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the agency by which the change is effected in honey-making. But the chemist effects the change (inversion) more rapidly and completely by the use of a dilute acid and heat. This I shall refer to later.

The extent to which the bee effects this change is well illustrated by the following example: Bonnier (Scientific Am. Suppt., Aug. 10, 1907, p. 92) found the nectar of a leguminous plant to contain 57.2 per cent. of cane sugar and 42.8 per cent. of invert sugar. After the same nectar had been converted into honey by the bee it was found to contain only 8.2 per cent. of cane sugar-i.e., 85 per cent. of the cane sugar had been converted.

The invert sugar produced by chemical treatment from cane sugar is nearly the same substance as that produced by the bee. Hence the ease with which so-called sugar honey can be manufactured. Almost any acid may be used to effect the inversion of cane sugar. We generally use hydrochloric acid (muriatic) in the laboratory, but for various reasons tartaric acid is to be preferred in the commercial preparation of invert sugar. Herzfeld's method, which is largely employed in Germany in the preparation of invert sugar for the manufacture of artificial honey, is as follows:

One kilogram of sugar boiled with 300cc water and 1.1 grain tartaric acid, till the resultant solution turns golden yellow (about 30 to 45 minutes).

The sample I show you has been prepared in this way, and its examination by chemical methods finds it to conform in many respects to genuine honey. It contains 22.15 per cent. of water, 8.77 per cent. unchanged cane sugar and 73.34 per cent. of invert sugar. These amounts add to 104.26, showing the almost unavoidable error of about 4 per cent. inhering in the methods of analysis, and chiefly belonging to the determination of invert sugar.

From the considerations just mentioned it is evident that invert sugar is the chief component of honey, so far as weight is concerned. One hundred samples of honey exhibited at St. Louis in 1903 were after analyzed at Washington, and the results are published in Bulletin No. 110 of the Bureau of Chemistry. These are representative of most of the States of the Union, and the following summaries for invert sugar are noteworthy and interesting:

7	samples	Leguminosæ	honey	av.	76.11
8	samples	Composite	honey	av.	74.84
4	samples	Roseceæ	honey	av.	73.85
6	samples	Basswood	honey	av.	75.14

6 samples Basswood

2 samples Buckwheat

honey av. 76.85

99 samples various sources honey av. 74.41 Very numerous analyses of European honeys confirm these averages for invert sugar, showing that honey contains an average of about 75 per cent. of invert sugar, with variations from 65 to 80 per cent.

Under certain not fully understood conditions bees fail to cause complete inversion of the cane sugar in their raw material. It is pretty well established that if the bees have access to molasses and cane sugar syrup the resultant honey will contain a higher percentage of unchanged cane sugar than when they obtain their raw material from flowers only The average amount of the cane sugar found in the one hundred samples of American honeys already referred to was 1.9 per per cent., and varied from none to 10.01 per cent. But Lippmann gives the analyses of a honey gathered by bees in the neighborhood of a sugar refinery, which contained 16.38 per cent. of cane sugar The average for 138 samples of European honey listed by Konig is 1.6 per cent cane sugar, with extremes of 0.00 to 12.91 per cent.

I think it is quite evident that we may now further amplify our definition honey by mention of a minimum of inver sugar and a maximum of cane sugar. could be only a very exceptional genuin honey which would show less than 65 pe cent. of invert sugar, but to be on the safe side we may agree to place this min imum at 60 per cent. As to cane sugar the legal definition fixed by the U.S. Congress in June, 1906, requires that cat

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> sugar shall n would certain genuine honey say nothing o guaranteed p per cent. cane

So far as th the Inland R cerned, no sai guaranteed pu contain as mu sugar. A few have yielded 1 assurance that bees that had honey-making vinced that no if 10 per cent. as a maximum my suggestions tion of honey.

Honey must from the nectar of plants, (3) a than 30 per cen than 10 per cen (5) nor less th: sugar.

The legal def United States, a cognizance of t tained in honey ash in analytica tions in German ash content of 1 such conflicting ash of certified h to come to any a Honey known t found to yield or The limit fixed : 0.25 per cent., or The German stan easily apparen to dust might ta matter as an impl as genuine so far concerned. For am unable to advi as a means of jud oney.

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