Hydrothermal method of nanoparticle preparation, involving oleic acid, has received certain attention in the last years. However, the published works lack systematic approach to the subject, and the mechanism was not thoroughly investigated, so as to achieve a predictable outcome of the synthesis. The present work investigated the influence of composition of organic and water phase on the synthesis of cobalt ferrite (cobalt(II)-iron(III) oxide) and magnetite nanoparticles, and the mechanism of nanoparticle formation was proposed. Organic phase was based on pentanol, octanol or toluene, containing the precursor – metal oleate. Besides hydrophobic particles, it was even possible to directly prepare hydrophilic oleate-coated particles by using water phase with sodium oleate. Synthetic procedure was then simplified by a separate preparation of cobalt-iron oleate, which led also to a product of narrower size distribution and better phase purity. Size control in the range of 6–11 nm and a batch yield of ca. 500 mg was achieved.

Attention was given also to the surface modification of the particles, thus imparting them hydrophilicity. Small di- or tricarboxylic acids were utilized, as well as carboxylmethyl dextran and titanium dioxide. Titanium dioxide required additional protection with nitrilotri(methylphosphonic acid) to stabilize the product in water dispersion.

Powder X-ray diffraction (XRD) was used to check the phase purity and to estimate the particle size. Prepared particles were characterized also by transmission electron microscopy, dynamic light scattering, Mössbauer spectroscopy and magnetic measurements on SQUID by means of zero-field-cooled and field-cooled magnetizations, hysteresis loops, and alternating-current (AC) susceptibility.

The present thesis also provides a more detailed explanation of XRD analysis and Mössbauer spectroscopy. Remaining characterization methods are sufficiently discussed in the attached publications.