Analysis of vinegar / by B.F. Davenport, late vinegar inspector for Boston.

ANALYSIS OF VINEGAR.

By B. F. DAVENPORT, Late Vinegar Inspector for Boston.

The following detailed practical method of determining whether a sample of "cider vinegar or apple vinegar" conforms to the requirements of the statute relating thereto, which requires that it should be not only the legitimate and exclusive product of pure apple juice or cider, but also that it should not fall below the quality of possessing an acidity equivalent to the presence of not less than 4½ per cent by weight of absolute, that is monohydrated acetic acid, and should yield upon full evaporation at the temperature of boiling water not less than 2 per cent. by weight of cider vinegar solids, may prove of interest to those dealing in the article. As the limits set by the statute are in per cents by weight, the portion of vinegar taken for the tests should, for perfect accuracy, be also taken by weight, that is the quantities of 6 and of 10 grammes are to be taken for the tests of strength and of residue, but as taking it by measure, if of about the ordinary atmospheric temperature of 60 to 70 degrees F. will make the apparent percentage at most only 1 to 2 per cent. of itself greater than the true, that is will make a true 5 per cent. vinegar appear to be, say from 5.05 to 5.10 per cent, measuring proves in practice to be accurate enough for all common commercial purposes, and therefore the quantities of 6 and of 10 cubic centimeters by measure may be taken in place of as many grammes.

All the measuring apparatus necessary for making the legal tests is one of the measuring tubes, called burettes. It is most convenient to have this of a size to contain 25 to 50 c. c., that is cubic centimeters, and have these divided into tenths. The best form of burette is the Mohr's, which is closed by a glass stop cock. Besides this only a dropping-tube, called a pipette graduated to deliver 6, and 10 c. c. will be needed. These tubes are to be obtained of any philosophical or chemical apparatus dealer, being articles generally kept in stock by them for common use, like yard sticks.

The only two chemicals needed in determining the strength of a vinegar are such as can be obtained of any competent apothecary in any city of the State. They are simply a small vial of a 1 per cent. solution of Phenol-phthalein in diluted alcohol, and a sufficient quantity of a solution of caustic soda, prepared as directed for "Volumetric Solution of Soda," upon page 399 of the last "U. S. Pharmacopœia," a book which is in the hands of every competent apothecary, as it contains the formulae according to which he is required by the law of the State to prepare all such medicinal preparations as are mentioned therein.

Having these, the procedure for making the test will be as follows: Fill the pipette by suction and then quickly close the top of it with the forefinger. Raise the tube out of the sample of vinegar and let it empty out by drops exactly down to the top graduation mark. This bearing the mark of o. c. c. Then holding it over a white mug or cup let it run out exactly down to the 6 c. c. mark. Dilute the 6 c. c. of vinegar, thus measured out into the mug, with sufficient clean water to make it look about white, and then add to it about three drops of the Phenol-phthalein solution. Then, having prepared the burette by filling it up to the top, zero, or any other noted mark of the graduation, with the volumetric solution of soda, let the soda solution run out cautiously into the diluted vinegar, which should be constantly stirred about. As soon as the vinegar in the mug begins to darken the soda should then only be allowed to run into it by drops. This dropping is thus continued until at last a final drop of soda turns the vinegar suddenly to a permanent pink or cherry color, which will not disappear upon further stirring. By now reading off from the graduations of the burette the number of full c. c. divisions and of tenths which have been emptied out to bring about this change of color in the vinegar is known the per cents and tenths of acidity equivalent to true acetic acid contained in the vinegar being examined This, if it is a pure cider vinegar and well made, will be upon the average about 6 per cent, but never under 5 per cent. If in like manner 10 c. c. of the vinegar is exactly measured off by the pipette into a small light porcelain dish, and then evaporated fully to dryness over boiling water, the number of grammes weight gained by the dish, when multiplied by ten gives the per centage of solid residue contained in the vinegar.

There are certain characteristics peculiar to the residue of a pure cider vinegar, the principal of which are the following: It will be about three per cent. in weight, and never less than two per cent. It is always soft, viscid, of apple flavor, somewhat acid and astringent in taste. A drop of it taken up in a clean loop of platinum or of iron wire and ignited in a colorless Bunsen gas lamp flame, imparts to it the pale lilac color of a pure potash salt, without any yellow due to sodium being visible. The ignited residue left in the loop of wire will be a fusible bead of quite a good size, and it will leave a strong alkaline reaction upon moistened test paper, effervescing briskly when immersed in an acid. The presence in a vinegar of the *slightest* trace of any free mineral acid will prevent the ignited residue leaving any alkaline reaction, or effervescing with acids. The presence of any practical amount of commercial acetic acid added, to "tone up" the strength of the vinegar, will cause the igniting residue to impart another color to the Bunsen flame, and the residue itself will have a smoky, pyroligneous taste or odor. Any corn glucose used in the vinegar will cause its residue when ignited to emit the characteristic odor of burning corn; and as the last spark glows through the carbonized mass, to usually emit the familiar garlic odor of arsenic. For the common oil of vitriol usually used in the production of glucose is now mostly derived from pyrites, which almost always contain arsenic. A glucose vinegar which has been made without vaporizing the alcohol after the fermentation of the glucose will also have a strong reducing action upon a copper salt in an alkaline solution, and also will give a heavy precipitation of lime with ammonium oxalate. A true malt vinegar always contains phosphates, and a wine vinegar cream of tartar. The presence of any acrid vegetable substance in a vinegar is known by the residue having a pungent taste, especially if before the evaporation the vinegar has been exactly neutralized with soda.

In a pure apple cider vinegar hydrogen sulphide gas will not cause any discoloration, nor will the addition of a solution of either barium nitrate, silver nitrate, or ammonium oxalate cause anything more than the *very slightest* perceptible turbidity. But the addition of some solution of lead acetate—that is, of sugar of lead—will cause an immediate voluminous and flocculent precipitation, which will all settle out in about ten minutes, leaving a clear fluid above. In most of the so-called "apple vinegars" brought into this market from other States, the addition of some of this lead solution will cause but a slight turbidity, without any precipitate settling out for several hours, and even then the precipitate will not be of the same appearance as in apple cider vinegar.

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Sophistications of cider vinegar that will not be detected by some one or more of the above given tests are not likely to be met with, for the simple reason that they are not profitable. To translate percentages of acid strength into the old commercial terms of grains of soda bicarbonate per troy ounce, the per cent. may be multiplied by 6.72; or, vice versa, divide the grains by the same factor. To reduce it into grains of potash bicarbonate, 8 would be the factor to be used in like manner.

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