

Charge Regulation of Dextran Sulphate Sodium Investigated with Membrane Osmometry

Sam Bastiaan, Ben Erné, Albert Philipse

Utrecht University

s.h.a.bastiaan@uu.nl

Charges are important in soft matter and play, for instance, a key role in colloidal stabilization and in the flocculant properties of polyelectrolytes. The effective charge, however, is difficult to determine experimentally. The commonly used technique laser-Doppler electrophoresis, for example, is limited in use to dilute solutions: At higher polyelectrolyte concentrations, the effective charge changes due to charge regulation.

Here, membrane osmometry was employed to observe how the effective charge of dextran sulphate sodium (DSS) changes with ionic strength and polyelectrolyte concentration. Using a membrane osmometer, the effective charge was deduced from the osmotic pressure of a DSS solution in excess to that of a reservoir salt solution.

Our results demonstrate an increasing effective charge with increasing NaCl concentration or decreasing polyelectrolyte concentration. These results are in line with theory since increasing the NaCl concentration leads to stronger screening of dissociated groups on DSS. This reduces the driving force for counterions to re-associate [1]. Increasing DSS concentration results in decreasing distances between DSS molecules and, consequently, increasing double-layer repulsions between the polyelectrolytes. Re-association of counterions reduces the repulsion and lowers the effective charge of DSS [2].

References:

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