Structural and Kinetic Studies on the Solubilization of Lecithin by Sodium Deoxycholate

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Abstract

Mixed dispersions of egg phosphatidylcholine (PC) and the bile salt sodium deoxycholate (DOC) were prepared by various methods, and their turbidities and proton magnetic resonance spectra were studied as a function of time. The spectra of dispersions prepared by dissolving both components in a common organic solvent and replacing the organic solvent by water did not change with time, indicating that the mixed aggregates formed represent "a state of equilibrium". In the HNMR spectra of these mixed aggregates, only signals from small mixed micellar structures were narrow enough to be observed. The dependence of the NMR line widths on the molar ratio of DOC to PC (R) is interpreted in terms of a model for the PD-DOC mixed micelles, according to which PC is arranged as a curved bilayer, the curvature of which increases with increasing R. Upon mixing PC with aqueous solutions of DOC, we found that the mixed aggregates formed are slowly reorganized and ultimately reach the same state of equilibrium. This reorganization was found to be a pseudo-first-order process, the rate constant of which depends linearly upon the detergent concentration. This process involves saturation of the outer bilayers of the multilamellar PC by detergent, followed by transformation of these bilayers into Mixed micelles. It is concluded that the solubilization occurs through consecutive "peeling off" of lecithin bilayers.