A. pectinatus and *A. bisulcatus* were markedly stimulated when a soil low in naturally occurring selenium was treated with a solution carrying 40 ppm of selenium (as sodium selenite). It was found to be impossible to secure a stand of either of these species of *Astragalus* on a Cecil clay loam from North Carolina.

Since plants of *Astragalus racemosus* are stimulated by selenium and sometimes accumulate as much as 15,000 ppm without visible injury,[4] it is perhaps not surprising to find that they can tolerate a relatively high concentration of selenium in the culture solution. A solution containing 27 ppm of selenium (as sodium selenite) retarded root development but stimulated the tops. With 81 ppm the *Astragalus* plants were stunted and chlorotic, exhibiting symptoms similar to those of wheat and buckwheat plants in a solution containing one tenth this concentration.[5]

Selenium, if required by certain plants, is unique among the essential elements in being needed by only a few species of the higher plants, in the Leguminosae, the Compositae and the Cruciferae. Even in the genus *Astragalus* some species appear to be definite indicators, limited to seleniferous soils, while others are indifferent in their soil requirements. These facts suggest an interesting evolutionary development of tolerance and requirement of selenium by a small number of species belonging to distantly related families.

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A NEW AND RAPID DEHYDRATION PROCESS FOR VEGETABLES[1]

IN present dehydration processes the principal difficulties are: (1) the cost of fuel, (2) detrimental effects of high temperatures on the material being dried and (3) the length of time required. The process described below obviates these difficulties. It depends on the fact that certain toxic vapors, notably those of fat solvents and some toxic gases, have the property of rapidly increasing the permeability of living tissue and finally killing it. This results in a loss of turgor and a release or separation of juice from the solid material. The juice containing the water and soluble matter, such as sugars, can then be removed largely by inexpensive mechanical means at low temperatures. Subsequent drying of the solid residue is rapid because of its complete permeability and its low moisture content.

In connection with studies on sweet potatoes used for starch manufacture it was found, for instance, that vapors of carbon tetrachloride, toluene, chloroform and other fat solvents and sulfur dioxide and chlorine gases increased the permeability of the roots so rapidly that they were reduced to a soft, water-soaked condition in a few hours. Wetting the surface of the roots with the liquid solvent accelerated the action, which began almost immediately and reduced the time of treatment to approximately one hour. Extrusion of drops of juice on the surface of the tissue occurred during the treatment. The juice from material in this condition was readily pressed out without crushing the tissue, since the latter had become tough and pliable. The pressed residue, which then contained only about 40 per cent. of water, dried very quickly at relatively low temperatures. This is in marked contrast with thin slices of untreated material which, even after a long period of drying under the same conditions, showed fresh tissue within.

The method was tried also on other vegetables, notably, red beets, string beans, carrots and rutabagas and was found to be equally effective. Losses in weight after pressing and after drying for thirty-six hours under atmospheric conditions to an "air-dry" state are given in Table 1.

TABLE 1
DEHYDRATION OF VEGETABLES

Material	Per cent. loss in weight on pressing	Per cent. loss in weight on drying	Solids content of juice degrees Baumé
Rutabaga	50.0	65.2	4.4
Carrot	60.2	74.4	4.3
Beet	85.0	93.3	5.4
Green beans	82.0	95.5	4.0
Sweet potato	50.0	64.0	7.4

A number of interesting points were noted in connection with these experiments. Most important, however, is the possibility of applying the method for quickly dehydrating and preserving perishable material. The juice concentrated to a sirup and the residue reduced to the "air-dry" condition will keep indefinitely for future use or manufacture.

This has been done on a fairly large scale with sweet potatoes. The dehydration is carried out in this case by grinding the roots to a pulp and treating the latter with sulfur dioxide gas. The treated pulp is then spun in a centrifuge to remove the juice and the solid residue further dried to about 12 per cent. of moisture. This final drying removes the last traces of gas. Fermentation tests have shown that sugars in the juice may be converted into alcohol.

The advantages of the process, for which a public service patent is pending, are that it provides a method

[4] Beath *et al., loc. cit.*
[5] A. L. Martin, *Am. Jour. Bot.*, 23: 471–483, 1936.
[1] Contribution No. 137 from the Carbohydrate Research Division, Bureau of Chemistry and Soils, U. S. Department of Agriculture.

of storing fleshy plant material without loss from rotting, freezing, respiration, moulding, enzyme action, etc., and that it can be carried out at low pressures and temperatures, mainly by cheaper mechanical operations, as distinguished from ordinary methods of drying. This will result in a large saving of fuel costs and will also give a better dehydrated product because of the low temperature and rapid drying. In the manufacture of starch from sweet potatoes, these last considerations are important in preventing physical and chemical changes in the starch before it is extracted.

It is obvious that, due to the removal of soluble substances in the juice by this process, wide claims for the dehydration of vegetables for food use should not be made. There may of course be special instances where the loss of nutrients or flavor with the juice would not be undesirable. Concentrating the juice and recombining it with the dried material does not seem to be feasible because of the high fuel cost. It appears, at present, that the principal applications will be in those cases where the loss of juice is not vital, such as in the manufacture of starch from either sweet or Irish potatoes and other similar processes.

The simplicity and low cost of this method suggest that it may be carried out in small-scale plants located at the source of the raw product. The dehydrated material can then be shipped economically some distance for further manufacture. This seems an effectual means of conserving surplus crops, cull vegetables and other farm wastes. In this way the method should become of considerable economic importance.

This investigation has been conducted by the Carbohydrate Research Division, United States Bureau of Chemistry and Soils, and financed by a grant of funds from The Chemical Foundation, Inc., of New York.

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THE GROWTH AND CHEMICAL ACTION OF ACETOBACTER SUBOXYDANS UPON I-INOSITOL[1]

PREVIOUS communications from this laboratory[2, 3] have dealt with the preparation of sorbose and of dihydroxyacetone by the action of *Acetobacter suboxydans* upon sorbitol and glycerol, respectively. It seemed of special interest to test the action of the organism upon cyclic polyhydric alcohols, and i-inositol was the first compound of this type chosen for study. This compound is of biological interest not only because of its wide occurrence, but because Miller and co-workers[4, 5, 6] have shown the compound to be identical with Bios I. It was thought that if this compound could be biologically oxidized to ketone compounds, which might exist in reversible oxidation-reduction systems, some light might be thrown upon its rôle as Bios I. Moreover, this type of reaction would permit the preparation of cyclic polyhydric ketones not now available. The organism has been shown, in our laboratories, to oxidize the i-inositol to a compound which present results indicate to be a di-keto-i-inositol. Details of preparation and identification of the compound will be published later.

Some observations on the culturing of the organism on i-inositol are of special interest and are noted at this time. In preliminary experiments, a medium containing 3 per cent. of i-inositol and 0.5 per cent. yeast extract (Difco) was inoculated with a culture of *Acetobacter suboxydans* which had been grown on a sorbitol medium. Growth was good and the Schaffer Hartmann[7] titration showed the formation of reducing material. However, it was found that the organism could not be carried on the inositol-yeast extract medium beyond the third transfer. The addition of as little as 0.1 per cent. of sorbitol to the above medium permitted indefinite subculture and high conversion of the inositol into the oxidation product.

The factor involved in the above phenomena is not surbose but is some other fermentation product of the sorbitol. The material is present in the filtrate obtained by separation of the bacteria from the medium by filtration through a Berkefeld filter; it is stable when heated for 10 minutes at 100°, but shows some slight deterioration when stored for three weeks at 30°. The bacteria, washed free from the fermented sorbitol medium, were unable to oxidize the inositol unless the filtrate was added. Detailed studies are in progress to determine the nature of this factor and whether it will affect the oxidation of other materials by the organism.

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THE EXCRETION OF PREGNANDIOL IN THE TOXEMIAS OF PREGNANCY

DETERMINATIONS have been carried out on the urine of pregnant women for sodium pregnandiol glucuronidate, an excretion product of progesterone, according

[1] Contribution from the Department of Chemistry, Iowa State College. This work was supported in part by a grant from the Industrial Science Research funds for the fermentative utilization of agricultural products. The i-inositol was kindly furnished by Dr. Edward Bartow, of the University of Iowa.

[2] E. I. Fulmer, J. W. Dunning, J. F. Guyman and L. A. Underkofler, *Jour. Am. Chem. Soc.*, 58: 1012, 1936.

[3] L. A. Underkofler and E. I. Fulmer, *Ibid.*, 59: 301, 1937.

[4] G. H. W. Lucas, *Jour. Phys. Chem.*, 28: 1180, 1924.

[5] Edna V. Eastcott, *Ibid.*, 32: 1094, 1928.

[6] W. L. Miller, Edna V. Eastcott and J. E. Maconachie, *Jour. Am. Chem. Soc.*, 55: 1502, 1933.

[7] P. A. Schaffer and A. F. Hartmann, *Jour. Biol. Chem.*, 45: 365, 1920.