

**VINEGARS AND CATSUP:
INTERPRETATION OF
STANDARDS, ANALYSIS,
ETC**

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R. O. BROOKS

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VINEGARS and CATSUP

INTERPRETATION OF STAND-
ARDS, ANALYSES, ETC



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PREFACE

The following matter deals with the Federal standards for various vinegars and a proposed standard for tomato catsup. It is an attempt to interpret the necessarily scientific terms and requirements of said standards and acquaint the manufacturing and wholesale trade with a little of the science of what is, or should be, a quite scientific industry. All chemical data of vital consequence was determined by the official testing methods called for in the Federal food law regulations and upon which the Federal food standards are based.

R. O. BROOKS.

PART I—VINEGARS

THE use of vinegar for condimental purposes, particularly wine vinegar, is very ancient, probably being contemporaneous with the utilization of wine itself. Practically any fruit juice capable of alcoholic fermentation can be converted into a vinegar by a subsequent acetous fermentation, which is also true of weak sugar syrups and honey solution. Moreover, of course, a weak alcoholic spirit distilled from a suitable fermented "mash" can be likewise subjected to an acetous fermentation, furnishing the so-called "distilled" or "spirit vinegar."

Vinegar is essentially a dilute solution of acetic acid, but it must be remembered that it is the product of a definite fermentation, containing appreciable quantities of certain solid and liquid substances derived from the material thus fermented, and that a solution of acetic acid (as purchased in the chemical market) reduced to proper strength can only be considered as an imitation spirit vinegar, at the best. And as an imitation of a good spirit vinegar it would be a very poor makeshift.

The constituents other than acetic acid which are present, as well as the characteristic flavor, etc., of a true vinegar depend, of course, upon the nature of the material which has been fermented into vinegar. The four principal vinegars in use at present are: Wine vinegar, resulting from the alcoholic and subsequent acetous fermentations of grape juice; cider vinegar from properly fermented pure apple cider; malt

vinegar from the alcoholic and subsequent acetous fermentation of an undistilled infusion of barley malt or cereals whose starch has been converted by malt; and spirit vinegar, as mentioned above. In addition there is more or less manufacture and sale of a sugar or syrup vinegar made from the alcoholic and subsequent acetous fermentations of solutions of syrup, molasses, etc.; glucose vinegar from similarly fermented glucose solutions; honey vinegar from fermented honey solutions; and special fruit vinegars, for instance, a vinegar is now being made from the juice of prunes.

In some countries a certain vinegar is often so extensively used, or was so exclusively used originally, as to restrict the simple term, vinegar, to that particular variety, as, for example, malt vinegar in England, or wine vinegar in Continental Europe. In the United States the only vinegar known for years was cider vinegar, and among food inspection authorities it has always been customary to hold that when the consumer simply asks for "vinegar," cider vinegar is called for and should be furnished by the dealer. Thus the Federal food standards (Circular 19, Office of Secretary, U. S. Department of Agriculture) restricts the single term "vinegar" to indicate cider vinegar.

The artificial coloring of vinegar is prohibited by many State food laws, while a certain few more liberal-minded state food inspection departments have allowed the use of a harmless color (caramel is customarily used) in vinegars having a distinct color naturally, provided the fact be stated on the label. It can be readily seen that the coloring of a naturally colorless vinegar, as, for instance, spirit vinegar or

glucose vinegar, is for fraudulent purposes only.

Vinegars are subject to more or less deterioration, dependent upon age, purity and method of storing; it being possible for certain vinegars, in time, not only to lose all their acetic acid, but to become actually alkaline in reaction. This deterioration is due almost wholly to a destructive fermentation, caused evidently by bacteria of the *Bacterium xylinum* type, as a cellulose containing "mother" is formed. Bertrand (*Comptes Rendus*, 122, 900) states that the well known small vinegar flies (*Drosophila cellaris*) which frequent places where fruit juices are fermenting, introduce the *Bacterium xylinum*. Pasteur claimed that the acetic acid forming bacteria themselves (*Mycoderma aceti* and *Bacterium Pasteurianum* principally) after converting the alcohol into acetic acid, consume the latter, forming carbon dioxide and water.

Vinegars also frequently are found to be increased in acetic acid strength, due to their having been put upon the market before all the alcohol of the fermented juice or infusion has been fermented into acetic acid. As is well known, the alcoholic fermentation itself is caused by various species of yeast (*Eumycetæ*) through the agency of the ferment or enzyme, recently isolated and known as zymase.

The constituents of a vinegar other than acetic acid, which are present, vary, as said before, according to the nature of the fermented juice or infusion or distilled spirit from which the vinegar has been made. In distilled or spirit vinegar there is naturally very little solid matter, but in other vinegars, noticeably malt, cider and wine vinegars, the proportion of solids is not only appreciable but sometimes relatively

high. These solid constituents may furnish some of the characteristic flavor of a vinegar, but the principal cause of flavor and odor (aside from the usual acetic odor) are certain fluid constituents of an ester nature. In a well-aged cider vinegar the odor of ethyl acetate is often very strong, in fact the writer knows of a case where the "vinegar stock," or cider which had undergone fermentation, contained little or no alcohol, no acetic acid, but a considerable quantity of the esters, particularly ethyl acetate.

The greater proportion of all the vinegar sold in this country is made by the so-called "generator" or "quick process," but there is no denying that a properly conducted cask fermentation extending over a period of a year or so furnishes a superior product, particularly as concerns flavor, odor, etc. The use of selected yeast cultures for converting the original fruit juice into an alcoholic liquid, as is the custom in Europe, would no doubt offset some of the disadvantages of the "generator" process and would yield a magnificent product by a "cask fermentation."

In succeeding papers we will take up in turn each of the various vinegars with especial reference to their chemical make-up, etc., as called for in the Federal food standards. Later a number of other food products of a condimental nature, other than spices, will be considered.

PART II—CIDER VINEGAR

AS pointed out in the introductory article of this series, the single term "vinegar" in America meant originally and exclusively cider vinegar, and in food inspection circles it has always been held that when a customer asks for simply "vinegar," cider vinegar must be served by the dealer, or, at least, any substitution of another kind of vinegar made plain to the purchaser. Thus in the Federal food standards (Circular 19, Office of Secretary, U. S. Dept. of Agriculture), "vinegar" is considered as synonymous with "cider vinegar" or "apple vinegar," the "product made by the alcoholic and subsequent acetous fermentations of the juice of apples, is levorotatory and contains not less than 4 grams of acetic acid, not less than 1.6 grams of apple solids, of which not more than 50 per cent. are reducing sugars, and not less than 0.25 gram of apple ash in 100 cubic centimeters (20°C.); and the water soluble ash from 100 cubic centimeters of the vinegar contains not less than 10 milligrams of phosphoric acid (P_2O_5) and requires not less than 30 cubic centimeters of deci-normal acid to neutralize its alkalinity."

The usual State standard in the past has been a very simple requirement of at least a certain acetic acid strength (usually 4 or 4.5 per cent.) and at least a certain proportion of solid residue (varying from 1.5 to 2.0 per cent.), with very