results with ling are shown in the accompanying graph ; little difference was revealed between the behaviour of wetting-agent solutions and water.

Within the scale of the experiments it was apparent that, though wetting agents gave no advantage in fire extinction, they may well prove to be of value in controlling heath fires by the technique of wetting the unburnt materials ahead of the fire. This is reasonable in view of the fact that, whereas the small quantities of wetting agent used can have little effect upon the thermal properties of the water, the reduction in surface tension which they bring about is likely to result in improved dispersion within the combustible material even when it causes no appreciable change in the total quantity of liquid retained.

It is intended to examine further the efficacy of wetting agents in similar materials of different specific surface.

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[1] For example, Edson and Parker, *Fire Engineering* (August, 1947)

Measurement of the Adsorption of Surface-Active Agent at a Solution – Air Interface by a Radiotracer Method

THE adsorption of a water-soluble surface-active agent at a solution – air interface has been measured by taking unique advantage of the soft beta radiation from the radioactive isotope of sulphur, S^{35}. The method depends upon the fact that, because of 'self-absorption' of the radiation by the solution, the amount of radiation escaping from a solution of a compound containing this isotope comes principally from that fraction of the sulphur which is near the surface. Since the molecules of a surface-active agent are preferentially adsorbed at the interface, the radioactivity above a solution containing such an agent labelled with radiosulphur should be higher than the activity from a solution (for example, of sodium sulphate) in which no surface adsorption occurs.

To investigate this idea experimentally, di-*n*-octyl sodium sulphosuccinate ('Aerosol OTN') and sodium sulphate were each synthesized with sulphur-35 (procured from the U.S. Atomic Energy Commission). A pure 2–3-mgm. sample of the surface-active agent was secured by five recrystallizations from alcohol – water solutions. Activity measurements were made by placing a mica-window bell-type Geiger counter over small open pans containing the solutions. Measurements were carried out on solutions of the sulphosuccinate and of sodium sulphate having identical concentrations and specific activities. Since the sulphate is not adsorbed at the interface, a comparison of the radioactivity of its solution with that of the surface-active agent permitted a calculation of the amount of agent adsorbed in the interface.

The experimental results showed that the radiotracer technique permitted a successful quantitative determination of the adsorption. Depending upon the specific activities and the concentrations, the counts per minute (c./m.) over the solutions of agent

were 1·1 to 20 times those of the corresponding sodium sulphate. For example, in one case the sulphosuccinate solution showed 2,360 c./m., the sulphate solution only 323 c./m. Measurements of some thirty-five different solutions covering a range of specific activities (1×10^{12} to 5×10^9 counts/min./mole) and of concentrations ($0 \cdot 1$ to 150×10^{-8} moles/c.c.) produced a well-defined adsorption isotherm. It is shown in the accompanying graph, along with an isotherm calculated by the conventional Gibbs equation from surface tension measurements covering the concentration range 4 to 50×10^{-8} moles/c.c. The radioactivity measurements suggested that, after the agent had formed a unimolecular layer, a further increase in bulk concentration caused further adsorption at the interface.
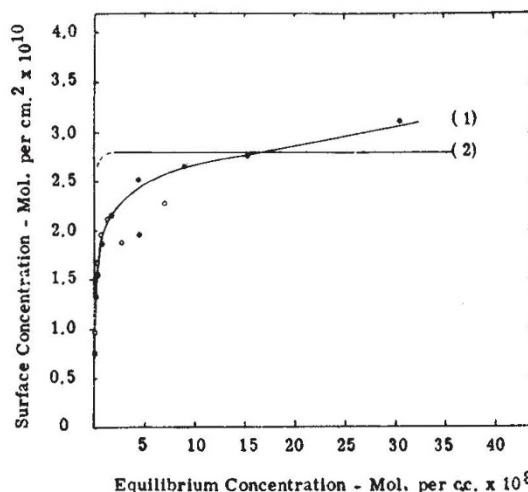
Adsorption isotherm for aqueous solutions of di-*n*-octyl sodium sulphosuccinate. The radioactive isotherm, Curve No. 1, continues without change of slope to a concentration of 150×10^{-8} mol. per c.c., at which point a surface concentration of $5 \cdot 5 \times 10^{-10}$ mol. per cm.^{2} is indicated. The surface tension isotherm, Curve No. 2, remains horizontal to the critical concentration (65×10^{-8} mol. per c.c.). (Temperature, 24° C.)

An interesting aspect is that the rate of adsorption was followed in the low-concentration ranges. The method promises to be useful for studying the kinetics of such adsorption processes.

The radiotracer method outlined above seems to be generally applicable to surface phenomena involving adsorbed layers, either mono- or multi-molecular in nature. Although this note describes the use of sulphur-35, it is evident that other radio-isotopes having sufficiently soft radiation, such as carbon-14, calcium-45, iron-59, etc., could be employed. Moreover, the method appears to open considerable possibility for examining interaction in surface layers. For example, by using labelled sulphate, the adsorption of sulphate ions in the surface layer in a solution containing both cetyl pyridinium chloride and sodium sulphate has already been measured. The application of the method to the study of surface phenomena in bubbles and in systems containing several surface-active materials is under consideration.

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