we worry out for ourselves is seldom forgotten.

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LEVULOSE SIRUP

THE present—and, we are told, very likely the permanent—shortage of crystallized sugar is stimulating very markedly the interest in other sugars. The consumption of glucose or corn sirup is increasing steadily; the making of sorghum sirup bids fair to return to the prominent place it once held; our friends the bees are being exploited more and more; and a great many breweries, instead of retiring as requested, are now malting grain as usual, but instead of fermenting it are converting it into maltose sirup. Of the above four sugar products, sorghum and honey are the only ones which compete with cane sugar in sweetness; maltose is much less sweet, and glucose is very much less sweet, than sucrose. Now, it is sweetness that we demand; we do not eat sugars and sirups primarily for their calories, but because they sweeten other, less palatable, and cheaper, food products. Therefore, glucose and maltose have very natural limitations on their extensive utilization, if sweeter materials can be found. Of the two sweeter products, honey will probably of necessity always remain a luxury; and sorghum sirup has a flavor that precludes its unlimited use for all purposes, although it should be said that this flavor can be almost entirely removed, with practically only the sweetness remaining, and that there is a possibility of an enormously increased utilization of sorghum in this way. Is there not, however, a sugar which is sweeter than any of the above, which is not now of commercial importance, but which possibly could be obtained in large enough quantities and at a low enough cost to become important?

Levulose, fructose, or fruit sugar, is the sweetest known sugar. Exact data as to the relative sweetness of the various sugars are not available, but it is often stated that levulose is 30 to 50 per cent. sweeter than sucrose. A levulose sirup, then, would be a distinct asset in the present commerce in sweet products. Levulose occurs in practically all fruits, is abundant in honey, and is found in appreciable amounts in sorghum sirup. Its most conspicuous occurrence in plants, however, is in the form of inulin in the tubers of the Jerusalem artichoke and in the bulbs of the dahlia. Inulin is a polysaccharide somewhat resembling starch, but whereas starch yields glucose on hydrolysis with acid, as in the manufacture of corn sirup, inulin yields levulose.

The inulin is present to the extent of 12 to 14 per cent. of the fresh tuber. As is well known, the artichoke gives very large yields, from 700 to 1,000 bushels per acre being normal. If one assume 40,000 pounds per acre, and a 10 per cent. recovery of inulin from the tubers, there would thus be 4,000 pounds of sugar per acre. A 50-bushel crop of corn yields about 2,000 pounds of starch; an acre of good sorghum yields about 1,600 pounds of sugar; an acre of sugar beets, 3,000 pounds; an acre of sugar cane 3,000 to 4,500 pounds.

Thus it is seen that the possible yield of sugar from artichokes compares very favorably with that of our other sugar crops; and the writer believes, on the basis of the above facts, that levulose sirup from artichoke tubers is one of the most promising sugar possibilities that we have. The levulose would probably have to be in sirup form, since it crystallizes with difficulty. The above figures are estimates based on known yields and analyses of artichokes. The unknown factor in the proposition at present is the technology of manufacture. Practically nothing is known about the isolation of the inulin and its hydrolysis to levulose on a commercial scale. But what is known concerning the chemistry of these substances gives us every reason to believe that the problem connected with the manufacture of levulose sirup could be solved, as were those in the manufacture of the other sugar products. Likewise the question of the cost of production is unknown. Since, however, the resultant product would be so much sweeter than any of the present sugars, it would be worth considerably more, and a greater cost of manufacture, if such should

be the case, would not necessarily be a handicap.

The usefulness of a levulose sirup is apparent. It would probably not be used alone as a sirup, but would be used for blending with other sirups to enhance their sweetness. Glucose and maltose sirups would be greatly improved if their sweetness were increased. And in the manufacture of soft drinks and confections levulose could very largely replace sucrose, and thus increase the amount of the latter that would be available as dry sugar.

In view of the above considerations, therefore, it is to be hoped that some institution, federal, state, or industrial, will see fit to inaugurate investigations on the production of levulose sirup from the Jerusalem artichoke, in order to augment our present sources of sweetness.

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RESOLUTIONS OF THE PAN-PACIFIC SCIENTIFIC CONFERENCE

V. GEOLOGY

1. *Geological Maps*

In the interest of science be it

Resolved, That the following maps of the Pacific region on the international scale of 1:1,000,000 be prepared as expeditiously as possible:

(*a*) A base map showing by contours or hachures as many topographic features as practicable.

(*b*) A map showing geological formations or groups of geological formations.

(*c*) A map showing mineral resources.

2. *Geological Surveys of Critical Insular Areas in the Pacific Ocean*

(*a*) Geological Survey of Easter Island

Since a knowledge of the geology of Easter Island might throw light on the question of whether there was in past geological time a westward extension of the land area of South American continent, be it

Resolved, That it is desirable to have a careful study of Easter Island to determine the character and geologic age of the rocks composing that island.

(*b*) Geological Survey of the Hawaiian Islands

Since the results of a detailed geological survey of the Hawaiian Islands would aid in the solution of many problems of the Pacific region, be it

Resolved, That this conference strongly recommends that a geological survey of the Hawaiian Islands be made and that appropriate geological maps and descriptive texts be published.

(*c*) Geological Survey of the Several Small Islands in Eastern Fiji

Since raised coral atolls with exposed basements of bedded limestone or of volcanic material are found in eastern Fiji, and since a geological survey of these islands supplemented by reconnaissance work in the neighborhood of Suva would be invaluable in the study of the origin of coral reefs, and in elucidation of the geology of the southwest Pacific, be it

Resolved, That a topographic and geological survey of the several small islands, such as Mango, Thithia, Lakemba, Vanua Mbalavu and Tuvutha be made at the earliest opportunity, and the results published.

3. *Form of Ocean Bottom*

Because of their importance as supplements to geological work on land in determining the structural framework of the Pacific region and in interpreting the geological history of the region, be it

Resolved (*a*), That the configuration of the bottom of the Pacific ocean be determined with adequate accuracy.

(*b*) That charts of the littoral and sub-littoral zones be made in all practicable detail, for example, wherever possible these charts should be on scales ranging between 1:10,000 and 1:40,000.

4. *Post-Cretaceous Correlation*

Since such knowledge is essential to the establishment of an adequate basis for the stratigraphic correlation of the post-Cretaceous formations of the Pacific region, be it