were pasteurized. This is, no doubt, below the true figure on account of the fact that the samples are taken uniformly from the different dealers and not in proportion to the size of their routes; the dealers selling the most milk are without doubt those who sell the pasteurized milk, while the man with the small route generally sells raw milk.

The number of adulterated samples are about the same as found in past years. The laboratory records would indicate that there is more watering done by the producer and more skimming is practiced by the small retailer. The adulteration of milk is not as a rule carried on by the same men. We make but few complaints in court alleging a second offense, for after one prosecution the convicted person either ceases the adulteration, or else goes out of the business. The actual market conditions are better in this respect than our figures show because we collect such a large number of samples from suspected persons. No doubt less than 2 per cent of our milk supply is subject to adulteration.

The alcohol precipitation test showed that 5.2 per cent of the total samples and 4.1 per cent of the pasteurized samples were sufficiently old when they reached the laboratory to curdle on boiling. The results of the M. reductase test showed that 5.6 per cent of the samples collected during seven months were too old to use as food when they reached the laboratory. If these samples could have been tested at the time of taking, the figures would have been lower during the summer months but not much difference could have been expected during cold weather. The pasteurized samples were better in this respect than the raw samples. These figures are higher than would be consistent with a thoroughly hygienic milk supply for if 94 per cent of the samples reached the laboratory in good condition the other 6 per cent collected at the same time would have done so if fresh. An example of very old milk was shown in the samples furnished to a contractor, which were nearly sour when they reached the laboratory, about two hours after being delivered by the producer. It is fortunate that these conditions are unusual or it would be impossible for the consumers in congested districts to obtain any sweet milk.

SUMMARY

1. It is possible to detect commercial pasteurized milk by the Schardinger reaction but not by the peroxidase reaction.
2. The amount of pasteurized milk on the market is greatest in the large districts.
3. The average quality of the milk is considerably above the legal standard.
4. The average quality of the pasteurized milk is very slightly below that of the raw milk but this does not appear to be due to adulteration.
5. Pasteurized milk shows less fluctuation in composition than raw milk, and the percentage of samples below standard is less of the former.
6. Fresh milk will not coagulate with an equal volume of 68 per cent alcohol.
7. Ninety-four per cent of the samples delivered

at the laboratory gave reactions for fresh milk; the balance was too old for use as fresh milk.

I wish to acknowledge my indebtedness to my assistant Mr. Lewis I. Nurenberg for collaboration in the experimental and routine work, and to Mr. Henry N. Jones for making the bacterial counts.

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THE DETECTION OF GELATIN IN SOUR CREAM

By ARMIN SEIDENBERG

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The usual method for the detection of gelatin in food products such as milk or cream and that adopted provisionally by the United States Department of Agriculture¹ consists in the removal of the proteids with acid mercuric nitrate and the precipitation of the gelatin in the filtrate with picric acid. It, however, has been frequently noticed that a sweet cream which gave no precipitate with picric acid would, after souring, show quite a perceptible turbidity on its addition, often heavy enough to lead to the assumption that gelatin was present. It seems most probable that this is due to protein decomposition products not precipitated by the acid mercuric nitrate. G. E. Patrick, in an address on "The Detection of Thickeners in Ice Cream,"² made before the 24th Annual Convention of Official Agricultural Chemists, speaks of what is probably the same or a very similar decomposition product, often found in ice cream after it has soured. He is not certain as to the exact nature of this substance, but believes it to be due to the action of bacteria. He finds that this "pseudo-gelatin," as he calls it, forms a precipitate with picric acid similar to that formed by gelatin under the same conditions and mentions that there is no method known for distinguishing the one from the other. His suggestion, that formaldehyde be added in the laboratory to prevent the bacterial action which produces this decomposition product, is of course not applicable to creams received sour.

The picric acid precipitate from the sour cream is flocculent, resembling $\text{Al}(\text{OH})_3$ in form and settles quite rapidly, while that due to gelatin is small and granular, much like BaSO_4 in form, settles very slowly and on shaking the test tube thoroughly will coalesce in large lumps leaving the solution almost clear. While these differences are quite well defined, the large number of sour cream samples received in this laboratory made a method leaving less room for doubt, in the detection of even small amounts of gelatin, very desirable. After some experimenting I found that there was a sharply defined difference between the solubilities of the two precipitates in hot, neutral water. While both precipitates are soluble on heating in slightly acid solutions, only the gelatin picrate is soluble in hot, neutral water alone. The picric acid precipitate from the sour cream is seemingly entirely insoluble in hot water, after all the picric or other acid has been removed.

To 10 cc. of the cream are added an equal volume

¹ U. S. Dept. Agr., *Bull.* 107 (rev.), p. 121.

² U. S. Dept. Agr., *Bull.* 116, p. 24.

of acid mercuric nitrate, the mixture shaken, 20 cc. of water added, again shaken and filtered after 5 minutes. To the filtrate an equal volume of picric acid is added when if gelatin or the soluble decomposition products from the sour cream are present, a precipitate is formed. This is the method mentioned in *Bulletin 107* of the U. S. Dept. of Agriculture.

In order, definitely, to determine the nature of this precipitate, proceed as follows: Cork test tube which should be a large one, and shake very thoroughly. In this way the gelatin picrate will coalesce and filtration be much more rapid. If possible allow to stand for some time after shaking; most of the liquid can then be siphoned off. The precipitate after being brought on to the filter is washed with water containing two to three drops of ammonium hydroxide to 100 cc. until the washings are slightly alkaline to litmus, and then with neutral water until the washings are neutral to litmus. This will remove all excess of picric acid. The precipitate is then transferred to a small beaker and 10 to 20 cc. distilled water added and heated to boiling. If the precipitate is very small in amount it need not be taken from the filter paper, but both can be boiled together.

Filter hot into a test tube. The filtrate will contain the gelatin picrate but not the precipitate derived from the proteids in the sour cream. Cool this filtrate and add an equal volume of picric acid, when, if gelatin was present in the original cream, a decided precipitate will be formed. When large amounts of gelatin are present the solution may become turbid on merely cooling.

In order to determine the delicacy of this method, 25 cc. of a 1 per cent solution of gelatin containing 0.25 gram of gelatin were added to 50 grams of sour cream. The sour cream thus contained only 0.5 per cent of gelatin, which had little thickening effect on it. By using 20 to 25 cc. of this cream instead of 10 cc. as above the presence of the gelatin could be determined with certainty. The above method has been in use in this laboratory for some time and has been found to work satisfactorily, provided the conditions described are obtained. Even smaller quantities of gelatin than this can, of course, be detected by using a larger amount of the original sample.

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A STUDY OF THE COMPOSITION OF CIDER VINEGARS MADE BY THE GENERATOR PROCESS

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When an investigation of the composition of cider vinegar was undertaken by the Bureau of Chemistry about four years ago, a study of the literature on the subject showed that the existing data were composed almost exclusively of analyses of vinegars made by the old barrel process. The authenticity of the two or three samples of generator vinegars reported was not beyond question because of the extreme difficulty of obtaining true samples of such vinegar. There was practically no analytical basis on which the purity

of a given cider vinegar could be determined, and only the most obvious adulterations or substitutions could be detected with certainty. Apparently authentic cider vinegars were reported as containing amounts of solids varying from 1.18 to 8.00 per cent of ash from 0.19 to 0.57 per cent with the other constituents in the same general proportions. A review of the extensive data on fermented ciders, however, showed no such wide variations in composition, and plainly indicated that this marked difference in the composition of cider vinegars was due not to a similar difference in the composition of the raw material, but rather to the method of manufacture. As a new and scientifically controlled process of manufacture had become widely established, and was the source of practically all of the "commercial" cider vinegar on the market, it seemed probable that the product prepared by this process might differ perceptibly from the "barrel" vinegars, and this study was projected with this idea in view.

The essential differences between the barrel method and the generator method of making cider vinegar will be apparent from a brief description of these processes. The conversion of apple juice into vinegar in the barrel was, until recent times, the generally accepted method in this country. Although no longer used for the preparation of cider vinegar in large amounts on a commercial scale, it is still very largely employed on the farm as the source of the family supply. The general procedure is as follows: The juice expressed from the apples is allowed to ferment in a barrel, usually of 40 to 50 gallons capacity, until practically all of the sugar has been changed into alcohol, and the resulting hard cider stored in some dark place, frequently a cellar, where the formation of acetic acid takes place gradually. Under the most favorable conditions the conversion into vinegar is slow. The long period of storage required gives opportunity for infection by harmful organisms, with the development of mal-fermentations, which frequently change the character and composition of the product to a marked degree. The conditions of storage, temperature, cleanliness of the barrel and surroundings are factors entering largely into the quality of the finished vinegar. The simplicity of the method as regards mechanical features is more than offset by the disadvantages of an uncontrolled acetification.

The rapid or generator process is carried on in this country in a very uniform practice which may be outlined as follows: Large quantities of apples are pressed and the juice collected in tanks, holding from 200 to 1,000 barrels where it is allowed to ferment until the sugar is almost completely removed. It is obvious that this alcoholic fermentation on a large scale in contrast to the fermentation on a small scale in the barrel, tends to produce a uniform product. The hard cider thus obtained is run over the generators, which consist of upright cylindrical tanks filled with beech shavings, corn-cobs, rattan, or some similar porous material saturated with strong vinegar. The alcohol is converted almost immediately into acetic acid. The entire process is under exact control, and