Magnetic Liposomes and Entrapping – Hollow Nanoparticles for Biomedical Applications

Nawroth, T., TU München/D, Rusp, M., TU München/D, May, R.P., ILL Grenoble/F

PD. Dr. Thomas Nawroth, TU München Physik-E17, James-Franck-Str., 85747 Garching

Liposomes are biocompatible hollow Nanoparticles covered by a lipid bilayer. They can be used as carriers for material entrapped inside the lumen and at the surface in cell-biological and medical applications [1]. Those applications can be improved, if the liposome can be detected or manipulated by magnetic forces [2]. This requires liposomes exhibiting a strong macroscopic paramagnetic moment, i.e. magnetic liposomes. A bio-functionalization can be achieved by insertion of membrane proteins, wich retains the entrappered material if the “detergent assisted reconstitution into preformed liposomes” is applied [3]. Size, structure and development (dynamics) can be analyzed by neutron scattering of liposome solutions [4] and electron microscopy, especially with time resolved methods.

Magnetic liposomes were prepared by a novel method from stabilized iron-complex solutions and biogenic phospholipids using a pH-shift/ pH-jump procedure and analyzed by time resolved neutron small angle scattering TR-SANS and electron microscopy [5]. During the preparation ions, dye or Boron were entrapped inside the liposomes in parallel to iron oxide. This enables optical detection, as well as later biomedical applications with Neutron capture and rheological experiments with magnetic tweezers. The formation of the liposomes and the internal iron oxide structure was observed by time resolved neutron scattering TR-SANS and electron microscopy using a stopped-flow mixing device. Under selected conditions, the iron oxide was obtained as shell located at the inner surface of the lipid layer. Thus our magnetic liposomes can be depicted as “magnetic shell liposomes”.

Inside the magnetic shell liposomes, the internal volume (lumen) covered the major volume, which was free for entrapping of other material, e.g. soluble compounds for drug targetting applications. The magnetic shell liposomes revealed a typical size of 100-400 nm, as required for applications in vivo. [5]

Literatur:

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