JAMS, JELLIESAND MARMALADES

In the Paleolithic period, people had already realized that if they could preserve the food they collected in times of plenty, it would make survival easier during the periods when food was scarce. By preserving food they could also avoid having to constantly look for fresh food.

And so they began to implement the earliest natural methods of preserving food, using cold (in areas with ice and snow) and drying (eliminating water from food by exposing it to the sun, applying pressure, or smoking). The use of salt for preserving food also has its roots in distant times.

Sugar was discovered in Asia, but it was the Arabs that introduced it to Europe. And so jam was born.Making jam has a very long history. The earliest cookbook, called of Culinary Matters, which dates back to 1st century Rome, contained recipes for making jam. It was part of the diet in the countries of the Middle East where there was an abundance of sugar that grew naturally. Honey was also used as a sweetener. This enabled the people to have vitamins from fruit all year round.

Marmalade came into existence in the 16th century when Mary Queen of Scots' physician mixed orange and sugar to help with her seasickness. Thus, marmalade became a favorite of royalty. Louis X1V of France had a variety of jams at his feasts made from fruits from the palace gardens, which include pineapples and other exotic fruits.

Jam

Jam is a thick mixture of fruit, pectin, and sugar that is boiled gently but quickly until the fruit is soft and has an organic shape, yet is still thick enough that it spreads easily. In general, jam is produced by taking mashed or chopped fruit or vegetable pulp and boiling it with sugar and water. The proportion of sugar and fruit varies according to the type of fruit and its ripeness, but a rough starting point is equal weights of each. When the mixture reaches a temperature of 104 °C (219 °F) the acid and the pectin in the fruit react with the sugar, and the jam will set on cooling.

Commercially produced jams are usually produced using one of two methods. The first is the open pan method, which is essentially a larger scale version of the method a home jam maker would use. This gives a traditional flavor, with some caramelization of the sugars. The second

commercial process involves the use of a vacuum vessel, where the jam is placed under a vacuum, which has the effect of reducing its boiling temperature to anywhere between 65 and 80 °C depending on the recipe. The lower boiling temperature enables the water to be driven off with the retention of volatile flavor compounds from the fruit. Preventing caramelization of the sugars, and of course reducing the overall energy required to make the product. However, once the desired amount of water has been driven off, the jam still needs to be heated briefly to 95 to 100 °C (203 to 212 °F) to kill off any micro-organisms.

During commercial filling it is common to use a flame to sterilize the rim and lid of jars to destroy any yeasts and molds which may cause spoilage during storage. Steam is commonly injected immediately prior to lidding to create a vacuum, which both helps prevent spoilage and pulls down tamper-evident safety button when used.

Glass or plastic jars are an efficient method of storing and preserving jam. Other methods of packaging jam, especially for industrially produced products, include cans and plastic packets, especially used in the food service industry for individual servings. Fruit preserves typically are of low water activity and can be stored at room temperature after opening, if used within a short period of time.

Pineapple Jam

Any variety of pineapple fruits could be used for jam making, since pineapple give a better yield of juice. However, the flavour is not as good as the Mauritius variety which being sweeter is usually eaten fresh. The pH of the pulp varies from pH 3.4-4.1. This means that, to give a jam with a good set the recipe has to be adjusted each time new pulp is used. The yield from whole fruit to usable fruit pulp from Mauritius is approximately 30%. Pineapple contains little or no pectin so pectin must be added when making jam. Pineapples contain the enzyme bromelain, which is a proteolytic enzyme . This can cause problems for operators hands which are in contact with the juice for long periods during cutting operations, gloves should therefore be worn and washed each day. To make 200 x 1Ib jars of pineapple jam requires approximately 62kg of sugar and 158kg of fresh pineapple.

Recipe (before boiling)

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Sugar **50 %**

Fruit pulp **38%**

Pectin **1%**

Water **12%**

Citric acid **(as required)**

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In most countries, preservative is not allowed to be added to the jam. Only a residue of preservative is allowed in jam made from fruit pulp that has been stored with chemical preservatives, (l00ppm sulphur dioxide or 500ppm benzoic acid). Citric acid is not a preservative, it is added to adjust the pH. Jams give a gel when there is the correct ratio of pectin to water and the pH is between 2.5-3.45. The optimum pH to give a good gel is pH 3.0.

Method

Pineapple fruits are prepared to remove stalks and tops from fruits andpeeled, the edible portion is cut into small portions. Only good quality fruits should be used.The cut pieces are fed into fruit pulp by liquidizing.Liquidizing the pieces gives a fruit pulp with a ‘chunky’ texture but contains a lot of pith and hard pieces. Using the sieve will give a fruit pulp of a smooth consistency, which is good for making pineapple jelly. The residue that does not pass through the colander/sieve can be put into a muslin cloth and the juice squeezed out to get the maximum extraction of fruit pulp. The yield of fruit pulp from whole fruit is 30%.

Adjust the pH of the fruit pulp by adding citric acid until it is pH 3.0. This can be measured with a pH meter. Mix the pectin with a small portion of the sugar. The dry mixing of the pectin is important because pectin powder is very difficult to dissolve in water because it clumps together. If it is still a problem to dissolve, grind the sugar to a fine powder and then mix it with the pectin.

Mix the water, fruit pulp, and the remaining sugar in a stainless steel saucepan and start to boil. When nearing the ‘end point’ the dry mix of pectin and sugar is added.

Jam should not be boiled for more than 12-15 minutes otherwise this can give rise to caramel flavours, over-sweetness and discoloration. By reducing the amount of water in the starting recipe, the boiling time can be reduced. The ‘end point’ is reached when the total soluble solids is up to 70%, this is measured with a refractometer. (In most countries the legal minimum sugar levels in jam, are 65% for jam in hermetically sealed jars, and 68.5% for jam in non-air tight containers). 70% gives a safety factor. Jam with over 70% sugar can give problems during storage, as sugar will recrystallise out into large chunks. The ‘end point’ is usually reached around 106-108°C (depending on barometric pressure and height above sea level). When the jam has nearly reached this temperature samples are taken and tested on a refractometer, the sample must be cooled before being measured. It is important to stir the jam at all times otherwise burning will occur at the bottom of the saucepan, causing off flavours and discoloration. When the ‘end point’ has been reached the jam should be filled into jars which have been cleaned and then steamed to sterilise them. The jars should be filled as quickly as possible so that the jam is not heated for longer than necessary. The filled jars can be placed in water to cool down the jam so that it does not keep cooking in the jar, the water level should be kept below the lid of the jars.

Jelly

Jelly refers to a clear or translucent fruit spread made from sweetened fruit (or vegetable) juice thus differencing from jam by excluding the fruit's flesh and is set by using its naturally occurring pectin.

Additional pectin may be added where the original fruit does not supply enough, for example with grapes.Jelly can be made from sweet, savory or hot ingredients. It is made by a process similar to that used for making jam, with the additional step of filtering out the fruit pulp after the initial heating. A muslin or stockinet "jelly bag" is traditionally used as a filter, suspended by string over a bowl to allow the straining to occur gently under gravity. It is important not to attempt to force the straining process, for example by squeezing the mass of fruit in the muslin, the clarity of the resulting jelly will be compromised. Jelly can come in a variety of flavors such as grape jelly, strawberry jelly, hot chili pepper etc. It is typically eaten with a variety of foods. This includes jelly with toast, or a peanut butter and jelly sandwich.

"Good jelly is clear and sparkling and has a fresh flavor of the fruit from which it is made. It is tender enough to quiver when moved, but holds angles when cut.

Jelly making

Fruit pulp/juice. It is possible, by hand, to peel and pulp the fruit, press and filter the juice but this level of production is very low (e.g. 10-20 half kilogram jars per day) and the procedure is both laborious and time consuming. For small-scale commercial production it is better to use small manual or powered equipment to pulp the fruit and/or express the juice. Juice or pulp contains enzymes and in many fruits these cause rapid browning if they are not destroyed or inhibited from acting. The easiest way to control browning is to heat the juice in small batches as it is produced, rather than producing a large amount and storing it for several hours before use.

Sugar

Refined, granular, white sugar should be used whenever possible, but even this will often contain small amounts of material (e.g. black specks) which reduce the value of a preserve. The sugar should therefore be dissolved in water to make a strong syrup and then filtered through muslin cloth or a fine mesh. It is most important that the filters and pans are thoroughly cleaned each day to prevent insects and micro-organisms from contaminating the equipment.

Pectin

All fruits contain pectin in the skins and to a lesser extent in the pulp. However, the amount of pectin varies with the type of fruit and the stage of maturity. Apples, citrus peels and passion fruit for example, contain a high concentration of pectin; strawberries and melon contain less. In general, the amount of pectin in fruit decreases as the fruit matures. Although it is possible to get a good preserve using the pectin already in the fruit, it is better to buy pectin powder or solution and add a known amount to the fruit juice or pulp. This will produce a standardized gel each time and there will be less risk of a batch failing to set.

There are many different types of pectin available, but for preserves, a slow setting type is needed to allow the gel to form in the jar during cooling. However, in larger containers (e.g. 5-10kg jars of jam) or for preserves in which peels or pieces of fruit are suspended in the gel, a faster setting pectin in needed. In both types, the concentration of pectin varies from 0.2-0.7% depending on the type of fruit being used. Pectin is usually supplied as '150 grade' (or 150 SAG) which indicates the ratio of the weight of sugar to weight of pectin that will produce a standard

strength of gel when the preserve is boiled to 65% soluble solids. 5 SAG is normally enough to produce a good gel.

An example of a calculation to find the weight of pectin to be added is as follows: 150 SAG pectin is diluted to 5 SAG, i.e. a 30 fold dilution. Therefore 3.3g pectin would be used for every 100g of material. However, if commercially produced pectin cannot be obtained it is possible to produce a pectin solution by boiling the sliced skins of passion fruit, lime, lemon, orange or grapefruit in water for 20-30 minutes. The solution should be filtered before adding to the fruit pulp. The amount of solution to be added depends on the type of fruit and a number of other factors, and must be found by trial and error.

Acid

Acids are added to fruit juice to bring the pH within the range 3.0-3.3 which is necessary for jam making (pH is a measure of acidity - lower pH means greater acidity). As the acidity varies in different types of fruit and also in different samples of the same fruit, it may be necessary to check for the correct acidity if different fruits are used. Limes have a lower pH than 3.3 and sodium bicarbonate is needed to reduce the acidity. The only acids that are allowed to be added to jam are citric acid, tartaric acid and malic acid. In practice citric acid is usually used and this is widely available from chemists or pharmacies. Food colours some fruit pulps/juices do not substantially change colour during boiling and in others the colour change is acceptable. In both cases it is not necessary to add artificial colours. However, some fruits become dark brown and are not sufficiently attractive to customers. In these cases, small quantities of permitted colours may be added if no other fruits are available for use. The list of permitted colours differ throughout the world and it is necessary to check with the local Bureau of Standards to see which colours are allowed

Batch preparation

First thoroughly mix pectin powder with 5 times its weight of sugar, this will allow the pectin to fully dissolve without forming lumps. The amount of sugar, pectin, fruit pulp/juice and acid needed will depend on the type of fruit and the customers' requirements. However, as an example of a typical product, the following recipe has been successfully used to make water melon jam:

- 115kg water melon

- 55kg sugar
- 0.9kg ginger
- 0.47kg citric acid
- 0.66kg pectin

Mix together the sugar/pectin, fruit juice/pulp and adjust the pH to 3.3-3.6 using citric acid. A pH meter may be necessary to establish the recipe but afterwards the ingredients may simply be weighed out. For marmalade, or jams which contain fruit pieces, it is necessary to soak the peel or fruit for 2-3 days in a concentrated (60%) sugar solution. This causes the peel/fruit to achieve the same density as the preserve and, as a result, it is evenly distributed through the jar and does not float to the surface.

A simple (rougher) equation can also be used for any type of jam:

- Add 550gms of sugar to every 450 gms of fruit that is high in pectin
- Add 450gms of sugar to every 450 gms of fruit that is medium high in pectin
- Add 350gmsof sugar to every 450 gms of fruit that is low in pectin.

Boiling

Pour the batch into a stainless steel boiling pan and heat as quickly as possible with constant stirring to prevent the product burning onto the pan. It is important to use stainless steel to prevent the acids in the preserve reacting with the pan and causing off-flavours. The mixture is boiled until the sugar content reaches 68%. This is most conveniently measured using a hand-held refractometer or a sugar thermometer (68% sugar corresponds to a jam temperature of 129°C). The correct sugar content is critical for proper gel formation.Repeated checks with a refractometer or thermometer are needed to make sure that: the sugar level reaches 68%. The sugar concentration increases rapidly at the end of boiling and particular care is needed.

Filling: In many countries there are laws concerning the weight of food sold in a package and accurate filling to the correct weight is therefore important. The weight, cleanliness of the container and appearance of the product after filling should be routinely checked. In particular it is important to avoid getting preserve around the rim of the jar as this may prevent a vacuum forming, and will look unsightly and attract insects. The preserve should be hot-filled into suitable containers which are then sealed with a lid.

Temperature of filling is important, too hot and steam will condense on the lid and drop down onto the surface of the preserve, this will dilute the sugar on the surface and allow mould growth.

Packaging

Ideally glass jars should be used with new metal lids. Metal cans are also suitable but very expensive. Cheaper alternatives include plastic (PVC) bottles or plastic (polythene) sachets. However, these cannot be filled with hot jam as they will soften or melt. It is possible to use paper, polythene, or cloth tied with an elastic band or cotton, to cover jam jars. Finally, the jars are held upright and the gel is formed during cooling. This can be done by standing the jars on shelves, or more quickly using a low cost water cooler. A partial vacuum should form between the surface of the jam and the lid when the product cools. This can be seen by a slight depression in the lid. If a vacuum does not form it means that the jar is leaking or the temperature of filling is too low.

Marmalades

Marmalade means a product prepared by boiling sound fruits with peel, pulp and juice, with or without water, added nutritive sweeteners and concentrating to such a consistency that gelatinization takes place on cooling of the product. It shall not be syrupy, sticky or gummy and shall be clear and transparent.

The specific requirements are as follows:

(i) Total soluble solids (m/m) - Min. 65.0 %
(ii) Fruit content except peel (m/m) - Min. 45.0 %
(iii) Peel in suspension - Min. 5.0 %
The container shall be well filled with the product and shall occupy not less than 90% of the net weight of the container, when packed in the rigid containers