Health Nanotech Lab

Laboratory of (nano)materials and (nano)technologies for health

UNIVERSITÀ DI SIENA
1240

DIPARTIMENTO DI BIOTECNOLOGIE, CHIMICA E FARMACIA

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DIPARTIMENTO
Chemistry, Biotechnology and Pharmacy

LAB
Health Nanotech Lab

Research activity

The research activities of the group are focused on the development, preparation, and characterization of intelligent nanomaterials, particularly:

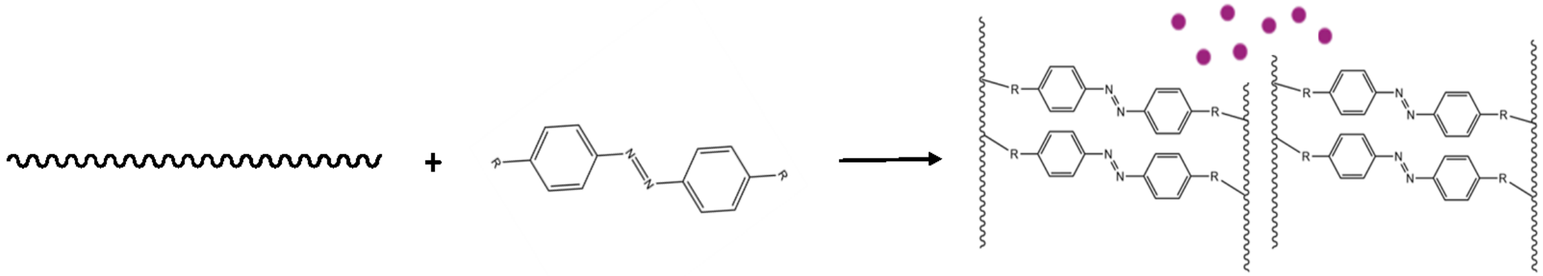
- Development of polysaccharide and lipid-based nanocarriers for drug delivery of bioactive substances with anti-inflammatory action for the treatment of diseases affecting the ocular apparatus.

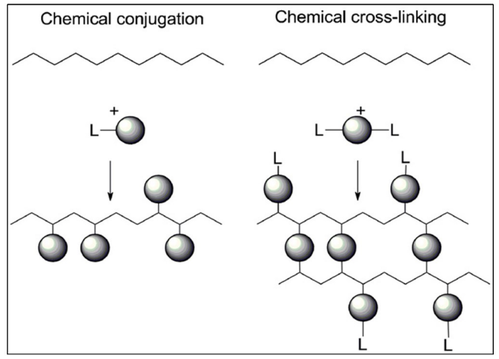
- Development of tissue substitutes in the form of three-dimensional polymeric and polysaccharide-based matrices in native form and enriched with micronutrients for the treatment of diseases affecting the osteoarticular apparatus.

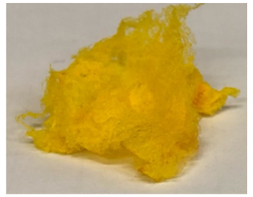
- Drafting of analysis protocols based on the main techniques for characterizing three-dimensional structures in solid and semi-solid form and in solution, using infrared spectroscopy, UV-Vis, secondary ion mass spectrometry, rheological and thermal techniques, dynamic light scattering, nuclear magnetic resonance and chromatographic methods.

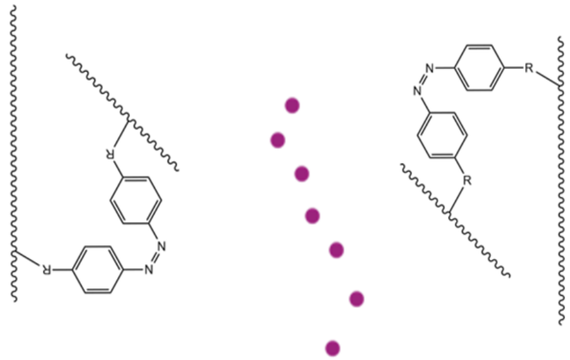
- Conformational and dynamic analysis of biomolecules in solution with one- and two-dimensional NMR techniques

Images

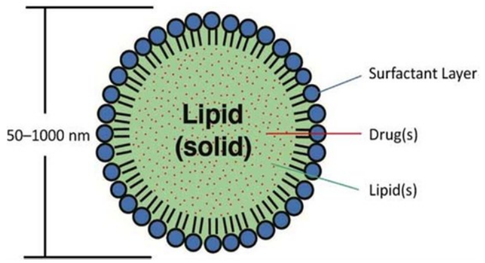


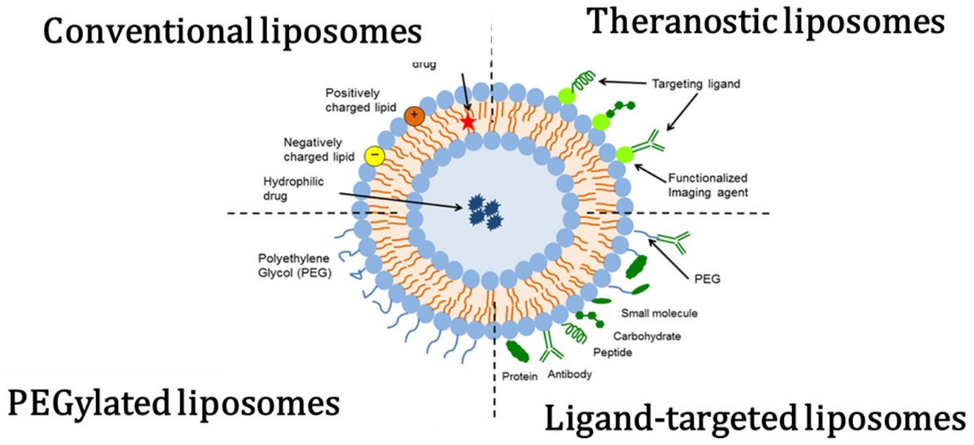






Pore open



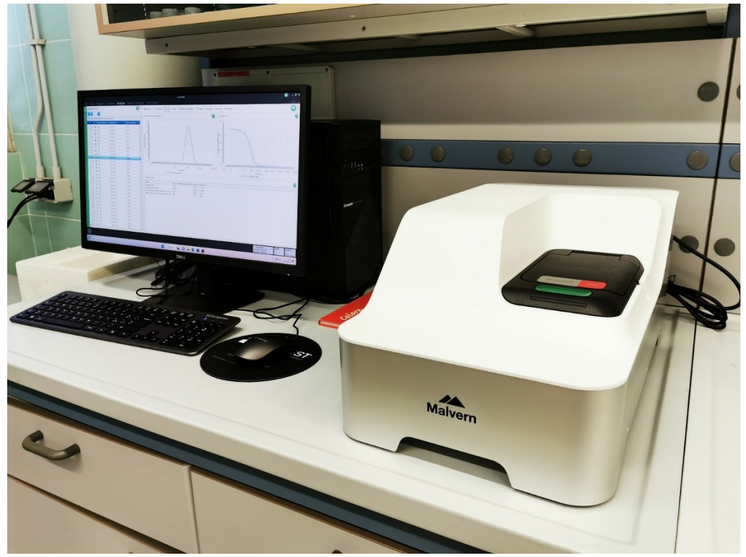


Technologies and services

Microfluidica Particle Works

The Particle Works microfluidic system ensures high performance in the production of monodisperse particles ranging in size from 1 nm to 500 µm in diameter, ensuring optimal control and reproducibility from research and development to scale-up and industrial production.

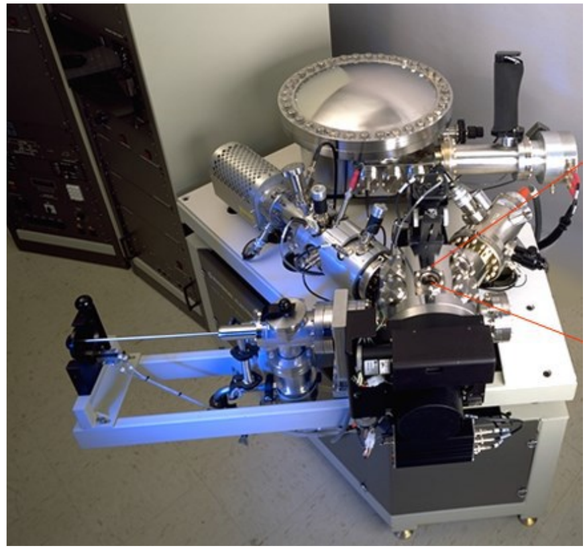
Malvern Zetasizer



The Dynamic Light Scattering instrument (Malvern Zetasizer) is an advanced tool for measuring the size of particles and molecules in suspension, particle charge, their concentration, and molecular weight.

Technologies and services

ToF-SIMS (Trift III, Physical Electronics)



TOF-SIMS: This mass spectrometry is a powerful surface analytical technique, capable of detecting molecular elements and fragments in solid matrices of any composition, with high sensitivity.

ATR-FTIR (iS-10, Thermo-Fischer)

ATR-FTIR: This spectroscopic technique is one of the most versatile and powerful investigation techniques for the chemical analysis of complex, organic and inorganic matrices of unknown composition, in terms of molecular groups present.

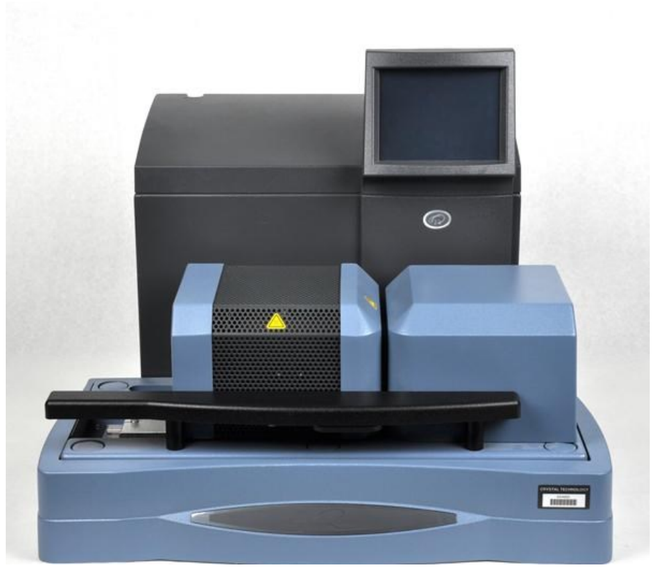
IR-MS (Delta Q, Thermo-Fischer)

IR-MS: IR-MS (isotopic ratio mass spectrometry) determines the isotopic ratios of light elements such as H, C, N, O and S, providing fundamental information of the tested samples

Thermal properties

Thermal analysis can be used as a standard technique for research and quality control and for the characterization of typical physical properties of substances. A small amount of sample is sufficient to measure important effects and properties, including specific heat, crystallization, polymorphism, content and glass transition of proteins, biomolecules, biomaterials, active ingredients, plastics, lubricants, etc.

(DSC- TA Instruments Q1000)



TGA- Ta Instruments STDQ600)

Technologies and services

Rheometer HDR-2 (TA Instruments)

Characterization of viscoelasticity, pour point and thixotropy of:

Suspensions, dispersions and emulsions

The measurement of the rheological properties of suspensions, colloidal dispersions or emulsions provides information on the colloidal state of the system and on the interactions existing between the different components.

semi-solid or soft materials: gels, pastes, creams, etc.

Rheological properties, such as pour point, thixotropy and viscoelasticity can be monitored by varying temperature, stress or strain. These analyzes allow us to evaluate the presence and/or predominance of liquid (viscous) or, conversely, solid (elastic) behaviors of semi-solid materials.

polymers

The measurement of the viscoelastic properties of polymers and plastics, generally carried out on diluted solutions or melted polymers, is aimed at determining the molecular architecture (molecular weight, distribution, degree of branching) of the polymer.

Technologies and services

Orbitrap (Exploris 240, Thermo-Fischer)

ORBITRAP®: Obitrap® allows high-resolution detection of organic compounds enabling the interpretation of molecular complexity and contributing to the metabolomic study of matrices.

NMR (Advance - 600 MHz, Bruker) con autocampionatore a 24 posizioni

NMR: Nuclear magnetic resonance spectroscopy can be used to explore the molecular structure and the chemical composition of matrices

Technologies and services

ICP-MS Agilent 8900 with auto-sampler

Microwave mineralizer ETHOS Easy

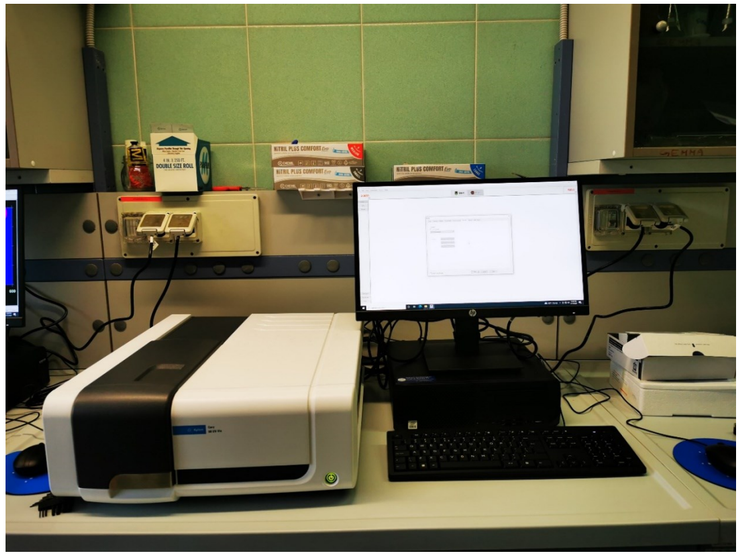
HPLC Dionex UltiMate 3000 with auto-sampler coupled with a Thermo Scientiific LTQ XL MS

ICP-MS: The samples (as they are or already mineralized by acid attack in an oxidizing mixture) can be analyzed in order to quantify the metal content

HPLC-DAD/MS: analysis of secondary metabolites

Technologies and services

Spectro-photometer UV-Vis (Agilent)



UV-Vis spectrophotometry: This extremely versatile technique counts several applications in almost every scientific field . It can be used both as a diagnostic tool (presence and/or quantification of salts or compounds with specific absorptions in unknown mixtures), or for characterization in the development of new materials.

XRF (Tracer 5g, Bruker)

XRF: This instrumentation, portable - and therefore also usable *in situ*, allows the identification and quantification - through appropriate calibration - of the elements present in the samples, allowing rapid and efficient analysis. Particularly effective in the analysis of metals and metalloids, the X-ray fluorescence technique is a versatile, practical and complementary alternative to the ICP-MS technique.

Applications and collaborations

Health Nanotech Lab Lab has ongoing projects and collaborations with:

Dompè Farmaceutici S.p.A.

Procter and Gamble S.p.A.

Oftalpharma srl, Medibase Brand

TECNAV srl

Industria Farmaceutica Galenica Senese srl

Health Nanotech Lab offers collaborations for:

1) Development of smart lipid/polysaccharide-based systems for the treatment of soft tissue pathologies and for targeted drug delivery

2) Chemical-physical, thermal and mechanical characterization of organic/inorganic matrices

For more information

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Logo