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Depletion Model of Casein Micelle at Low Temperature

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Numerous functional properties of casein micelle in milk are related to its dynamic behaviour. Casein micelles are in dynamic equilibrum, constantly disintegrating and reforming, depending on environmental conditions. During the storage of milks, the cooling at 4°C induces the release of β-casein from micelle, whereas when upon heating, this effect is reversed. Up to 40% of {\beta}-casein could be removed from the micelle at 4°C. However this phenomenon significantly affects technological processes involving structural organisation of this assembly such as the coagulation rate or rheological properties of dairy gels. Our aim is to understand this micellar dynamic between 4°C and 24°C by means dynamic of light scattering, turbidity, densimetry measurements and cryo transmission electron microscopy coupled with investigations on micellisation of pure {\beta}-casein by Isothermal Titration Calorimetry. The data obtained in this study allow us to extend the first model proposed by Creamer et al(1977) in which {\beta}-casein located at the surface of casein is released to the milk serum, leading to the diffusion of {\beta}-casein from the core to the micellar surface, which in turn, can be released to the milk serum. Possible mechanisms for the above phenomena are presented. Influence of calcium on {\beta}_caein solubility as a function of temperature is also addressed.
Reference L. K. Creamer, G. P. Berry and O. E. Mills, 1977, A study of the dissociation of {\beta}-casein micelle at low temperature, New Zealand Journal of Dairy Science and Technology,12, 58.