SOLID NANOPARTICLES FOR THE TREATMENT OF NEURODEGENERATIVE DISEASES

Solid lipid nanoparticles (SLN) have recently been proposed as biocompatible and biodegradable nanotechnological systems for the transport of a large number of molecules with different physical and chemical properties. The clinical and preclinical use of molecules with important pharmacological activities is often difficult, due to unfavorable chemical-physical characteristics, such as poor solubility in aqueous media and important side effects. In this regard, the nano-encapsulation strategy based on the use of lipid matrices, therefore non-toxic and biocompatible, can be proposed. In particular, poorly water-soluble drugs can be administered to the central nervous system through solid lipid nanoparticles and nanostructured lipid carriers. In order to obtain NSL suitable for brain delivery it is possible to modify its surface, altering its biodistribution and prolonging the circulation time in the blood. The inclusion of fluorophores in the nanoparticles enables to assess their biodistribution through fluorescence molecular tomography (imaging).

GOALS

- Production of SLN through the lipid phase fusion method followed by homogenization.

In particular, lipid nanoparticles consisting of tristearine and nanostructured lipid carriers consisting of tristearine in association with glyceryl monoolein are produced. Several neuroactive drugs (eg levodopa derivatives) are taken into consideration.

- Dimensional and morphological characterization of SLN, analysis of the efficiency of drug encapsulation and stability.
- Functionalization of particles for directing to the brain.
- Behavioral studies on animal models and biodistribution studies following nasal and intraperitoneal administration on athymic mice.

INSTRUMENTS AND METHODS

To achieve the objectives of this research different instrumental techniques will be used, such as HPLC chromatography analysis, low-angle and high-angle diffraction (WAXS and SAXS), cryotransmission microscopy (cryo-TEM), and photonic correlation spectroscopy (PCS). For fluorescence imaging studies, optical images will be acquired with IVIS Spectrum (Perkin Elmer) in fluorescent mode with 740 nm excitation filter and 800 nm emission filter (University of Verona).

SUBJECTS

Pharmaceutical technology, Analytical chemistry, Applied Physics, Pharmacology.

WORKING GROUP

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COLLABORATIONS

The research group makes use of both internal collaborations at the University (Prof. Michele Morari, Medical Science Department. Pharmacology section), and collaborations with national universities (Department of Life and Environment Sciences, Marche Polytechnic University Department of Computer Science, University of Verona), and international (Macromolecular Chemistry II, University of Bayreuth, Germany).