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Electrical Properties of Films of ω-Bromo-Hexadecanoic Acid

It has been shown that the potential difference at an air solution interface is shifted to more negative values if halogenated aliphatic compounds are introduced in the solution.[1] This can be explained if we assume that the halogen atoms are orientated outwards by surface forces. No data concerning insoluble compounds which could give analogous effects have been available until now. Through the kindness of Dr. M. Stoll (Geneva, Research Laboratory of Chuit-Naef and Co.) we were able to investigate the behavior of films of $Br-(CH_2)_{15}-COOH$. The relation between surface pressure, potential difference and area per molecule for $Br-(CH_2)_{15}-COOH$ on 0.01 N $KCl+10^{-4}$ N HCl is given in Fig. 1. As shown by Fig. 1, remarkably high negative potential differences are observed. Under certain conditions, still higher values up to -0.87 v have been found. It must be kept in mind that the corresponding nonsubstituted compound, i.e., palmitic acid, gives a positive potential difference with a limiting value of about 0.39 v. The difference 1.26 v is to be considered as due to the orientation of $C-Br$ linkages. The calculated effect should be 2.9 v assuming the area per molecule to be 20 sq. A, the dipole moment of the $C-Br$ linkage $\mu=1.9\times10^{-18}$ and the angle between the $C-Br$ linkage and the water surface $109°\ 28'/2$. The main reason for the discrepancy between the calculated and the observed values of the potential difference lies certainly in the mutual polarization of the $C-Br$ linkages; the interaction with water molecules can be neglected in this case.

A remarkable change in the properties of the film occurs if the acidity of the underlying solution is increased above 5×10^{-4} N. The surface pressure decreases strongly, and the negative effect is changed into a positive one with a limiting value of about 0.07 v on 0.01 N $KCl+10^{-3}$ N HCl. The observed phenomenon is probably due to a change of the structure of the film and not to a hydrolysis of $Br-(CH_2)_{15}-COOH$ into $OH-(CH_2)_{15}-COOH$. The latter compound gives on 0.01 N $KCl+10^{-3}$ N HCl a limiting value of the potential difference equal to 0.22 v. The investigation of the properties of these films is being continued and a detailed account will be published in the *Acta physicochimica U.R.S.S.* We are very much indebted to Dr. M. Stoll who generously supplied one of us with samples of some ω-substituted long-chain compounds, without which this investigation would have been impossible.

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August 13, 1936.

[1] D. A. Frumkin, Zeits. f. physik. Chemie 111, 190 (1924); S. Zofa, A. Frumkin and P. Tshugrenoff, Acta physicochimica U.R.S.S. 1, 889 (1936).

Fig. 1.

Liquid Propane. Electrical Conductance and Dielectric Constant

We have constructed conductivity cells of glass with platinum electrodes[1] which were used in a study on liquid hydrogen chloride. The same apparatus served to measure the specific conductance of liquefied propane.

The value found was less than 5×10^{-13} reciprocal ohm at 1 kilocycle in the temperature range: $-90°$ to $+15°C$. From the balancing condensers we were able to determine the dielectric constant (ϵ) of liquid propane as follows:

$$\epsilon_t = \epsilon_0(1+\alpha t);$$
$$\epsilon_0=1.61; \quad \alpha=-0.00124; \quad t=°C.$$

From the density of liquid propane[2] and the dielectric constant we calculated the molecular polarization to be 14.3 cc independent of the temperature.

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[1] G. Glockler and R. E. Peck, J. Chem. Phys. in press.
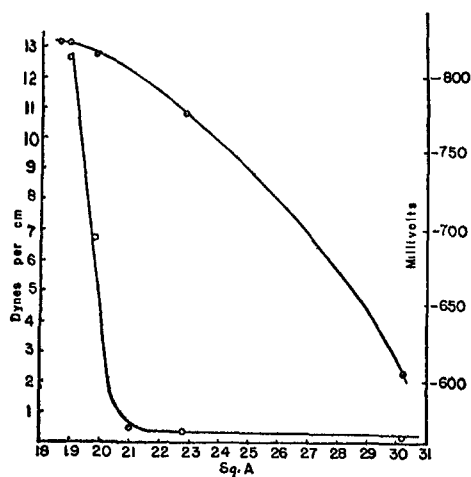[2] *International Critical Tables*, III, page 228.