intervals over a period of twelve months, using a specially designed twin microcalorimeter which gave a precision of measurement of approximately ± 1·5 microwatt (± 0·00086 cal./hr.). The small size of the sample and consequent very low heat outputs (400 μW. at the beginning, falling to 100 μW. at the end of the experimental period) seriously limit the precision attainable in the determination of the half-life; but the results appear to be sufficiently precise to confirm the value already published.

After correcting for the plutonium-238 daughter produced on decay, and for a small amount of a long-lived contaminant, we have computed the half-life from each pair of our results, using the formula:

$$\tau_{1/2} = \frac{0\cdot693t}{2\cdot303\,(\log_{10} A_t - \log_{10} A_0)},$$

t being the time interval in days and A_t and A_0 the heat outputs corresponding to times t and zero respectively.

The mean value obtained is 163·0 days with a standard deviation of ± 1·8 days. A detailed account of this work is to be published elsewhere.

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Speed of Circulation in Droplets

The initiation of circulation in the form of vortex rings in droplets in motion in another liquid has been shown to depend on such physical properties as the viscosity of both the liquid in the droplet and of the outer liquid, and also particularly on the character of the interface. An attempt is now being made to obtain the velocity of circulation inside such liquid droplets in relation to their speed of fall or rise under varying conditions.

In preliminary experiments, droplets of redistilled nitrobenzene containing aluminium particles were allowed to fall through a 0·5 per cent w/w solution of 'Cellofas B' in tap water (viscosity c. 12 centipoises) contained in a square cross-sectioned column of dimensions 30 in. × 2 in. × 2 in. Their fall was photographed using a 16-mm. ciné camera to give a magnification of 1/3, and the camera table was counterbalanced by a weight and pulley system so

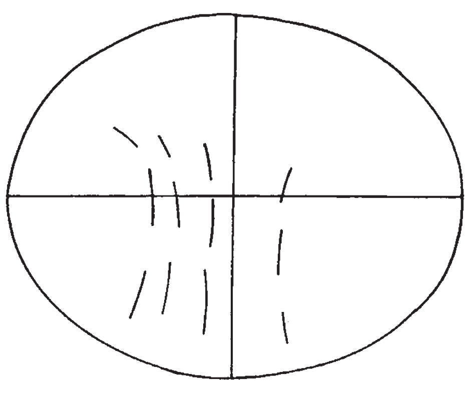

Fig. 1. The farther the streaks from the centre of the droplet, the greater their elongation due to refractive distortion

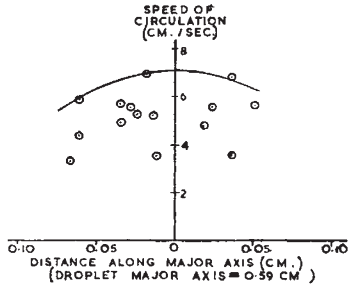

Fig. 2

that with judicious hand pressure the path of the droplet could be followed. High-powered side-lighting was used, and the amount of aluminium in the dispersed phase was such that, with a camera speed of 64 frames per sec., dark streaks were recorded on the film by reflexion from the individual particles. A series of frames showing the fall of a droplet were enlarged by projection and, with each image of the droplet occupying the same position on the screen, successive streaks made by the same particle were plotted to trace the streamlines of circulation (Fig. 1).

From the length of the streaks and the frame-speed of the camera, the velocities along each streamline were obtained. After allowing for refraction at the interface by geometrical construction, these velocities were plotted against the distance from the centre of the droplet to the intersection of the streamline and the major axis.

The envelope of these points represents the velocity distribution in the vertical plane through the centre of the drop perpendicular to the optical axis, and its peak gives the highest circulation velocity. (Points below this envelope represent motion in other vertical planes, Fig. 2.)

For a droplet of major and minor axes equal to 0·59 cm. and 0·47 cm. respectively, this velocity was found to be 7·3 cm./sec. compared with a fall velocity of 13·4 cm./sec. For a spherical droplet the maximum possible circulation velocity is equal to 1·5 times the velocity of fall, so that it can be inferred that the circulation in this particular droplet is about 30 per cent of its maximum possible value.

The velocity of circulation decreased during fall; but as no attempt was made to eliminate injection effects due to the nozzle, it is not yet clear whether this was due to a change in the interfacial properties or not.

During the analysis there is a difficulty in accurately measuring the velocities, especially of particles at 'apparent' distances from the centre greater than half the radius. The work is being continued using liquids of the same refractive index in order to obtain the circulation velocity distribution more accurately, particularly nearer the surface of the droplet. It may then be possible to show how the relative rate of circulation varies with the physical properties of the system, and hence throw more light on the phenomena influencing the initiation of circulation.

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