

that these solutions were applied too late in the season to be effective. It is intended to repeat the treatments next year using solutions of iron and manganese salts.

The low starch content of the rhizomes of the chlorotic plants supports the view usually held that manganese is intimately linked with carbohydrate metabolism.

The deleterious effect which heavy liming sometimes has on bracken may be due to a physiological disturbance produced either by a reduction of the availability of the manganese in the soil or by an increase in the calcium content of the plants.

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also to assume that part at least of the electronic energy of excitation can be transformed into energy of activation of the hydrocarbon molecule.

The experiments with iodine just described lend support to this idea of photo-enolization, not only of acetone but of other ketones as well. The kinetics of the process are complicated and are still being investigated.

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¹ Bamford and Norrish, *J. Chem. Soc.*, 1531, 1544 (1938).

² *Trans. Farad. Soc.*, **30**, 120 (1934).

³ Iredale, *Trans. Farad. Soc.*, **35**, 458 (1939).

⁴ Dawson and Leslie, *J. Chem. Soc.*, **95**, 1880 (1909).

⁵ Rice and Kilpatrick, *J. Amer. Chem. Soc.*, **45**, 1401 (1923).

⁶ Bhattacharya and Dhar, *Z. anorg. Chem.*, **173**, 372 (1923).

⁷ Bowen and Horton, *J. Chem. Soc.*, 1635 (1936).

Photo-enolization of Ketones

PURE, anhydrous liquid acetone in the absence of oxygen reacts with iodine after absorption of ultra-violet light. In the dark a negligible change is observed in the same time. These experiments were originally designed to detect any radicals which may be formed from the photodecomposition of ketones. It is thought¹ that the radicals formed at room temperature (15°) quickly recombine by the Franck-Rabinowitsch mechanism², but at 70° they can react with the molecules of a hydrocarbon solvent with an energy of activation of 12,000 calories. They must therefore survive between $e^{12000/2 \times 288} = 10^9$ and $e^{12000/2 \times 343} = 10^8$ collisions with solvent molecules before recombination, and must have a comparatively long life. In view of the high efficiency of the recombination reaction $\text{CH}_3 + \text{I} = \text{CH}_3\text{I}$ ³, it was thought that illuminated iodine solutions furnishing iodine atoms in concentration comparable with that of the radicals themselves would serve as a method of detecting the presence of methyl and other radicals, by their ready reaction to form alkyl iodides. But irradiated liquid acetone gave no methyl iodide or di-acetyl which could be detected.

The irradiated ketone appears to follow the course of the well-known iodine-acetone reaction studied by Dawson and Leslie⁴, Rice and Kilpatrick⁵, Bhattacharya and Dhar⁶ and others. The trace of hydrogen iodide formed in the preliminary photoreaction makes the subsequent reaction autocatalytic. There is therefore a photochemical after-effect, and the ketone will now react with more iodine in the dark and finally reach a state of equilibrium, as originally found by Dawson and Leslie.

It is difficult to resist the conclusion that absorption of light by the acetone molecules shifts the equilibrium in the direction of the enol form, which alone is capable of reacting with the iodine. If the acetone be irradiated first and additions of iodine made afterwards in the dark, the 'mopping up' of the halogen becomes very much less pronounced. It would seem that the light is not acting as a catalyst in hastening the attainment of a normal equilibrium, but rather acts to disturb this equilibrium, and so produce an abnormal amount of enolization.

In order to account for the formation of di-methyl-*n*-hexyl and di-methyl-cyclohexyl carbinol which is reported⁷ in irradiated mixtures of acetone and *n*-hexane or cyclohexane, it may be necessary to postulate the photo-enolization of the acetone, and

Ciliary Movement and the Density of Pleurobrachia

THE density of the living Ctenophore *Pleurobrachia pileus* (O.F.M.) has been determined recently at Plymouth by two distinct methods. In the first case ten specimens all having the approximate diameter of 1 cm. were introduced into a 5 ml. density bottle, together with sea water, and weighed. The volume of the animals was calculated by measuring their diameter carefully and assuming that they were spheres. The density was found to be 1.02742 at 13.0° C. In the second case more than a hundred specimens were introduced into a density bottle and weighed, but the volume was found by the more accurate displacement method¹. Here again the density was found to be 1.02741 at 13.0° C. The water content was also estimated and found to be 94.73 per cent.

However, in dealing with most of the problems involved in connexion with this type of work one does not want to know the actual density but rather the density of the organism in relation to that of its environment at the time of the determination. The density of the environment, sea water, was found to be 1.02720 at 13.0° C. The easiest way of expressing this ratio or sinking factor is obviously density of organism/density of environment, which gives in the first example 1.00022/1, but since this figure is apt to be confused with the actual density it is better and more convenient to keep the two distinct by multiplying the result by 1,000, giving the result 1000.22/1000, and if the density of the environment is always equated to 1,000 it need not be given in the expression. Thus in the one case the sinking factor becomes 1000.20 and in the other 1000.22, or the density of the organism differs from the density of its environment by only 2 parts per 10,000.

In 1928, Prof. Gray², from theoretical grounds, made the following statement: "For very small animals whose surface is richly ciliated the specific gravity is relatively less important; but if the size increases the body must have a high water content". Clearly this indicates that the density must be reduced, though an increase in water content is not the only means by which this can be brought about. However, the statement is fully supported by the data now obtained, since the Ctenophores are relatively large animals and swim by means of a highly complicated ciliary mechanism, while the water con-