Formation and Stability Control of Well-Defined Vesicles and Their Fixation by Polymerization

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Vesicle templated hollow nanocapsules are interesting systems with their potential applications in pharmaceutical processes as drug carriers, cosmetic and detergency formulations [1]. Insertion of different monomers and cross-linking agents into the bilayer of vesicle templates with consecutive polymerization lead to polymeric nanocapsules [2]. A well-defined spontaneously formed vesicle system from mixing of micellar TDMAO (tetradecyldimethylamine oxide) and LiPFO (lithium perfluorooctylsulfonate) solutions, can be controlled with respect to the size by the addition of the Pluronic type of copolymers (EO_m-PO_n-EO_m) via the mechanism of vesicle formation with a polydispersity of 5% [3-4]. These vesicles are kinetically stabilised and therefore offer the possibility to use them as templates and eventually to stabilise their structure by UV induced radical polymerization.

The structural changes of the vesicles upon incorporation of the different monomers and the cross-linker as well as the effect of subsequent polymerization in the membrane have been investigated by light scattering, small angle neutron scattering (SANS), electron microscopy and turbidity measurements. Similarly the formed polymerized vesicles and polymeric capsules have been characterized by light and neutron scattering and electron microscopy. SANS analyses indicate an evident transition from monomer loaded micellar system to vesicle structure and these structures are retained during the subsequent polymerization process which shows that the initial structures can be successfully used as templates (fig 1). From this study valuable information regarding a systematic and optimized formation of such nano-sized polymer capsules shall be gained as they would be interesting for instance as containers for active agents.

Figure 1 a) SANS intensity patterns of vesicles containing increasing monomer amounts. b) Cryo-TEM image of cross-linked polymerized vesicles.