20. Physico-chemical Properties of Surface Active Agents. (II) Solution and Melt Viscosities of Polyoxyethylene Glycol mono-Alkyl Ethers.

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The solution viscosities of polyoxyethylene glycol mono-alkyl ethers (PEGAE) in benzene and iso-propanol were measured under the similar conditions as in the preceeding report (This Bulletin, **25** 63 1951).

The observed values of the intrinsic viscosity $[\eta]$ were given in Table II.

Table I.

Sample		PO-8	PO-20	PC-10	PC-13	PC-18	PL-6	PL-20
$[\eta]_{25°C}\cdot 10^2$	in CCl_4	5.2	6.6	5.2	6.3	6.2	4.9	6.2
	in C_6H_6	3.5	5.4	4.3	4.3	4.5	2.8	4.4
	in $(CH_3)_2$ CHOH	3.6	4.6	3.2	4.4	3.6	2.6	3.7

As seen from Table I, the values of $[\eta]$ were smaller in benzene and iso-propanol than in carbon tetrachloride. The difference in $[\eta]$ was ascribed to decrease of the solvent power.

Neither cyclohexane nor methanol was good solvent for the PEGAE.

Solutions in these solvents were not clear and showed the occurence of the aggregation of solute molecules.

Hence, it may be considered that the variation of solvent power with the nature of a solvent was related to a balance of oleophilic and hydrophilic properties in a PEGAE molecule.

The melt viscosities η of PEGAE were also determined with an Ostwald viscometer at a range of temperatures from 35° to 75°C, and the energy of activation $\Delta E\ddagger$ for viscous flow was evaluated from the temperature dependence of viscosity. The results obtained were shown in Table II.

Table II.

Sample	PO-8	PO-20	PC-10	PC-13	PC-18	PL-6	PL-20	PEG-1100
$\eta_{55°C}$ in poise	18.77	44.45	23.50	30.18	36.80	14.47	37.07	60.96
$\Delta E\ddagger$ in Kcal/mol	6.62	6.85	6.79	7.02	7.18	6.08	6.58	8.38

These high values of the viscosity η and the energy of activation $\Delta E^{\ddagger}$ were considered to be due to the large hydrodynamic unit in viscous flow and the interaction between molecules.

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21. Physico-chemical Properties of Surface Active Agents. (III) On the Critical Micelle Concentration in Aqueous Polyoxyothylene Glycol Alkyl Ether Solution

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Recently many reports concerning the properties of aqueous ionic detergent solution have been published. And it has been well known that the molecules of the detergent associate into micelles in the aqueous solution above a certain critical concentration, i.e., c.m.c.,

However, the properties of the aqueous solution of the non-ionic detergent has not completely been investigated.

In the present work, the c.m.c. in the aqueous solution of polyoxyethylene glycol alkyl ether was examined by the following four different methods, i.e., viscosity, density, absorption spectrum, and electrical conductivity method. And the last two methods were carried out in the following procedure.

1) Absorption spectrum of aqueous pinacyanol chloride solution (1.4×10^{-5}mol/l) was measured in the presence of the detergent at room temperature (about 15°C) and it was found that the intensity of the absorption band maximum in 610$m\mu$, increased greatly with addition of the detergent, though this band maximum shifted about 10$m\mu$ towards longer wave length than in water. The concentration at which the most rapid increase of this band maximum occured was taken into concideration in this case.

Method	Temperature	The c.m.c. in aqueous PEAGE solution Mol/Litre$\times10^3$						
		PO-8	PO-20	PC-10	PC-13	PC-18	PL-6	PL-20
Viscosity	31°C	—	—	7.6	2.6	5.3	—	—
Density	31°C	3.8	5.6	7.1	6.4	2.5	6.7	3.3
Absorption Spectrum	ca. 15°C	—	—	—	0.9~3.7	—	—	—
Electrical Conductivity	18°C	—	—	—	5.6	3.9	—	—

The same symbols of the detergemt as in the previous reports are used in this table.