



# Analysis of Production Technology of Marmalade and Pastille Products

**Barnokhon Sattarova**

PhD in Chemical Sciences, Docent, Fergana Polytechnic Institute, Fergana, Uzbekistan  
E-mail: [b.sattarova@ferpi.uz](mailto:b.sattarova@ferpi.uz)

**Aziza Mahmudova**

Master's Degree Student, Fergana Polytechnic Institute, Fergana, Uzbekistan  
E-mail: [azizahonmahmudova02@gmail.com](mailto:azizahonmahmudova02@gmail.com)

## ABSTRACT

This article presents ideas about the production of marmalade and pastilla products, the technology of making marmalade.

### Keywords:

marmalade, lozenge, jelly marmalade, fruit-berry marmalade, liquid pectin extract, modifier salts.

## Introduction

Marmalade and pastille products are confectionery products with a jelly-like consistency, made mainly from fruit and berry raw materials. They belong to the group of fruit and berry products. In addition to marmalade and lozenges, this group also includes jams, povidlo, jam, sweets and the like [1-4]. Marmalade refers to a confectionery product with a jelly-like structure, made from fruit and berry puree or a solution of jelly-forming substances in water, sugar and other components [5-9].

## The main part

The technology of making marmalade is divided into two types depending on the basis of making jelly: fruit-berry and jelly. In fruit-berry marmalade, pectin present in fruit-berry (apple, plum, apricot, etc.) puree is considered to be a jelly-forming agent. In the production of jelly marmalade, agar, agaroid, pectin and other

jelly-forming agents extracted from plant raw materials are used as jelly-forming agents [10-17]. Fruit and berry marmalade is divided into the following types depending on the fruit and berry puree (apple puree or cereal fruit puree) used as a basis for its preparation and the method of shaping: molded marmalades produced in the form of small products of various shapes. They are based on apple or plum puree, and the surface is covered with a sugary crust formed by crystallized sugar during drying, and they are produced in the form of small rectangular prisms. Their basis is apple puree, layered marmalades are made in the form of rectangular layers, sprinkled with sugar or powdered sugar [18-26].

Depending on the raw materials used to create a jelly-like structure, jelly marmalade is divided into:

- prepared in agar, dry agar forms the base of their jelly;

- prepared in pectin, their jelly-forming base is dry pectin or liquid pectin extract;
- made in agaroid, their jelly-forming base is agaroid or agar made from Baltic Sea aquatic plants.

Jellied marmalades are divided into the following types depending on the method of forming:

- molded marmalades, produced in the form of small products of various shapes, sprinkled with sugar;
- shaved marmalades made in the form of orange and lemon slices, rectangular or rhombic single-layer or multi-layer, smooth or corrugated surface, sprinkled with sugar on the surface;
- shaped marmalades produced in the form of fruits, berries, various animals and the like.

"Strawberry" marmalade is an example of shaped marmalade. This marmalade is shaped like a strawberry, consisting of two halves stuck together, with sugar sprinkled on top. In addition, marmalade is produced in different names depending on the fruit and berry raw materials, flavoring and dyes added according to the recipe: apple, plum, apricot, etc [27-34]. Both marmalade and pastille are produced with chocolate-glazed surfaces. In addition, special dietary types are prepared, for example, sea cabbage is added to the recipe, or sugar is replaced with xylitol or sorbitol in the recipe for people with diabetes.

### **Preparation of fruit-berry marmalade mass**

Preparation of fruit-berry (apple) marmalade mass consists of the following stages: preparation of raw materials, preparation of the recipe mixture, boiling of the recipe mixture, addition of flavoring substances and acids.

### **Preparation of raw materials**

The diameter of the sugar pores is not larger than 3 mm. Flat oscillating and "Pioneer" type sifting machines can be used for sifting. To separate the sugar from the metal, it is passed through magnetic devices. The molasses is passed through a filter whose diameter is not larger than 2 mm. Apple puree is usually not

uniform in quality, with different amounts of dry matter, ash, pectin, acids, and correspondingly different jelliness [35-42].

To work in the usual mode, the same mash should be used as much as possible in terms of quality, first of all, in terms of the ability to form jelly. This is achieved by mixing a strong jelly-forming mash with a weak jelly-forming mash, and a sour mash with a slightly sour mash. The recipe of mixtures is made on the basis of laboratory analysis. The applesauce mixture is prepared for at least one shift. Mashing is done in special mixers made of stainless steel [43-48]. The finished mixture is sent to control grinding. This is necessary to clean up any debris and get a smoother (more dispersed) puree. Such a puree is easily mixed with sugar, allowing to obtain a marmalade jelly with a good structure. Grinding of puree is carried out in grating machines with a mesh of holes no larger than 1 mm in diameter. After that, the puree is transferred to the recipe mixer with a gear pump. Preparation of the recipe mixture involves adding modifier salts to the coupage (mixed) puree, mixing the puree with sugar. Marmalade jelly is obtained from solutions containing a certain amount of pectin, sugar and acids. In production, the ratio of these components may be different. For the formation of jelly, the boiled mixture should contain 0.8-1.2% pectin, 0.8-1.0% acids (calculated as malic acid) and 65-70% sugar. Jellied applesauce contains about 1-1.2% pectin, 0.6-1.0% acids (calculated as malic acid), 6-10% sugar and about 88-90% water. There is enough pectin and acids to make jelly, but not enough sugar and too much water. Therefore, in the production process, 0.9-1.0 parts of sugar are usually added to 1 part of puree. When 1 part of puree is added to 1 part of sugar and the content of the puree contains 1% of pectin and acids, the amount of pectin in the recipe mixture is 0.5%, and the amount of acids is 0.5%.

These amounts of pectin and acids are insufficient, but when the mixture is boiled, the amount of water in the marmalade mass decreases and the amount of pectin and acids increases, and is usually enough to obtain a mass capable of forming jelly. Depending on

the amount of pectin in the puree and its quality, the ratio of puree and sugar may vary. Accordingly, 0.8-1.1 parts of sugar are added to 1 part of puree. The specified ratio depends not only on the amount of pectin in the puree, but also on the quality of pectin and the amount of acid. Additives, ash and other substances in the puree can slightly affect the recipe. Usually, in addition to determining the amount of pectin in the puree, a sample of marmalade is prepared in the laboratory and a recipe is made based on it. Preparation of the recipe mixture is carried out in mixers with a stainless steel mechanical stirrer capable of holding 3-4 hours of consumption. The blended (mixed) mash is transferred to the mixer using a pump, and a 40% solution of sodium lactate is added in the amount of 0.4-0.5% of the mass of the mixture. When the recipe mixture is boiled in vacuum devices, i.e. at a low temperature, 5-10% of invert paste is added to the mass of sugar. The recipe mixture is mixed in agitators and pumped to collecting vessels located in front of the boiling apparatus. About 3% molasses is added to the recipe mixture. The molasses creates a glossy film on the surface of the marmalade and makes the film even thinner and prevents the film from becoming coarser. Boil the recipe mixture. The recipe mixture is boiled in various boiling devices, continuous working vacuum devices (spherical devices) or universal boiling vacuum devices.

When boiling in spiral boiling devices, the recipe mixture with a dry matter content of 50-55% is continuously transferred by a plunger pump to the spiral boiling column, where it is boiled. The mass with a temperature of 106-107 °C falls from the separator to the steam separator, and the secondary steam is separated from it.

Mass boiled without adding sodium lactate has 60-62% dry matter, and when boiled with sodium lactate, this indicator is 68-74%. Spherical vacuum devices with and without a continuous stirrer are also used for boiling the marmalade mass.

Their useful capacity should not exceed 150 liters. Boiling in them is carried out when the pressure of the heating steam is 300-500 kPa and the residual pressure is 35-40 kPa. When

boiling in universal boiling vacuum devices, the recipe mixture is placed in the upper boiler and boiled for 6-8 minutes in steam at a pressure of 400-500 kPa, with continuous stirring, until the amount of dry matter is 67-69%, then the valve is opened and the mass is lowered into the lower boiler. As a result of a sudden decrease in pressure, steam is released and the dry matter of the mass increases further.

Boiling time depends on the amount of the recipe mixture, its humidity and the size of the boiling apparatus. When boiling in continuously working vacuum devices and adding about 160 kg of the recipe mixture, the boiling time is 10-12 minutes without adding sodium lactate (final moisture content of the mass is 40%), and when modifier salts are added - 15-20 minutes (final moisture content of the mass is 28-30%) organizes.

Add flavors and acids. Ready marmalade masses are poured from the steam separator of the continuously operating zmevik apparatus into containers with a mixer installed on the funnel of the marmalade pouring machine. Additives to the mass are added in these containers: primers, essences, dyes, acids. Acid is added last. When the mass is boiled with the addition of modifier salts until the dry matter content reaches a high value, acidification plays a special role. When acid is added, the activity of the salts, that is, the ability to maintain the rate of binding of the pectin molecule to the jelly shell, suddenly decreases. When acid is added to the pectin-sugar solution, the pH of the medium decreases, which reduces the solubility of pectin and accelerates the formation of jelly. The solubility of pectin decreases for two reasons: the carboxyl groups are freed, the hydrogen in them is exchanged with metals; when more dissociated acids are added, the amount of positively charged hydrogen ions increases, and the negative charge of pectin solutions decreases. Jelly begins to form. Therefore, the acid is added only before the pouring process. The readiness of the boiled mass is determined by determining the amount of dry matter using a refractometer, and by pouring a small amount of the mass into a marmalade mold (in this case, the speed of jelly formation and quality

when touched by hand). The quality of the marmalade mass is continuously determined by the workshop laboratory. The finished marmalade mass should contain 70-73% dry matter and 13-17% reducing substances. The recipe mixture for layered marmalade is prepared by boiling the applesauce with sugar and modifier salts in the same way as in the preparation of mold marmalade.

Marmalade and pastilla products are produced in fully mechanized and non-mechanized lines of equipment. Most of the equipment installed in the lines is also used in the production of other confectionery products.

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