

By H. Goldstein

MODEL SHOWS SELF-ASSEMBLY OF POLYMER-SURFACTANT MIXTURES

A new model detailing the onset of self-assembly in a dilute aqueous solution containing a flexible polymer and surfactant makes several interesting predictions on the process, according to Haim Diamant and David Andelman of Tel Aviv University.

Diamant's and Andelman's model gives a more coherent and universal solution to a very important class of chemicals: water soluble polymer mixtures with surfactants. "In the short term, it is important to have a more global picture that furthers the understanding of self-assembly in current applications," Andelman says. "We have simple, general predictions for the onset of self-assembly, which are applicable to a large variety of systems."

First, polymer-surfactant self-assembly always starts at a lower concentration (the critical aggregation concentration or "cac") than the one required for surfactant-surfactant self-assembly (critical micellar concentration or "cmc"). Second, in charged systems the cac increases with salt concentration and is almost independent of polymer charge. Third, in weakly interacting systems the cac remains roughly proportional to the cmc over a wide range of cmc values. The special case of amphiphilic side-chain polymers strongly supports their basic conjecture. Andelman and Diamant found the conditions when the cac can be made very small as is desired in some applications. Lower cac means less additives. Armed with this knowledge, you can control the rheological properties for applications that employ self-assembly.

Eventually, predictions such as the dependence of the critical aggregation concentration on system parameters such as ionic strength, fraction of charge on the monomers, hydrophobicity of the chains, and temperature can be of use in better understanding current applications and in the design of new ones. In particular, the important effect of chain features (e.g. chain hydrophobicity) was not properly appreciated before and might be used in future applications, says Andelman. He wants to collaborate with a commercial partner to transfer the more fundamental results of the model into some specific applications.

R990096

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