

A POSSIBLE PHYSIOLOGICAL EFFECT OF THE HEAVY ISOTOPE OF H IN WATER

Sir:

While running experiments on the biological effect of melted ice water and recently condensed water [*Proc. Nat. Acad. Sci.*, **18**, 136, 422 (1932); **19**, 638 (1933)] I tried heavy water obtained from electrolysis in the manufacture of oxygen. The preliminary results are of interest in connection with the recent communication of G. N. Lewis [THIS JOURNAL, **55**, 3503 (1933)] reporting that tobacco seeds failed to sprout in pure $\text{H}^2\text{H}^2\text{O}$ and that growth was considerably inhibited in water in which one-half of the hydrogen was H^2 . Since the pure $\text{H}^2\text{H}^2\text{O}$ appears to be lethal, it is probable that more interesting effects will be obtained with less concentrated water such as the sample used in the present experiments which had a specific gravity of 1.000061 (kindly determined by Drs. E. Ball and O. W. Richards).

The tests were made during May and June, 1933. In experiment No. 1 ten 250-cc. covered Pyrex beakers were used, each containing 90 cc. of water. There were four beakers of heavy water and two of each of the following: distilled water, melted ice water renewed daily, and freshly condensed water also renewed daily. Approximately equal amounts of freshly collected *Spirogyra* were rinsed in the water to be tested, drained on filter paper and placed in the beakers. The heavy water was changed after twenty-four hours to avoid dilution by water carried over with the filaments. The beakers were exposed to northern light in an unheated aquarium room (temp. 18-22°). Measurements with an illuminometer showed no differences in light intensity that might affect the results. The filaments in heavy water were characterized by their lack of movement, absence of abscission or cell disjunction [*cf. Lloyd, Mich. Acad.*, **6**, 275 (1927)] and greater longevity. In the distilled water controls more spreading occurred, the filaments broke into short lengths (abscission) and began to fade within twenty days. The usual effect was found in the ice and steam water, *i. e.*, almost normal condition in the former and bleaching in the latter. In experiment No. 2 consisting of two beakers of each of the four kinds of water the samples were buffered with Sørensen's phosphates to PH 7.16 and the effects secured again. In the third series the heavy water used in the preceding tests was redistilled in permanganate, buffered again and the results duplicated.

The experiments suggest a stabilizing action of water containing the heavy isotope and the hypothesis may be considered that this is an effect on the colloids in the organism whose bound water is known to be of greater density than "free" water.

PH determinations with brom thymol blue indicated a slightly higher PH for the heavy water. Further work with a glass electrode is planned

to determine if this is a real effect, possibly due to the lower mobility of the heavy H isotope [*cf.* Bernal and Fowler, *J. Chem. Phys.*, **1**, 515 (1933)].

OSBORN ZOOLOGICAL LABORATORY
YALE UNIVERSITY
NEW HAVEN, CONNECTICUT

T. CUNLIFFE BARNES

RECEIVED SEPTEMBER 14, 1933

PUBLISHED OCTOBER 6, 1933

SCALE READINGS OF ISOMERIC ESTERS ON THE MAGNETO-OPTIC APPARATUS

Sir:

In a former report [THIS JOURNAL, **55**, 2614 (1933)] the scale readings of the characteristic minima of a number of organic compounds were determined and were found to increase with the increasing weight of positive radicals and to decrease with the increasing weight of the negative radicals. We desired to determine whether these observations held true in the case of isomeric esters or whether it might be that compounds having the same total mass would also have identical scale readings. In order to test this point, the scale readings of various types of esters which are isomeric with the normal alkyl acetates (published in the above mentioned report and reproduced here) were determined experimentally.

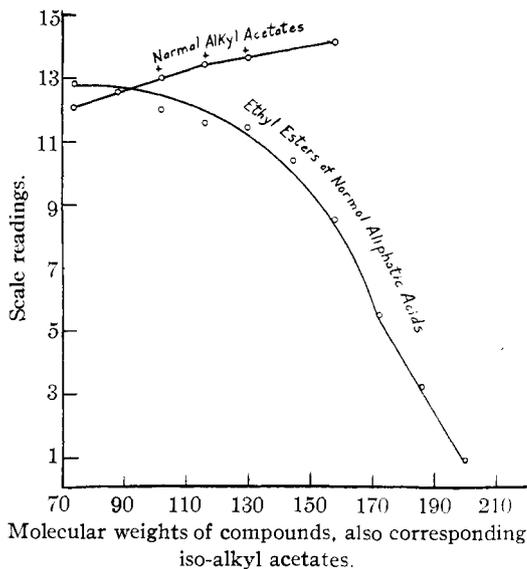


Fig. 1.—Scale readings of isomeric esters on the magneto-optic apparatus.

The readings referred to carbon bisulfide are given in the table herewith.

The usual precautions regarding impurities and contaminations were observed. All readings were made in both water and ether.

A study of the table will show that in the case of corresponding iso and normal acetates, where there is no change in the weights of the positive and negative radicals, the scale readings are identical. But for isomers such as methyl acetate and ethyl formate, where there is a change in the weight of both positive and negative radicals, different scale readings for the two compounds are obtained.