Comparison of Magnetic Properties of Magnetic Beads for Magnetic Separation

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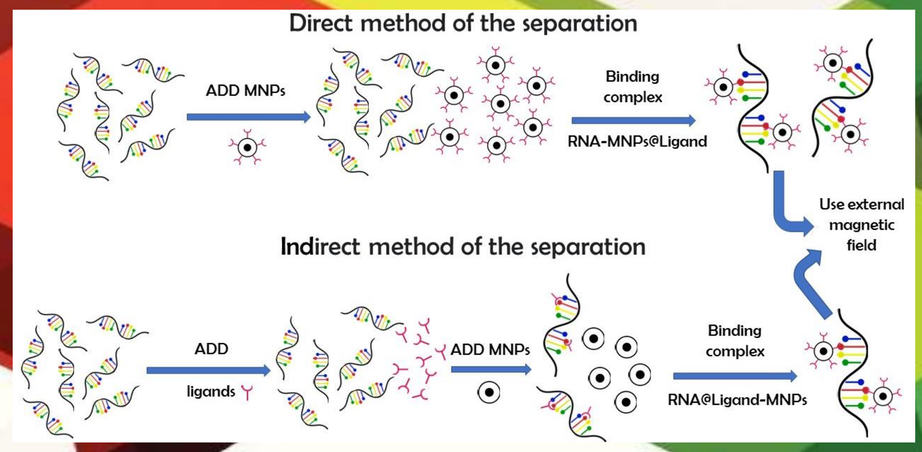
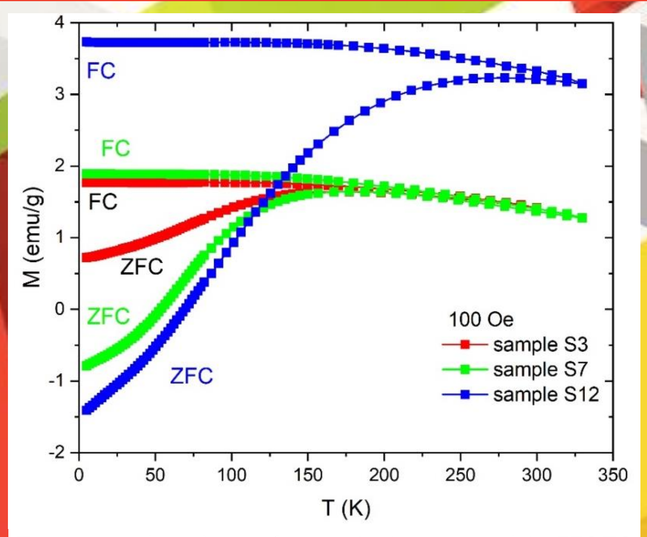
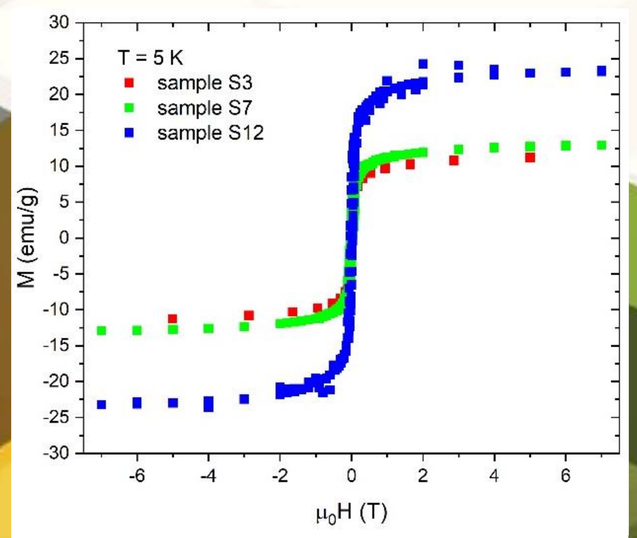
Abstract. Three different magnetic beads consisting of Fe_3O_4 magnetic core, silica shell and organic ligand's shell of 3-Mercaptopropyl-trimethoxysilane, Phenyl-3-aminopropyltrimethoxysilane and Trimethoxysily-propyl methacrylate were prepared with the aim to increase the surface active centres for DNA/RNA magnetic separation. The magnetic properties of prepared samples in powder form were studied by ZFC/FC magnetization and by field dependence of magnetization using SQUID magnetometry. The magnetic moment and the particles size distribution were calculated from experimental data by fitting of Langevin function. The properties of samples containing Trimethoxysilyl-propyl methacrylate in liquid form was compared with those measured on a commercially purchased kit designed for RT-PCR diagnostics. We have found that a detailed study of magnetic parameters serves as a very sensitive tool for the design of magnetic beads for PCR diagnostics, despite the fact that they contain a diamagnetic surface layer.

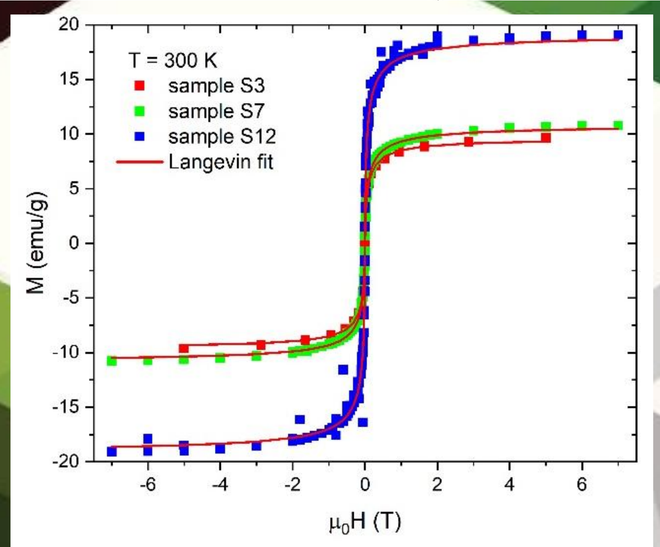




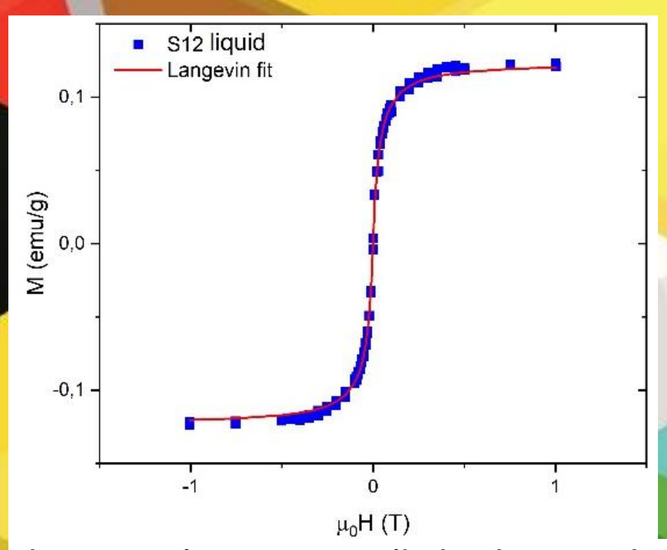
Temperature dependence of magnetization measured in ZFC/FC regimes for 3 different studies samples with organic ligands. Blue symbol represents sample S12, red symbol sample S3 and green symbol sample S7.

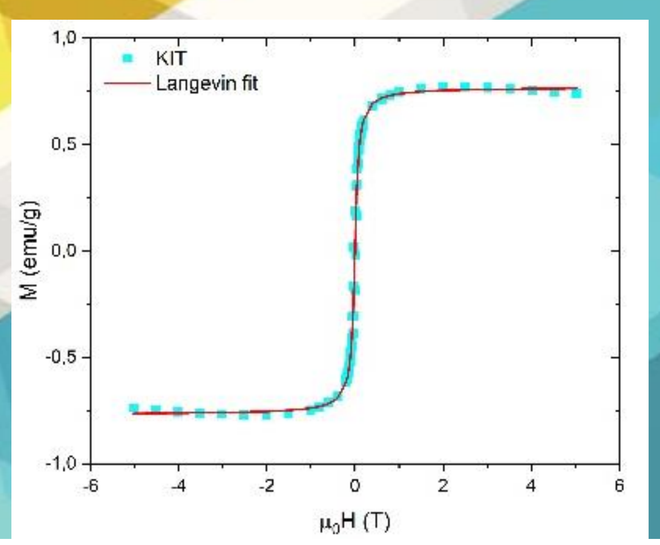


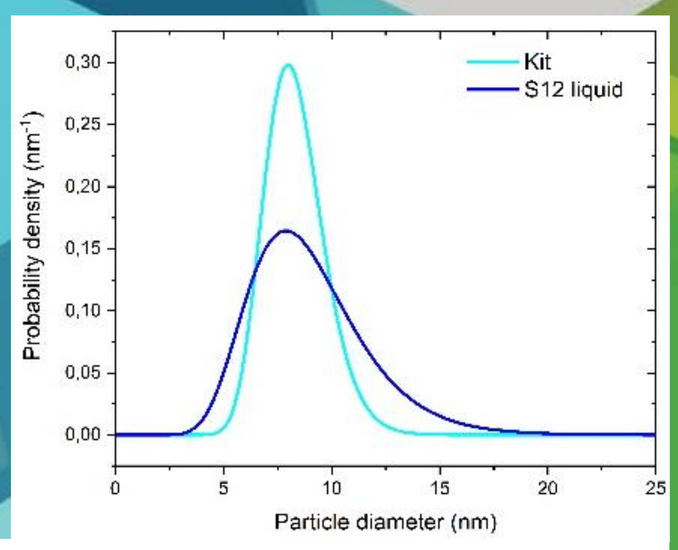
Field dependence of magnetization for three different samples measured at 5 K. Blue symbol represents sample S12, red symbol sample S3 and green symbol sample S7.



Field dependence of magnetization for three different samples measured at 300 K. Red lines represent the Langevin fit of experimental data in samples in superparamagnetic state.



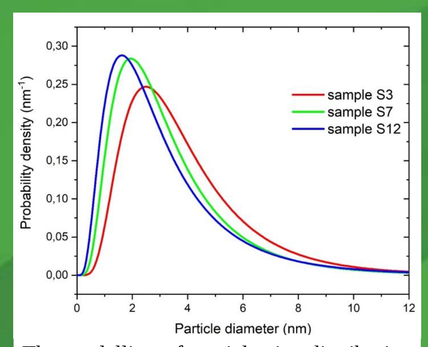




The comparison of magnetic properties of beads used in commercial PCR kit with magnetic properties of our sample S12 measured in liquid form.

CONCLUSIONS

We prepared magnetic beads of Fe_3O_4, coated with a silica shell to which we bound three different the ligands. We investigated the magnetic properties using SQUID magnetometry on three samples prepared by us, S3, S7 and S12, and on a sample of beads from a commercial kit designed for RT-PCR. Samples S3, S7 and S12 have the same magnetic cores, composed of Fe_3O_4, so the magnetic properties differed due to the different ligands that were bound to them. The measurement was done also in liquid form, as we also had the sample from the kit in liquid form. From the measured results we found that our sample S12 has similar magnetic properties, the same particle size and magnetic moment. Our magnetic measurement findings are of great importance for further design of experiments for magnetic separation using RT-PCR.



The modelling of particle size distribution from M(H) curves by Langevin function

ACKNOWLEDGMENTS

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