



CYCLE DE CONFÉRENCES DE CHIMIE

*Avec le concours de : Manufacture Française des Pneumatiques MICHELIN
Ecole Nationale Supérieure de Chimie de Clermont-Ferrand
Institut de Chimie de Clermont-Ferrand (ICCF UMR 6296)
U.F.R.S.T. Département de Chimie*

Lundi 23 Septembre 2013 à 14h (Hors cycle)

Salle C- Bâtiment de Chimie - (Site des Cézeaux)

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Aggregation of Colloidal Particles Induced by Oligomers and Polyelectrolytes

Multivalent ions strongly modify interactions between charged interfaces, therefore, such ions represent important additives to control aggregation or deposition of colloidal particles. In the present study, surface charge properties and colloidal stability of polystyrene latex particles functionalized with amidine or carboxylic groups were investigated in the presence of oppositely charged polyacrylates and polyamines by electrophoresis, light scattering and atomic force microscopy.

Electrophoretic and time-resolved dynamic light scattering experiments revealed that charged oligomers of low valence destabilize the particle dispersions by screening the charge of the particle surface similarly to the effect of simple salt. Oligomers of higher valence induce a charge reversal of the particles due to their partial adsorption on the surface. Close to the charge reversal point, the aggregation is rapid while the suspension becomes stable away from this point. At high oligomer concentrations, the aggregation becomes rapid again due to screening induced by the increased concentration of counter ions of the oligomers. With increasing the valence of the oligomers, the critical coagulation concentration which separates slow and fast aggregation regimes shifts towards lower concentrations in accord to the Schulze-Hardy rule [1]. However, polyelectrolytes of valences higher than about ten adsorb strongly on the surface leading to a characteristic charge reversal and restabilization effect and the critical coagulation concentration values are no longer dependent upon the valence [2].

The stability data of any valence can be well described by the classical theory developed by Derjaguin, Landau, Verwey, and Overbeek (DLVO) indicating that the interactions are governed by attractive van der Waals and repulsive electrostatic double layer forces as confirmed also with colloidal probe technique based on atomic force microscopy [3]. This fact has two main implications. First, additional non-DLVO forces are mostly unimportant in these cases. Second, DLVO theory can be used to make reliable predictions of suspension stability in systems containing multivalent ions or their mixture with polyelectrolytes.

[1] I. Szilágyi, A. Polomska, D. Citherlet, A. Sadeghpour, M. Borkovec, J. Colloid Interface Sci. 392 (2013) 34-41.

[2] I. Szilágyi, A. Sadeghpour, M. Borkovec, Langmuir 28 (2012) 6211-6215.

[3] M. Finessi, P. Sinha, I. Szilágyi, I. Popa, P. Maroni, M. Borkovec, J. Phys. Chem. B 115 (2011) 9098-9105.

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