

Department of Food Science

Food Processing

FSE 99-21

Manufacturing Jelly and Preserve Products

John E. Rushing, Ph.D.

Jelly and preserve products are characterized by concentration of fruit components and sugars to produce a preserved product of high solids and low pH. Products in this category include fruit butters, jellies, preserves, jams and similar products. Some of these products have standards of identity in the regulations.

Typical manufacture of these products requires concentration of the fruit component prior to the addition of sugar, the addition of pectin and pH adjustment with citric acid. Other safe and suitable ingredients may be used depending on the product.

Standards of identity have been enacted to require specific amounts of the comparatively expensive fruit ingredient. Without these guides, pectin and sugars could substitute for fruit, given additional flavor or color. Only the products of specific fruits are defined in the regulation. For example: a product such as jalapeno pepper jelly is not defined. It does however, have certain composition limits within which it will set and will be a safe product.

Some standards

Fruit butters have five parts by weight of the fruit ingredient to each two parts by weight of the nutritive carbohydrate sweeteners (5:2). The finished soluble

solids content of a fruit butter is not less than 43%.

Fruit jellies have 45 parts by weight of the fruit component to each 55 parts of the sweetener solids (45:55). The finished soluble solids content of a jelly is not less than 65%.

Fruit preserves and jams are divided into two groups, generally the berries and the pomes. Those made from the berry group require 47 parts by weight of the fruit component to 55 parts of the sugar. Those made from pomes are 45:55. In both cases the finished product is not less than 65% solids.

Weights of components

The weight of the sugar component is the weight of the sugar solids. However, the weight of the fruit component is not so easily determined. Individual fruit can vary widely in solids. In addition, the fruits, purees and juices used in the manufacture of these products are often concentrated.

The regulation provides for the calculation of the weight of the fruit component by listing numerical factors to calculate the pounds of fruit at a standard solids level. An example should suffice.

The law requires jelly to be 45 parts by weight juice to 55 parts by weight sugar. To determine the weight of the single strength juice when using a concentrate:

- I. Check the Brix (% sugar) or soluble solids (using the refractometer) of the fruit juice or concentrate. For instance: apple concentrate (three-fold) at 40° Brix.
- II. Multiply the percent solids by the weight of the ingredients and divide by 100. For instance 100 lbs apple concentrate at 40% solids.
$$\frac{100 \times 40}{100} = \frac{4000}{100} = 40$$
- III. Subtract any added sugar solids for a sweetened or capped concentrate or juice.
- IV. Multiply by the factor in Table 1.
$$40 \times 7.5 = 300$$

This means your 100 lbs. of 40° Brix apple concentrate was equal to 300 lbs. of single strength juice. Added sugar solids may be no higher ratio than 55/45 or 1.22 times the weight of the single strength juice: In this case we have the equivalent of 300 lbs. of single strength juice.
$$300 \times 1.22 = 366 \text{ lbs. of sugar solids may be added}$$

The advantage of not diluting the concentrate to single strength is that cooking time may be regulated by judicious addition of water. The above combination would be only about 61% solids and the excess water must be “cooked off” until 65% solids is reached. The sugar ingredient may be added as a syrup and its water can be taken into account in the formulation.

The Soluble Solids Content

Soluble solids of juices, jams, jellies and similar materials are measured using an optical instrument called a refractometer, available from scientific supply houses.

Refractometers are made for specific ranges of solids, so the same refractometer may not suffice for single strength juice and for finished jellies or preserves. The percent sugar is read directly on the refractometer scale and is usually referred to a “degrees brix”. Sixty six percent sugar is (66° Brix). The accuracy of the reading is temperature dependent, so the refractometer and the sample should be at room temperature.

Pectin

Many fruits such as plums have high levels of pectins which cause jams to solidify at the proper pH level. In many products, the pectin will need to be supplemented in order to produce a product with the proper “set”. Most fruit juices will be very low in pectin.

Citrus pectin is commonly used to supplement the pectin in jelly products. Pectins are graded for their ability to set a specific weight of sugar solids under standardized conditions. A 150 grade pectin should set 150 lbs of sugar in solution at the prescribed brix.

Pectins are also categorized by how quickly they set on cooling. As jellies cool, air bubbles slowly rise to the top to allow a clear product. A slow set pectin is desirable. However, should one wish to produce a cherry preserve in which the fruit tends to float, a rapid set pectin would be desirable. The pectin must be carefully chosen for each product.

The pectin set is a function of temperature, soluble solids, pectin type and concentration, and pH. Usually it is advantageous to cook the fruit and sugar

components to produce a syrup in which certain sugar changes called “inversion” take place. Water is also removed at this step or often later in a vacuum pan.

When the predetermined solids level has been reached, pectin is added. The mixture can be handled until the pH is adjusted to 2.8-3.2, usually with citric acid. At this point, time is of the essence. The hot product is packed into jars and capped.

Safety and Spoilage

Jams, jellies and preserve products are characterized by low water activity and a low pH. Since they are also packed at high temperatures, they are not likely to harbor harmful foodborne illness organisms.

Some mold spoilage may develop if the cap applied is not heated to a temperature adequate to destroy mold spores. This destruction of organisms on the cap is usually accomplished by inversion of the jar or by the use of a steam capper. Home canners often pour hot wax on the surface to exclude air from the surface of the product.

The Regulation

Copies of 21CFR150 which contain standards of identity are available from NCDA, Food & Drug Protection Division at 919-733-7366. They will advise of other appropriate regulations.

Table I. Factors for Calculation of Single Strength Juice

Name of Fruit	
Apple	7.5
Apricot	7.0
Blackberry (Other than dewberry)	10.0
Black raspberry	9.0
Boysenberry	10.0
Cherry	7.0
Crabapple	6.5
Cranberry	9.5
Damson, damson plum	7.0
Dewberry (other than boysenberry, loganberry, and youngberry)	10.0
Fig	5.5
Gooseberry	12.0
Grape	7.0
Grapefruit	11.0
Greengage, greengage plum	7.0
Guava	13.0
Loganberry	9.5
Orange	8.0
Peach	8.5
Pineapple	7.0
Plum (other than damson, greengage, and prune)	7.0
Pomegranate	5.5
Prickly pear	11.0
Quince	7.5
Raspberry, red raspberry	9.5
Red currant, currant (other than black currant)	9.5
Strawberry	12.5
Youngberry	10.0