Isolation of n-Heptadecanoic Acid from Hydrogenated Mutton Fat

In the course of investigations on hydrogenated mutton fat[1], a fraction with saponification equivalent approximating to that of methyl heptadecanoate has been obtained by fractional distillation *in vacuo* in a packed 490 cm. × 3·9 cm. stainless steel column.

Refractionation of an aliquot of this material in a smaller efficient column provided a series of fractions the middle ones of which had saponification equivalents about 284, and these, when converted to acids and submitted to low-temperature crystallization, yielded several grams of a purified acid, of which the saponification equivalent (270·2), melting point (61·2–61·4°) and X-ray analysis (long spacing, 40·8 A.) were all consistent with it being n-heptadecanoic acid.

Although other investigators have reported the occurrence of n-heptadecanoic acid (margaric acid) in natural fats, Ralston[2] summarizes their work as follows : "All the naturally occurring heptadecanoic acids which have been described and subsequently investigated have been shown to consist of mixtures of palmitic and stearic acids". In the present investigation, however, the characteristics of the fractions preclude the possibility of its being a mixture of palmitic and stearic acids and establish the presence of n-heptadecanoic in hydrogenated mutton fat. Further work on the occurrence of n-heptadecanoic acid in this and other fats (hydrogenated and unhydrogenated) is in progress and will be published elsewhere.

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[1] Hansen, R. P., Shorland, F. B., and Cooke, N. J., *Biochem. J.*, **52**, 203 (1952) ; **53**, 374 (1953). Hansen, R. P., and Cooke, N. J., *Biochem. J.*, **54**, 14 (1953). Hansen, R. P., Shorland, F. B., and Cooke, N. J., *Chem. and Indust.*, 516 (1953).
[2] Ralston, A. W., "Fatty Acids and their Derivatives" (John Wiley and Sons, Inc., New York, 1948).

Short-range Electrical Forces between Charged Colloid Particles

In a previous communication in *Nature*[1], I suggested that the short-range equilibria which have been proved to occur between montmorillonite lamellæ might be ascribed to electrical attractive forces due to a 'crystalline' layer of interlamellar cations, these forces being balanced by repulsive forces due to adsorbed layers of oriented molecules. The phenomenon is unlikely to be confined to montmorillonite. It is therefore of general interest to consider how such an arrangement might pass into the normal diffuse Gouy layer distribution as the separation between the lamellæ increases.

The first modification to be expected in the 'crystalline' layer of ions is that, as more space becomes available, it should separate into two layers, one attached to each of the facing surfaces. We may reasonably suppose that each of the two layers thus formed will arrange itself so as to make the separation between the ions as great as possible, that is, in a hexagonal lattice. The two lattices of ions will adjust their relative position so as to make the mutual
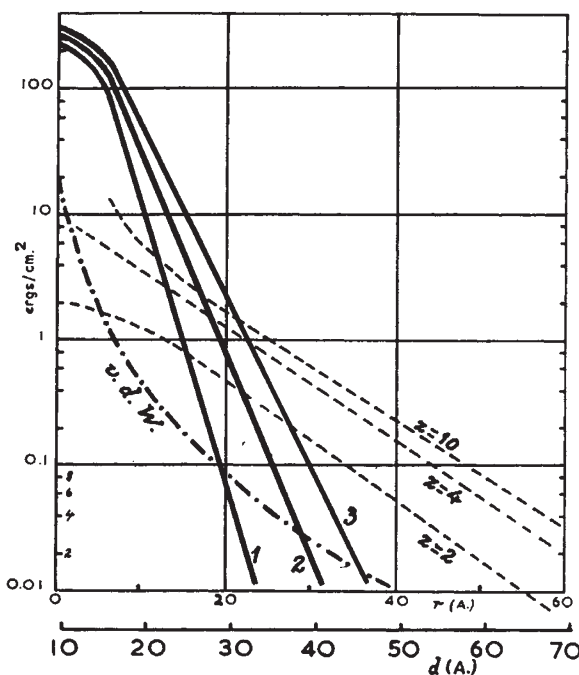

Fig. 1. Potential energy curves for montmorillonite layers. ———, Stern-layer interaction energy (attractive) calculated as described : 1, monovalent cations ; 2, divalent ; 3, trivalent. —·—·, van der Waals energy (attractive) calculated using Verwey and Overbeek's formula (ref. 3), with $A = 5 \times 10^{-13}$. — — —, Gouy-layer interaction energy (repulsive), from Fig. 30 of Verwey and Overbeek's book, with $\varkappa = 10^7$. The discontinuous expansion on Norrish's curves (ref. 4) occurs at about $0\cdot27\ N$, corresponding to $\varkappa = 10^{7\cdot2}$

potential energy a minimum. This leads to an attractive force between the lamellæ.

For the sake of simplicity of calculation, square lattices rather than hexagonal were postulated. The mutual potential energy of the two lattices of ions may then be evaluated by Madelung's method[2]. The full expression is complicated, involving a double sum of exponential terms, but the following approximate expression will serve as a basis of discussion :

$$V \simeq \frac{2\sqrt{\sigma^2 ev}}{\varepsilon} \exp\left(-2\pi r\sqrt{\frac{\sigma}{ev}}\right)$$

where e is electronic charge, ε is dielectric constant of medium, σ is surface charge density, v is valency of ions, and r is separation between the two layers of ions. The value of σ is given by the known structural charge of the montmorillonite lamellæ, but some assumptions must be made to fix values for ε and r.

For Fig. 1 these assumptions essentially were : (a) each ion is surrounded by a hydration shell one molecule thick ; (b) the dielectric in these shells is saturated ($\varepsilon = 3$) ; and (c) outside the shells the dielectric is normal liquid water ($\varepsilon = 81$). An increase or a decrease in the extent of the saturated dielectric would result, respectively, in a raising or lowering of these curves without change of shape. A shift of the ionic layers towards or away from the lamellæ would result in a bodily shift of the curves to left or right, respectively, again without change of shape.

The same figure shows some of the curves deduced by Verwey and Overbeek[3] for the Gouy-layer repulsive potential, and the van der Waals attractive