STERIC STABILIZATION OF SUSPENSIONS, THE ADSORBED POLYMER LAYER THICKNESS

J. B. Kayes, D. A. Rawlins, Pharmaceutics Research Group,
Department of Pharmacy, University of Aston, Birmingham B4 7ET

The stability of colloidal suspension systems is known to be affected by the presence of an adsorbed polymer layer at the surface of the particles; a similar effect is apparent with coarse suspension systems (Kayes, 1976).

It has been shown (Garvey, 1977) that the thickness of the adsorbed layer is of primary importance in controlling the magnitude of attractive forces between particles and the resulting stability of the system. Knowledge of its magnitude is therefore essential when examining the theoretical aspects of particle-particle interaction in such systems. Determination of adsorption isotherms of a series of polyoxyethylene-polyoxypropylene block copolymers* on polystyrene latices (used as a model system) and diloxanide furoate show that these polymers form a monolayer on adsorption. The thickness of the monolayer on polystyrene latex was determined microelectrophoretically and by measurement of the diffusion coefficient of the latex using intensity fluctuation spectroscopy (IFS)(Pusey, 1973). Two polystyrene latex samples were prepared and subsequently characterized by electrophoretic and conductometric techniques. Latex A, used for adsorption isotherms, was of mean diameter 0.3 μm with surface carboxyl groups, Latex B used for IFS studies was of mean diameter 0.16 μm with both sulphate and carboxyl surface groups.

The mobility-surfactant concentration plots obtained microelectrophoretically levelled out in the region of the critical micelle concentrations indicating an adsorbed monolayer. Conversion of these mobilities to zeta potentials and use of an expression derived from double layer theory (Garvey, Tadros & Vincent, 1976) enabled the thickness of the monolayer to be calculated.

IFS studies on Latex B gave accurate measurements of the diffusion coefficient D and enabled the radius of the particle (with and without polymer layer) to be estimated from the Stokes Einstein relation $a = kT/6\pi\eta D$. The fact that large errors are apparent with the values of δ obtained in this way is due to the additive nature of the errors involved in calculating D.

Values for δ obtained by these methods, together with the fully extended length of the ethylene oxide chains of the polymer obtained using molecular models are shown below

PLURONIC	THICKNESS OF ADSORBED LAYER δ nm		
	extended length	microelectrophoresis	IFS
L62	1.8	1.0 ± 0.4	
L64	2.6	2.0 ± 0.4	
F38	7.7	5.3 ± 0.5	5.4 ± 4.8
F68	14.4	9.5 ± 1.0	7.4 ± 5.1
F88	18.3	12.1 ± 1.2	11.9 ± 3.8
F108	26.1	14.4 ± 2.0	13.4 ± 4.5

The results show that the ethylene oxide chain is bent back towards the surface, support for this is given by the adsorption isotherms which indicate a regular increase in the area occupied per molecule on increasing the ethylene oxide chain length whilst keeping the anchored hydrophobic group constant.

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