1. Summary

The objective of this thesis was the embedding of nanoparticles into the bilayers of blockcopolymervesicles. The focus in this respect were ironoxide-nanoparticles to move the vesicles in a magnetic field. The first step was therefore the synthesis of the nanoparticles. Two different routes were used for the synthesis. Both ways have been high temperature syntheses. The first route was the decomposition of ironpentacarbonyl with trimethylamine-N-oxide in n-hexadecylamine. The n-hexadecylamine was both, coordinating ligand and solvent. The second way was the reduction of irontrisacetyleacetonate with 1,2-hexadecanediole. Both syntheses yielded stable ironoxide-nanoparticles between 2 and 14 nm. The TEM pictures showed crystalline particles which most probably were magnetite.

The next step was the embedding of the ironoxide-nanoparticles into the vesicles. The vesicles could be produced out of three different blockcopolymeres. One was polyisoprene-*block*-polyethyleneoxide and the second and the third were poly-2-vinylpyridine-*block*-polyethylenoxide which differed in their blocklenghts. There have been different ways to embed the nanoparticles into the bilayer of the vesicles. One possibility was to form an organic solution of the polymer and the nanoparticles. This solution was covered with a layer of water. The organic solution vaporized and during this process the vesicles were formed by way of selforganisation (chloroform method). The nanoparticles favorize the hydrophobic inner part of the vesiclebilayer because of their hydrophobic shell. Another method was the preparation of an organic solution of the nanoparticles and the blockcopolymer in for example chloroform. After a few days the chloroform had vaporized. Water was added to the resulting film of blockcopolymer and nanoparticles and thus the vesicles were formed (film method). The last method was to add water directly to dried nanoparticles and the blockcopolymer. The formerly unsolvable nanoparticles embedded themselves into the vesicle bilayer to avoid the contact with the water (water method).

The sucess of the embedding could easily be controlled by lightmicroscopy. With the first control the formation of the vesicles and their size distribution was checked. The size of the vesicles was between 1 and 10 μm. Their size distribution and morphologies have been dependent on the way of preparation. In the next step the magnetic character of the vesicles was controlled by applying a magnetic field. The embedding was sucessful when the vesicles showed an ordered movement in a magnetic field. The proof of embbeding was carried out via deeptemperature embedding after which the sample was cut into slices and could be analysed with TEM. This analysis was carried out in cooperation with Dr. Heinrich Hohenberg of the Heinrich-Pette-Institut.

The vesicle solutions in many cases not only contained vesicles but also a considerable amount of polymer particles. These polymer particles had the capacity for much more nanoparticles than the vesicles. This fact could be used to remove the polymer particles from the solution. Due to their higher load the magnetic movement was faster than that of the vesicles. For the removal a magnetic field was applied to the solution and a precipitate of polymer particles was the result. After this procedure the remaining solution showed a higher amount of vesicles.

The vesicles had a broad polydispersity and were too large for biological or medical application, so that a procedure was required to reduce the size of the vesicles and lessen their polydispersity. This was achieved by extrusion with a polycarbonate membran (pore diameter 400 nm). After this procedure the size of the vesicles was between 1 and 2 μm and they showed a narrow size distribution. The magnetic movement was not destroyed by this method.

In addition not only ironoxide-nanoparticles have been embedded into the vesicles, but also cobalplatinum-nanoparticles. The vesicles with this particles also showed a movement in the magnetic field.