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in kemijsko tehnologijo

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VABILO NA PREDAVANJE
V OKVIRU DOKTORSKEGA ŠTUDIJA
KEMIJSKE ZNANOSTI

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z naslovom:

Formulation of nanoparticles: from basic research to everyday systems

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Vljudno vabljeni!

Povzetek:

Particle dispersions (or so-called colloids) are widely used systems in various applications in environmental, industrial or biomedical processes. The dispersed solid particles may possess dimensions from a few nanometers to micrometers. Their compositional and morphological diversity is large, therefore, spherical (e.g., metals, polymers and oxides) or elongated (e.g., clays, carbon derivatives and chalcogenides) particles exist. The stability of the particle dispersions is a critical issue in the applications. Stable dispersions contain mainly primary particles homogeneously distributed in the continuous liquid phase. On the other hand, fast aggregation of the particles leads to unstable dispersions and to the formation of doublets at short and large clusters at longer time periods. Such large aggregates may interlink giving rise to phase separation. The main factors influencing the colloidal stability of the particles are the composition, concentration and surface charge. The latter property originates from the structure (structural charge) or the protonation equilibria of the surface functional groups (pH-dependent charge) of the particles.
The present talk will be concerned with the influence of the materials composition, experimental conditions and surface functionalization on the colloidal stability of spherical latexes [1], platelet-like anionic clays [2] and titanate nanowires [3]. Key experimental methods suitable to study the charging and aggregation of the particles in dispersions will be introduced and results obtained by these techniques will be presented and interpreted. Adsorption of monovalent salts, multivalent ions and polyelectrolytes on the surface of the particles and its effect on the colloidal stability will be clarified as well as the results will be compared to predictions by traditional colloid theories. The origin of the interparticle forces responsible for the stability of the heterogeneous systems will be explored. It will be shown that colloidal stability of dispersions containing charged particles can be tuned by appropriately chosen charged species of different valences and the major forces between the particle surfaces can be identified reasonably well. The relation between aggregation processes and potential use of the particle systems will be discussed, particularly from the bio-related aspects. With this knowledge in our hand, one should be able to predict the conditions to develop particle dispersions of optimal properties for various applications in environmental, biomedical and other chemical manufacturing processes.

[1] I. Szilagyi, G. Trefalt, A. Tiraferri, P. Maroni, M. Borkovec, Soft Matter 10 (2014) 2479-2502.
[2] M. Pavlovic, P. Rouster, I. Szilagyi, Nanoscale 9 (2017) 369-379.
[3] M. Pavlovic, M. Adok-Sipiczki, E. Horvath, T. Szabo, L. Forro, I. Szilagyi, J. Phys. Chem. C 119 (2015) 24919-24926.