Effect of Salt on Swelling Behaviors of Thermo-Sensitive Hydrogels: Applicability of the Non-Random Contact Model

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Thermo-sensitive nano-sized particle gels are prepared by a precipitation polymerization of the N-vinylcaprolactam (NVCL) monomer. Photon correlation spectroscopy (PCS) technique detects a significant effect of the added Sodium Chloride (NaCl) on thermo-sensitive swelling behaviors. For theoretical treatment of salting-out effect on the swelling behaviors, we propose a non-random contact (NRC) model that considers the occupation of salt molecules on the nearest lattice sites of gel molecules, inspired from Guggenheim's approach. Specifically, salt-dependent interchange energy (ε_{salt}) is introduced to the mixing contribution term in order to overcome a major limitation of classical Donnan type approaches, which have poor applicability of conventional ionic model to non-charged gel systems and thermo-sensitivity. We combine three closed-packed lattice models with NRC model to evaluate its general applicability. Remarkably improved results are observed with one additional model parameter from NRC model when applied to given three lattice models. The calculated results show good agreement with experimental data for thermo-sensitive and salt-sensitive swelling behaviors of various types of hydrogels.