Effect of Ovalbumin, Gelatin & Transfusion Gelatin on Micellization of Non-ionic Surfactants

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The lowering in critical micelle concentration of non-ionic surfactants has been observed in the order: ovalbumin > gelatin > transfusion gelatin. The results have been explained on the basis of electrostatic mechanism involving a weak positive charge due to oxonium ions on the micelles and negative charge sites on protein molecules.

THE effect of added salts[1-4], aliphatic alcohols[5-7], hydrocarbons[8-10] and of non-electrolytes[11-14] on micellization of surfactants has been extensively studied. The effect of added proteins, viz. ovalbumin, gelatin and transfusion gelatin, on the micellar behaviour of non-ionic surfactants, viz. Nonex 501, Nonidet P40 and Nonidet P42, has now been studied and the results reported in this note.

Nonex 501 (methoxy polyoxyethylated glycol laurate), Nonidet P40 (100% polyethylene oxide condensate) and Nonidet P42 (condensation product of dioctylphenol and ethylene oxide) were BDH products. Transfusion gelatin (TG) was obtained in the form of 6% isotonic saline solution from NCL, Poona. Ovalbumin was prepared in the laboratory according to the procedure of Sorensen and Hoyrup[15]. All solutions were prepared in doubly distilled water. The critical micelle concentration (c.m.c.) values of non-ionic surfactants alone as well as in the presence of varying amounts of proteins were determined by measuring surface tension at 25° ± 0·1° by du Nouy's method.

The plots of surface tension (ovalbumin) versus log concentration (C in g/dl) of Nonidet P40 exhibit breaks which obviously correspond to the c.m.c. values of Nonidet P40. The c.m.c. values calculated from these breaks are given in Table 1. The c.m.c. values obtained similarly in the presence of other proteins are also given in Table 1. The sharp breaks in these plots representing the c.m.c. values become less pronounced as the concentration of the protein is increased. The breaks almost disappear when the [protein] is about 0·05 g/dl for ovalbumin and 0·1 g/dl for gelatin and transfusion gelatin. Obviously, at these concentrations, the c.m.c. values cannot precisely be deduced.

An examination of the c.m.c. values in Table 1 reveals that the values decrease in the presence of proteins. The lowering of the c.m.c. of non-ionic surfactant by added proteins is due to electrostatic mechanism involving a weak positive charge on the micelles and oppositely charged sites (negative) on protein molecules, in accordance with the observations of Klurschmit[16] and Hsiao *et al.*[17].

TABLE 1 — C.M.C. VALUES OF NON-IONIC SURFACTANTS IN THE PRESENCE OF VARYING AMOUNTS OF PROTEINS

[Protein] g/dl	c.m.c. × 10^3 (g/dl)		
	Nonidet P40	Nonidet P42	Nonex 501
0·0	13·26	37·59	5·62
	OVALBUMIN		
0·01	11·42	31·60	5·01
0·02	9·44	26·60	4·73
0·05	—	—	—
	GELATIN		
0·02	11·55	33·5	5·16
0·04	10·53	28·2	4·60
0·08	9·18	25·8	4·47
0·10	—	—	—
	TRANSFUSION GELATIN		
0·02	12·23	34·47	5·31
0·04	11·22	30·73	4·87
0·08	10·00	28·20	4·73
0·10	—	—	—

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Some Special Features of the Reaction Between Aluminium & Orthophosphate Ions

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Equilibrium *p*H titration curves of aluminium ions with orthophosphate ions suggest variscite to have the composition $AlPO_4.2H_2O$. This has been further confirmed by its IR spectrum. The titration curves also depict the existence of a new compound $Na_3Al(PO_4)_2$. IR spectra of strengite, mansfieldite and scordite show that position of lattice water in these minerals as well as in variscite is alike.

VARISCITE and strengite are the normal phosphates of Al^{3+} and Fe^{3+} with chemical composition corresponding to the formulae $AlPO_4.2H_2O$ and $FePO_4.2H_2O$ respectively. Assuming six coordination for Al^{3+}, Swenson *et. al.*[1] argued that $H_2PO_4^-$ replaces one water molecule from $[Al(H_2O)_4$-