other would find their way into crops grown on a soil of this kind. Analyses of agricultural products, made by Langworthy and Austen in the Department of Agriculture, show the quantities of alum in our agricultural food products to be extremely minute. It is not likely that the combined intake of aluminum from the sources mentioned would in any way equal the hundreds of tons of alum taken into our stomachs every year through the wide-spread use of alum baking powders. The very warning that Miss Parker gives should be a danger signal not to increase beyond a minimum content the intake of aluminum compounds in our foods.

"The Truth about Baking Powder" is chiefly concerned with the evidence showing that S.A.S. (sodium aluminum sulphate), which is an alum according to the common definition of the term, is not, in point of fact, alum as it is understood at the drugstore. Copious extracts from evidence to establish that fact form the bulk of the book.

"THE CURRENT SIGNIFICANCE OF THE WORD 'ALUM'"

Dr. Richardson's work is peculiarly well written, in a proper ethical spirit and was copyrighted by himself in 1927. It bears no indication of having been written in any spirit except that of a difference of opinion as to the scope to which the term alum should apply. It was published, evidently, by interests engaged in the production of alum baking powder. It thus belongs to the category of the other books mentioned in this discussion. They are all intended for propaganda to further popularize the use of alum in our foods. There can be no valid objection to propaganda of this kind if it is plainly labeled. The vice in this particular case lies in trying to conceal this purpose. In two cases the title page contains a statement that the book was in the interest of alum baking powder. In the other cases such information is not found. The greater number of readers of these books (including myself) would naturally conclude that the authors had no ulterior purpose beyond stating facts and drawing unbiased conclusions therefrom. I was not even rendered suspicious by the fact that all these publications came to me without a bill. The chemical authors are my personal friends.

Mr. Richardson pays a high compliment to Dr. Patterson's contribution. He says:

> Dr. Patterson has taken great pains in looking up authorities and his presentation is a scholarly one. The bibliography of the subject which he has worked up is extensive and the quotations which he introduces are correct * * * The author is indebted to Dr. Patterson for many references and takes this opportunity to express his appreciation of the pains-taking way in which Dr. Patterson has investigated the early, middle and recent history of alum. Dr. Patterson and I agree with reference to our authorities but we differ widely in our conclusions.

Dr. Richardson takes the ground that the term "alum" should be applied strictly to its original chemical definition as a double sulphate or aluminum and potash or ammonia. He accedes, however, to the chemical definition of the term alum in general, which is a double sulphate of aluminum and any other metal that will fit in and produce a sulphate of similar crystallographic structure.

Dr. Patterson, on the other hand, claims that sulphate of alumina alone is also entitled to the name alum, and particularly when used without water of crystallization in baking powders.

Officials of the United States and states when called upon to enforce the national and state laws have placed upon them an obligation expressed by the phrase *noblesse oblige*. Their first duty is to the people of their respective states and of the whole country. When the Bureau of Chemistry was selected by law to enforce the National Food and Drugs Act, its officers were animated by the one supreme obligation, namely, that, when doubt existed of any kind as to whether the given article of food or drugs was adulterated or misbranded, the decision should always be in favor of the people of the United States. If any harm or injury were done to the manufacturer and dealer they had full recourse to defend themselves before a federal judge or, in the states, before a state judge. It seems to me that this is the attitude which the instructed citizen at large should take in regard to the use of alum in our foods. If there is any doubt as to the wholesomeness of alum we should incline to the decision that it ought to be forbidden in our food products.

HARVEY W. WILEY

WASHINGTON, D. C.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

ETHYLENE GLYCOL AS AN ATMOMETER REAGENT TO MEASURE THE EVAPORATING ENVIRONMENT AT TEMPERATURES BELOW FREEZING

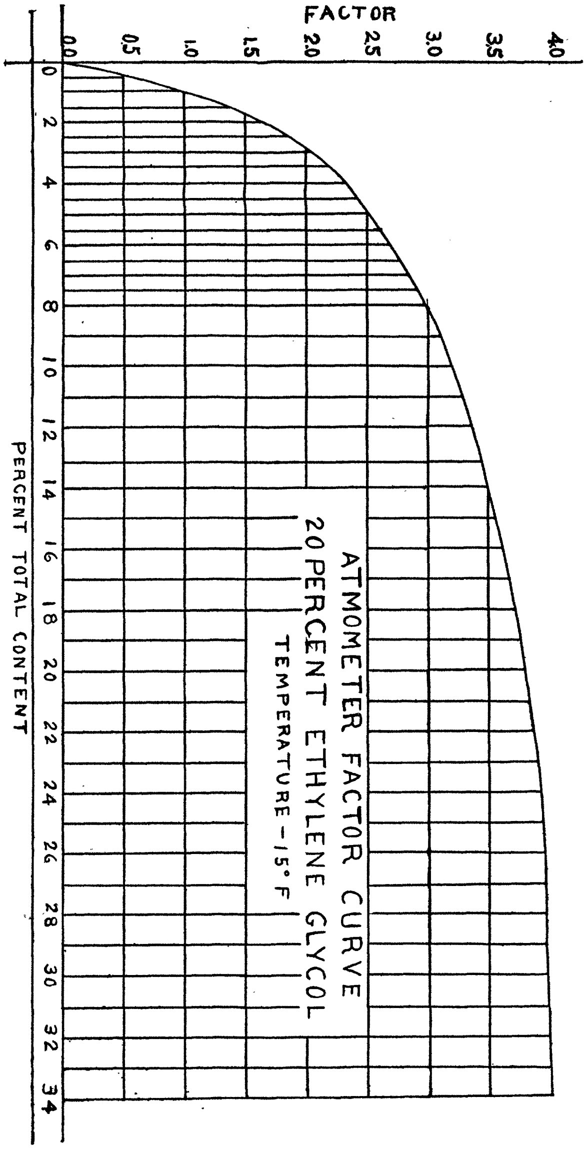
IN certain investigations where it is necessary to measure the evaporating environment, limitation is encountered when the temperatures are below freezing, especially at the beginning and toward the close of the active growing season. For want of a desirable anti-freeze compound there is practically nothing to tell us what the evaporating complex is during periods of cold weather.

Inasmuch as ethylene glycol has certain chemical and physical properties which make it an ideal solution to use in automobile radiators to prevent freezing during winter weather, it seemed probable that such a compound should lend itself as an atmometer reagent to measure the evaporating environment when the temperature was low.

In the recommendations which are given automobile drivers, the concentration of ethylene glycol[1] to be used is determined by the temperature which is current at the particular time. For temperatures approximately 15 degrees F. a 20 per cent. solution is used; for a temperature of −15 degrees F. a concentration of 40 per cent. It might be necessary to use a 50 per cent. solution or even a sixty per cent. solution. But this is true that the stronger the solution the greater is the force necessary to evaporate water from it. The more concentrated the ethylene glycol the longer will be the time necessary to evaporate the mixture to a given volume.

In the procedure which was used in determining the atmometer factor the cylindrical type of standardized atmometer was used. The simple type of mounting was employed, but each was provided with a Livingston-Thone[2] valve, to prevent any inflow as a result of possible condensation. The solution used took into consideration the temperature at which the evaporating environment was contemplated. For this section of the country at least, the 20 to 40 per cent. solutions are the only two concentrations necessary and will take care of all such temperature conditions as would likely be encountered. Where the temperature reaches a lower point a 50 per cent. solution is advisable. A solution of this concentration has a corresponding relation as far as its factor is concerned.

To secure the factor, one half of the atmometers were filled with distilled water in the usual way and the other half were filled with the ethylene glycol solution. They were placed alternately around the periphery of a revolving table and caused to rotate. The method is much the same as is used in standardizing atmometers. The containers were marked so that the percentage of the total content evaporated might be determined at any time. The evaporation from the ethylene glycol solution is less than that from water and naturally as evaporation proceeds the concentration of the ethylene glycol solution becomes greater; at the same time there is a greater resistance to the passage of water. If the amount of water loss for a given interval from the ethylene glycol solution is designated as Y and that from distilled water as W, the factor X is secured by dividing W by Y. Stated algebraically this is as follows: $X = \frac{W}{Y}$. The relation is made clear from an examination of the accompanying graph for the 20 per cent. ethylene glycol.



All one needs is to be sure that he has the given concentration of ethylene glycol to start with. This may be readily secured by determining the specific gravity. At the end of the period of exposure the percentage of the total initial amount is determined, and by interpolation on one of the graphs the factor is found. The product of the factor times the actual amount evaporated from the ethylene glycol gives the reading which would have taken place in an atmometer

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[1] Curme, G. O., and Young, C. O., "Ethylene Glycol," *Indus. and Engin. Chem.* 17 (11): 1117. 1925.

[2] Livingston, B. E., and Thone, Frank, "A Simplified Non-absorbing Mounting for Porous Porcelain Atmometers," SCIENCE, 52: 85–85. 1920.

TABLE I

MOLAR COMPOSITION OF SAPS EXPRESSED AS PER CENT. OF HALIDE

	A	B	C	D	E
	Sea water Bermuda	*Halicystis* Bermuda	*V. macrophysa* Bermuda	*V. macrophysa* Tortugas	*V. ventricosa* Tortugas
Cl + Br	100.00	100.00	100.00	100.00	100.00
K	2.15	2.58	86.24	82.33	94.74
Na	85.87	92.80	15.08	18.55	5.73
Ca	2.05	1.36	0.288	0.02	Trace
Mg	9.74	2.49	Trace ?	0.08	Trace
SO_4	6.26	Trace ?	Trace ?	0.04	Trace

Analyses: B by Dorcas.[2]
A, C by Van der Pyl.[3]
D, E by Cooper.

which had been filled with water. The accompanying graph is for a 20 per cent. solution and is applicable for temperatures not below 15° F. The graphs for the lower temperatures are not shown here. They are similar but the factors are correspondingly greater.

As ethylene glycol is easily procured under the trade name prestone, and as the cost is low, the procedure as given above for the measurement of evaporation should have a rather wide application.

A. L. BAKKE
J. M. AIKMAN

IOWA STATE COLLEGE

SPECIAL ARTICLES

THE CELL SAP OF VALONIA AND HALICYSTIS

PHYSIOLOGICAL and morphological study of *Valonia* has made it evident[1] that the Bermuda plant formerly known as *V. ventricosa* is a species of *Halicystis*. In order to correct the label for the cell-sap analyses formerly published [2, 3] and to extend the comparison, further analyses of sap of undoubted *V. ventricosa* are here presented. This sap was collected, taking care to avoid contamination, from cells gathered on the reefs at the Dry Tortugas keys, Florida. Samples of sap from *V. macrophysa* growing in the moat of Fort Jefferson, about a mile from these reefs, were likewise analyzed for comparison with the Bermuda species.

Potassium was determined as perchlorate; sodium as sodium chloride; calcium as calcium oxide; magnesium as magnesium pyrophosphate; halide by titration with silver nitrate; and sulphate as barium sulphate.

The maximum errors to be expected, from the determination of a known solution, are: potassium 0.5 per cent. too low; sodium 3.0 per cent. too high; halide 0.3 per cent. low; when porcelain is used. The determina-

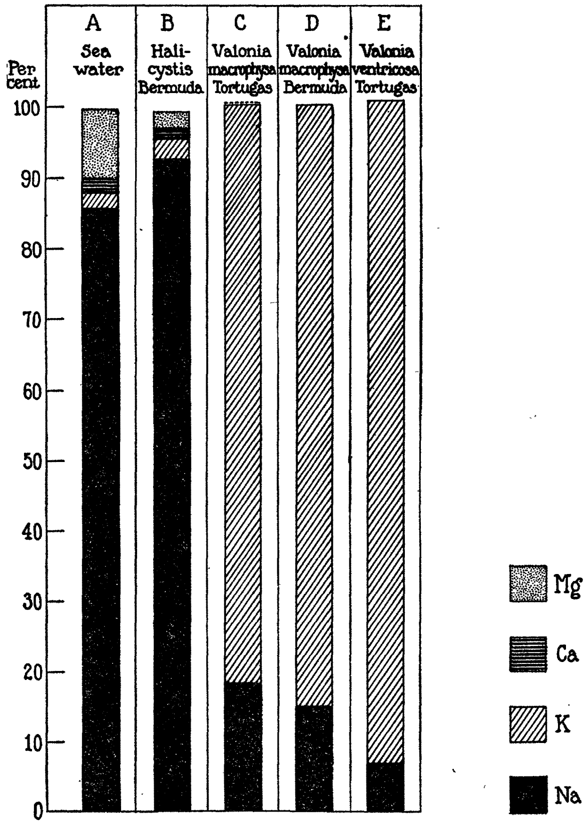

FIG. 1. Graph showing molar concentration, expressed as per cent. of halide, of the chief elements in the saps of *Valonia ventricosa, V. macrophysa,* and *Halicystis,* compared with sea water.

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[1] Blinks, L. R., SCIENCE, 1927, lxv, 429.

[2] Osterhout, W. J. V., and Dorcas, M. J., *J. Gen. Physiol.,* 1924–25, vii, 633.

[3] Osterhout, W. J. V., *J. Gen. Physiol.,* 1922–23, v, 225.