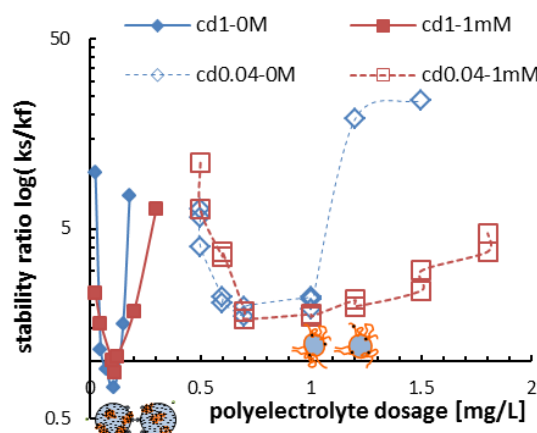


# Effects of charge density of polyelectrolyte chain on the flocculation of colloidal particles

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Rates of flocculation of polystyrene particles induced with two positively charged polyelectrolytes, similar in molecular weight ( $M_w=5 \times 10^6 \text{ g/mol}$ ) but different in charge density ( $cd=1$  and  $0.04$ ), were measured as a function of ionic strength. It is found that both ionic strength and charge density play important roles in the stability of colloidal suspension. In the case of flocculation with highly charged polyelectrolyte ( $cd1$ ), an enhancement of rate of flocculation <sup>[1-2]</sup> was confirmed at isoelectric point and decreases with the increase of ionic strength. This enhancement was rationalized by the concept of “patch” <sup>[1]</sup>, that is, an additional attraction is induced between bare parts of a particle and polyelectrolyte covered parts of neighboring particles. The flocculation proceeds effectively in a rather narrow range of polyelectrolyte dosage, and electrostatic stabilization is induced above the range, where the charge of particles is reversed. However, in the case of flocculation with weakly charged polyelectrolyte ( $cd0.04$ ), the optimum dosage shifts toward a higher polyelectrolyte dosage, approximately 5 times higher than that of highly charged polyelectrolyte. The flocculation proceeds in a rather wide range of polyelectrolyte dosage and is rationalized by “bridging”, originated from the adsorption of polyelectrolyte segments on more than two particles. But the maximum rate of flocculation, even at isoelectric point, is still lower than that of salt-induced rapid coagulation. The reduction can be ascribed to steric interactions of adsorbed polyelectrolyte chains located in the gap between particles.



**Fig.1 Stability ratios for polyelectrolyte coated colloidal dispersion as a function of ionic strength and polyelectrolyte dosage.  $k_f$  and  $k_s$  refer to the rate of flocculation with polyelectrolyte and KCl 1M, respectively.**

[1] J. Gregory, J. Colloid Interface. Sci. 42(1973)448-456.

[2] L.Feng, Y.Adachi, A. Kobayashi. Colloid Surf. A, DOI: 10.1016