Magnetoliposomes for Medical Imaging: Liposomal Carriers for Superparamagnetic Iron Oxide Particles

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Magnetoliposomes (MLs) are superparamagnetic iron oxide particles (SPIOs) surrounded by a phospholipid bilayer. Due to their magnetic behaviour SPIOs are utilized as negative contrast agents in magnetic resonance imaging (MRI), where they cause a hypointense signal. This work reports the preparation of MLs by incorporation of iron oxide particles (made of Fe_3O_4 and γ-Fe_2O_3) in sterically stabilized liposomes. As magnetic core we have used commercially available standardized polar coated iron particles (FerroTec Corp., USA) with an average diameter of about 10 nm. Liposomes are made of phosphatidylcholine, cholesterol and low amounts of PEG-ylated lipids, which sterically stabilize the liposomes reducing their classical rapid clearance from the bloodstream. In a first step a dry film was formed adding different concentrations of SPIOs, previously solved in butanol, to a lipid mixture in organic solvent. In a subsequent step, magnetic unilamellar vesicles were prepared by hydration of the dry film with PBS-buffer followed by size extrusion through 100 nm polycarbonate membranes. An increased diameter of 140-190 nm was observed for the MLs with respect to the empty liposomes, which are about 130 nm in size. MLs were purified by size exclusion chromatography (SEC) and the iron oxide content was evaluated analyzing the collected fractions with a colorimetric test. Increasing encapsulation efficiencies (from 49-90%) were achieved for decreasing initial concentrations of iron oxide (3.2 to 0.8 mg/ml). Preliminary qualitative characterization by MRI measurements has proven a strong effect of ML in T_2 relaxation giving promising results for *in vivo* imaging. The final aim for the construction of MLs is to enable non-invasive diagnosis by targeted molecular imaging.