

Manufacture of **JELLIES and PRESERVES**

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THE manufacturer of jellies and preserves must standardize his procedures and the amounts of ingredients if he expects to turn out a product which conforms to the minimum Federal standards and is other than mediocre in quality. Because of lack of control over the factors that are involved, his results frequently are not satisfactory. This is particularly true when the beginner attempts the manufacture of these commodities and where the operator approaches the preparation of jellies and preserves with considerable lack of information and with little or no experience. This bulletin has been prepared to assist such beginners in manufacture of jellies and preserves.

EQUIPMENT

A steam jacketed stainless steel or aluminum kettle, which resists the corrosive action of fruit acids and aids in color retention, is preferred. Because of the danger of scorching when the fruit mixtures are exposed to the heated metal surface, it is advisable that the kettle be so designed that the working level of the liquid contents extends above the steam jacket or chamber. The recommended capacity is from 25 to 50 gallons. For quantity production additional kettles will be needed, depending upon the scale of one's operations. Arrangements should be made for dumping or draining off the finished product, and if cooling pans are not provided for strawberry preserves, then water should be admitted to the jacket of the kettle. An overhead dispenser of weighed or measured quantities of sugar contributes greatly towards speed and convenience in the operations. A suitable source of steam supply, of course, must be provided. This should furnish steam at 20 to 100 pounds of pressure.

By locating the filler at a lower level than the cooling pan or vat, filling is accomplished without effort and the jars are automatically moved by gravity to the sealing equipment. In some instances sealing is accomplished by use of steam jets which create, within the jar, a partial vacuum which serves to retain the cap firmly in place. In other cases, the products are sealed hot and upon cooling a satisfactory vacuum is obtained. Equipment for this purpose is simple.

The lid is crimped onto the jar and it is conveyed to the cooling chamber all in a straight line operation.

Pre-cooled preserves, of course, will require pasteurizing equipment to insure proper keeping qualities. This equipment may consist of some form of chamber through which the filled jars are moved and in which they are subjected to water at proper pasteurizing temperatures. The cooler must provide gradual but thorough cooling before the jars pass to the labeling and casing equipment. To avoid unnecessary carrying or trucking, the line should be planned in such manner that the products move quickly and automatically from one operation to another.

An armored type Fahrenheit thermometer is suggested for use during the cooking process. Some operators will prefer a refractometer to make certain that the end points correspond with Pure Food and Drug requirements. Either a hand refractometer or a larger Zeiss or Abbe type may be used.

Wooden stirring spoons or paddles and suitable dippers should be available.

RAW MATERIALS

A good grade of ripe (but not overripe) fruit should be used for jellies or preserves. Overripe fruits are apt to be deficient in pectin which is necessary for the proper setting up of the finished products. The fruits should be washed, trimmed, and pitted when necessary. To prepare a juice for jelly, the fruits are heated just enough that they will break up sufficiently to release the natural pectins, the juice, and in some cases plant pigments. To insure a clear juice for jelly manufacture, some means of clarification must be used. Various types of filter equipment and a filter aid like Hyflo Super-Cel, Bentonite, or Dicalite may be used.

PECTIN

Powdered pectin whose grade is known may be required for fruits not naturally abundant in this material. Federal specifications permit its addition when necessary to make up any deficiency. A total pectin content of 1 per cent of 100 grade, including that naturally occurring in the fruit, is considered about right. Commercial pectin is standardized and is available in different strengths such as 80, 100 or 150 grade. The particular grade designation for such pectin means that one pound of it is sufficient to cause as many pounds of sugar to set up as that particular grade designation indicates. That is, one pound of dry 100-grade pectin will be needed for every 100 pounds of sugar used in preparing a jelly where a 1 per cent pectin concentration is desired. Slow-set pectins are used for jelly manufacture where the pouring into the jars should be completed before

it begins to set. Rapid-set pectins are satisfactory for jams and preserves. While liquid pectin preparations are available and some operators prepare their own liquid form, most manufacturers prefer the dry medium, since it is considered easier to secure standardized results.

ACID

If additional acid is necessary to cause a jelly to set or to add tartness to the jelly or preserves, then a water solution of some organic acid such as citric or tartaric may be added. A 50 per cent solution of citric acid is prepared by dissolving any given weight of citric-acid crystals in an equal weight of water. It is difficult to recommend how much acid to use since the acidity of juices varies and individual tastes dictate different amounts. Actually, the acidity of jellies and preserves may vary from as little as 0.2 to 1.0 per cent. A favorable pH is in the range of 3.1 to 3.4 where one has some means of checking this measure of acidity. A potentiometer of some kind should be provided for this purpose where the magnitude of the output justifies this additional investment.

SACCHARINE INGREDIENTS

Sugar, either beet or cane, will constitute the major portion of the sweetening material. According to Federal Food and Drug standards of December 4, 1940 (5), the use of 25 per cent replacement of dextrose (corn sugar) or one of the various grades of corn syrups is permitted. Invert syrup and honey, or a combination of any of the saccharine ingredients already mentioned, are permissible under Federal standards.

COMPOUNDING AND COOKING

Federal specifications require that not less than 45 pounds of fruit or fruit juice for each 55 pounds of sugar or its equivalent may be used.

A total batch of from 25-35 gallons is recommended as desirable for most operators. If pectin is necessary, it should be mixed with a small amount of sugar, added to the fruit or juice, and boiled a minute or two. Then the remainder of the total sugar should be added and the mixture cooked to the proper end point, using a rapid rolling boil. Slow cooking exposes the fruit to the heat for too long a period. This results in deterioration of both the color and flavor of the finished product. Therefore, one should cook as rapidly as is practicable—but keep in mind the fact, as in the case of strawberry preserves, that the cooking must be slow enough to permit the fruit to absorb sufficient sugar to prevent it from floating in the jar.

Whether to add pectin can be determined by a simple but crude test as follows: Place a small quantity in a test tube and then pour

down the side an equal amount of 95 per cent alcohol. If a goodly coagulant of gummy pectin appears, there is sufficient pectin in the juice. If the precipitant is scanty or light and flocculent in appearance, there is a deficiency of pectin and some must be added. The exact amount to include can best be determined by preparing small test runs of jelly or preserves, adding different amounts of pectin, and selecting for the larger batch the amount which shows the best setting characteristics.

A typical formula for the preparation of standard 45-55 strawberry preserves:

Water (about 2½ gallons)	20 pounds
Fruit	82 pounds
Sugar	100 pounds
Pectin, 100 grade (rapid set)	6-8 pounds
Citric acid, 50 per cent solution	11 fluid ounces
Yield approximately 154 pounds of finished preserves at 68 per cent soluble solids.	

A formula that is suitable for the preparation of standard 45-55 grape, blackberry or plum jelly:

Fruit juice	82 pounds
100-grade citrus pectin (slow set)	10-12 ounces
Sugar	100 pounds
Citric acid (50 per cent solution)	12 fluid ounces
Cooking temperature 220° F. or 8° F. above the boiling point of water at your locality.	
Yield, approximately 163 pounds of jelly at 65 per cent soluble solids.	

Cook the preserves to 221° F. at or near sea level or 9° F. above the boiling point of water at your location. A good refractometer is the best means for determining the correct end point (65 or 68 per cent solids), depending upon the group into which the particular jelly or preserves falls according to the Food and Drug Standards (5). The well known sheeting test is useful to the experienced operator in determining the end point. This is made by collecting a small quantity of jelly or preserves on a wooden spoon or paddle and twirling it rapidly to cool. If it congeals and breaks away in sheets or forms jelly-like sheets on the side of the paddle or spoon, the cooking has been completed. However, due to the personal equation and to variations in the jelly or preserve stock, this test is subject to more or less error. In the case of most preserves cooling is accomplished in shallow water-cooled pans until they have a temperature of 160-180° F. When the jars are filled and sealed with this material, they are immersed in the water bath at 180° F. for 20 to 30 minutes. This should destroy all mold spores and insure perfect keeping. Prompt but gradual cooling of this pasteurized material to room temperatures is essential to protect the color.