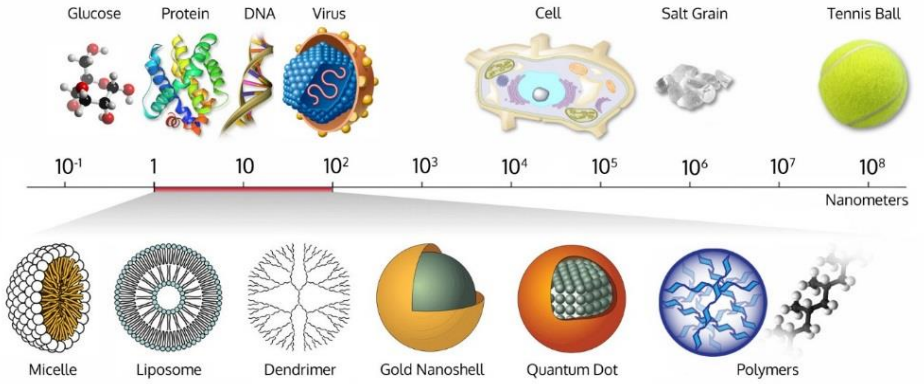
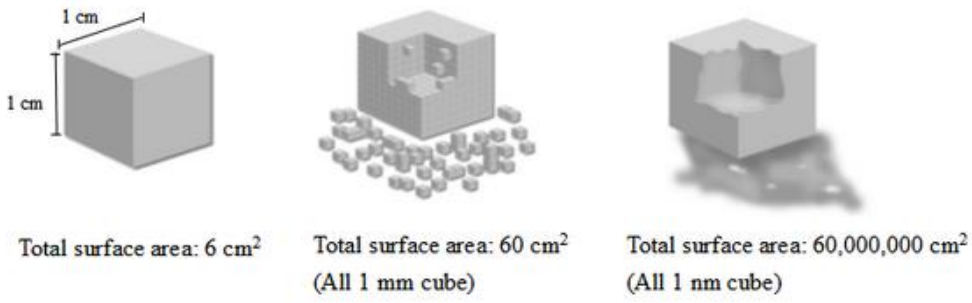
(Nano/Micro)-PARTICLE-BASED COSMECEUTICALS

Why? Wider surface, much reactive/better catalyst.



In the cosmetic arena it is believed that the smaller particles are readily adsorbed into the skin and repair damage easily and more efficiently.



increasing of the surface area
increased reactivity
enhanced and new properties

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(Nano/Micro)-PARTICLE-BASED COSMECEUTICALS

Type of carriers and related advantages

Nanoemulsions
Nanocapsules
Liposomes
Nanocrystals
Dendrimers

TYPE OF CARRIERS

ENCAPSULATION OF:

- Vitamins
- moisturizers
- retinoids
- antioxidants
- depigmentation agents

…other active agents

- ✓ improvement in the stability of cosmetic ingredients
- ✓ targeting of active ingredient to the desired site
- ✓ controlled release of active ingredients for prolonged effect
- ✓ aesthetically pleasing products

ADVANTAGES

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FILARETE R&D ACTIVITIES

Nano/micro-particles for controlled delivery

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- ❑ **Cosmetics (controlled releasing of active agents)**
- ❑ **Food & Nutraceutics (vitamins microemulsions)**
- ❑ **Pharma (particles characterization)**

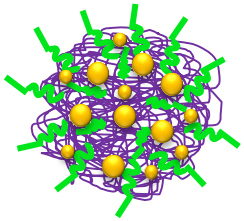
PREPARATION and FUNCTIONALIZATION	*commercially available or synthesized polymers*	✓ monodisperse polymeric nano/ micro-particles
	size control, encapsulation and surface engineering	✓ customized carries
CHARACTERIZATION and RELEASING STUDIES	*size and surface charge*	✓ Dynamic Light Scattering (DLS)
	optical properties for localization and cytotoxicity	✓ Confocal microscopy
	morphology	✓ Scanning Electron Microscope (SEM) ✓ Transmission Electron Microscope (TEM)
	optical properties for releasing studies	✓ UV-Vis spectroscopy ✓ Fluorescence spectroscopy
***IN VITRO* STUDIES**	*cytotoxicity, localization or internalization and efficacy*	✓ cellular and 3D-tissue models

OUR PROPOSAL: NANO/MICRO-EMULSIONS

Synthetic procedures can be tailored as a function of custom-made purpose

Nano/micro-spheres

Single emulsion (O/W)
Nanoprecipitation
Ionic gelation
UV-mediated cross-linking

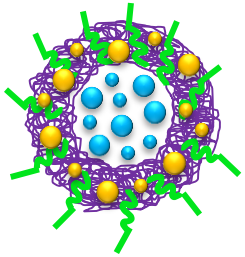


active ingredient

- *hydrophobic*
- *hydrophilic*

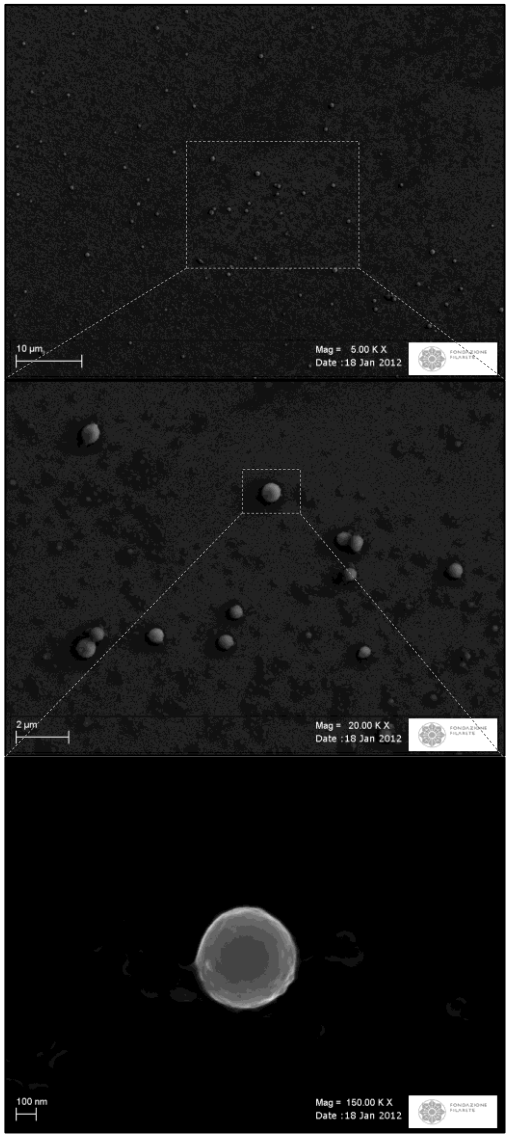
Nano/micro-capsules

Double emulsion (W/O/W)



Polymers { *FDA-approved*, *Biocompatible*, *Biodegradable*

Surfactants { *system stabilization*, *limit agglomeration*, *tuning size*



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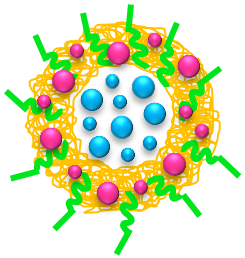
CUSTOM-MADE NPs FOR SPECIFIC PURPOSE

Simultaneous encapsulation of two different bioactive molecules

Confocal microscopy

Double emulsion Synthesis (w/o/w)

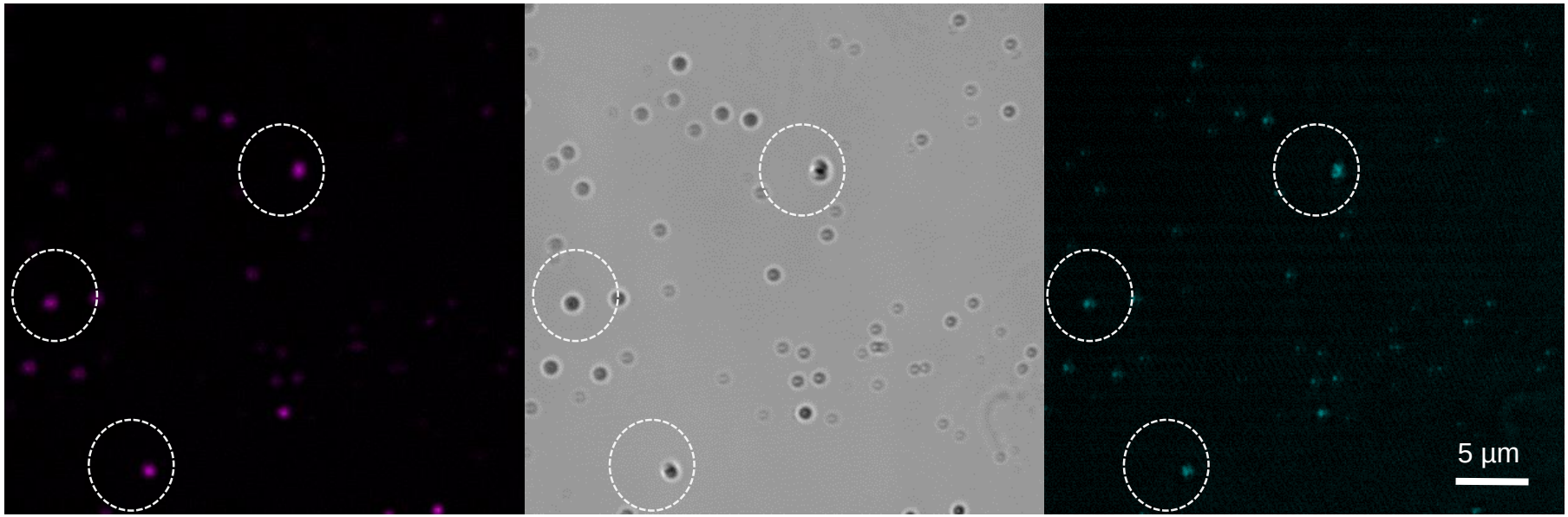


polymer

surfactant

fluorescent hydrophilic molecule

fluorescent hydrophobic molecule



TCS SP5 AOBS (Leica)
Co-localization of the *hydrophobic drug* (**Left**, 458nm) with the *hydrophilic drug* (**Right**, 633 nm).

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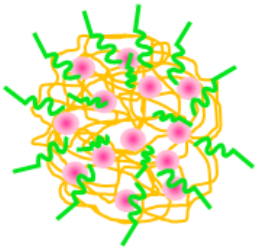
CUSTOM-MADE NPs FOR SPECIFIC PURPOSE

Releasing studies of bioactive fluorescent molecules

Fluorescence spectroscopy

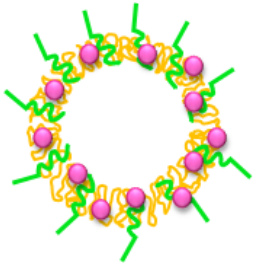
Nanosphere (o/w)



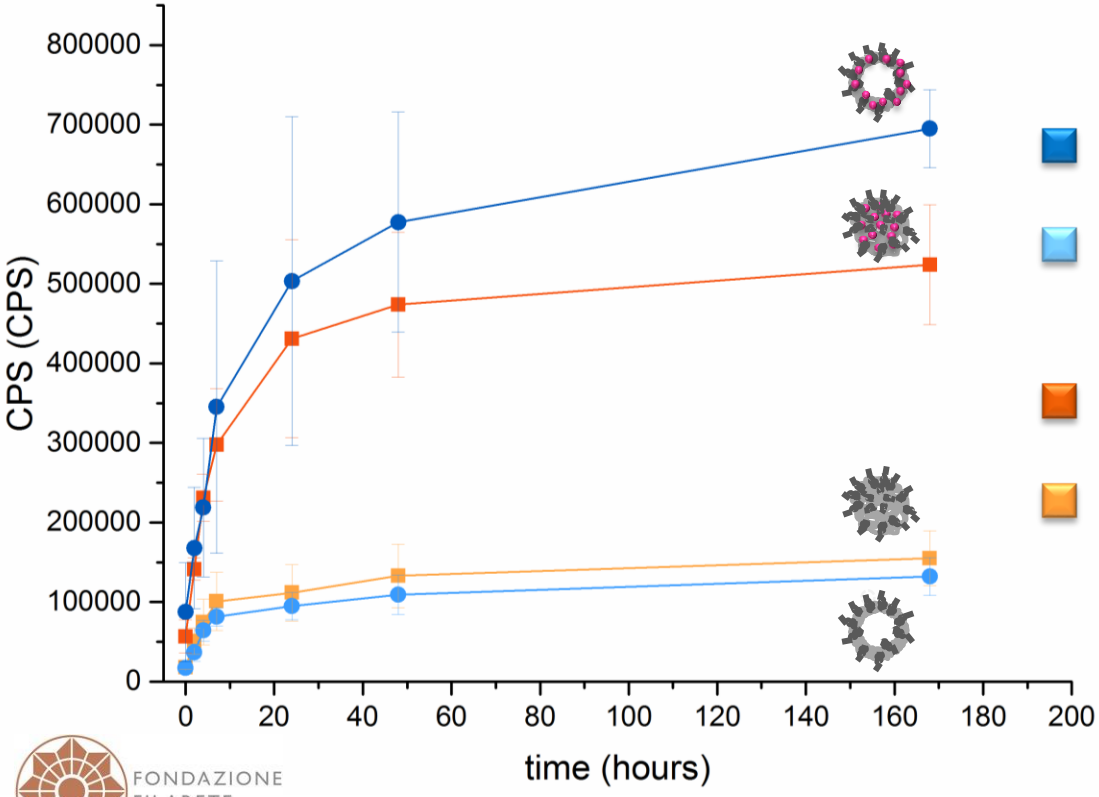
PLGA, poly(lactic-co-glycolic acid)

PVA, polyvinyl alcohol

fluorescent hydrophobic molecule



Nanocapsule (w/o/w)



- Nanocapsule+DRUG, w/o/w synthesis
- *negative control* w/o/w synthesis
- Nanosphere+DRUG, o/w synthesis
- *negative control,* o/w synthesis

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RELATIONSHIP WITH A PERSONAL CARE INDUSTRY

Controlled releasing of active agents

DIFFERENT TYPES OF COOPERATION

Agreement type	Service	Contract Research	Co-Development
Agreement characteristics	Supporting already existing internal activities with high-end expertise and analysis services	Filarete performs R&D activities based on specific objectives of the company with Filarete's contribution in the design of the project	Filarete provides novel solutions based on the innovation needs of the company. Strong involvement in the design
IP Rights	Usually no IP issue involved	Usually the company holds all the IP rights connected with the results	Emerging IP rights may be shared
Economics	Standard fee for services	Success fee on top for the achievement of particular objectives (i.e. the development of new IP)	There can be an agreement for revenue sharing or royalties

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Thank you!