

In addition, we have found that both methane and hydrogen have considerable lead responses. The latter result differs from that of Egerton, Smith and Ubbelohde⁵, who found tetraethyl lead to have no effect in hydrogen. It may be that the results of Egerton *et al.* were complicated by the incidence of pre-ignition, which is difficult to exclude when working with hydrogen.

This work was carried out in the Ricardo Laboratory on behalf of the Shell Petroleum Co.

D. DOWNS

Ricardo and Co. (Eng.), 1927, Ltd.,
Shoreham-by-Sea.

A. D. WALSH

Laboratory of Physical Chemistry,
Cambridge.

¹Townend and Mandekar, *Proc. Roy. Soc., A*, **141**, 484 (1933).

²See Newitt and Townend, "The Science of Petroleum", **4**, 2884, 2958 (1938).

³Chamberlain and Walsh, Symposium on Oxidation, Paris (April 1948). Symposium on Combustion, Madison (September 1948).

⁴Townend, *Chem. Rev.*, **21**, 259 (1937).

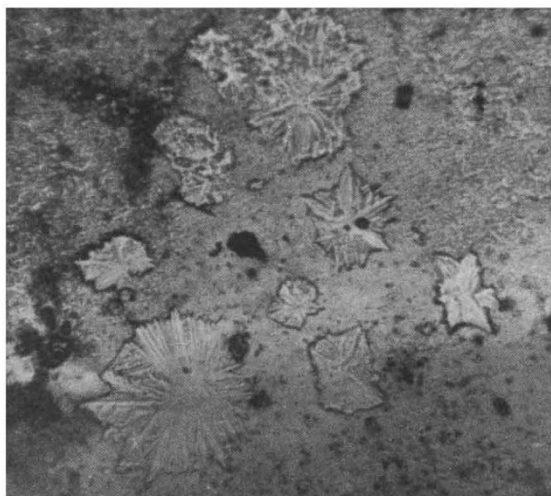
⁵Egerton, Smith and Ubbelohde, *Phil. Trans. Roy. Soc., A*, **234**, 433 (1935).

Hydrolysis of Starch Grains by Polarized Infra-Red Radiation

At the Liverpool meeting of the British Association in 1923, it was shown that polarized radiation had the effect of accelerating the change of starch grains, in a *weak* suspension of diastase and at ordinary laboratory temperature, into a crystalline reducing substance; but if the diastase were active or concentrated, no *selective* effect was observed¹. Earlier experiments in 1922 had shown me that, when ground cereals in plain tap water were exposed to this radiation, a portion of the starch was turned to sugar. This was estimated by Bertrand's method². To meet criticism that the effect might be due to the pressure of the cover glass, the experiment was repeated; but instead of using a microscope slide, the starch suspension was in a flat-bottomed, very thin-walled flask, the base of which was irradiated by light, polarized and reflected vertically upward by a suspension of diastase in an *outer* vessel³.

The resulting hydrolysis was so remarkable that, not only did it dispose of the cover-glass theory, but also it suggested that the polarization of the incident radiant energy by the diastase was the important *physical* factor in enzymatic hydrolysing action; for the enzyme was not in contact with the substrate.

Hydrolysis without enzyme. Prof. E. C. C. Baly pointed out to me that the absorption bands, both of water and the carbohydrate groups, were in the short infra-red. Fused silica ('Vitreosil') dishes, which transmit these rays, have now been used. Radiation from an electric spiral or small radiator was reflected by black glass or by ferrotype at the polarizing angle, striking the underside of the dish containing a suspension of well-washed potato-starch grains. After a period of about seven hours, the grains in some places had a dull, swollen appearance. On drying, clusters of crystals were seen exuding from the grains, or totally escaped into the surrounding medium (see photograph). The temperature was usually only one, or sometimes two, degrees above the room temperature (generally about 19° C.).



The addition in later experiments of a trace of sodium chloride (0.0-0.3 per cent) greatly increased the effect. In this case, the crystals often formed *within* the grain, the coat of the grain gradually disappearing. The sodium chloride apparently acted as a co-enzyme.

The contents of the dish were washed out with distilled water, and, when tested in the usual way, gave evidence of sucrose.

If the experiment is done during the months when the potato tubers are in a dormant condition, the control, placed by the side with ordinary radiation, gives intact starch grains; but after February some crystals may be found and a few of the grains will be seen breaking.

The similarity of the results, though in a much smaller degree, indicates that in this experiment we are imitating the natural process of enzyme hydrolysis.

ELIZABETH SIDNEY SEMMENS

Chelsea Physic Garden,
London, S.W.3.

¹*Nature*, **111**, 49 (1923).

²*Chemistry and Industry* (Oct. 5, 1923). Baly and Semmens, *Proc. Roy. Soc., B*, **97**, 250 (1924). *Nature*, **134**, 813 (1934).

³*Nature*, **117**, 821 (1926); *J. Brit. Assoc.*, **13** (Oxford meeting, 1926).