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## PRESERVATIVES IN FRUIT JAMS

### KONSERWANTY W DŻEMACH OWOCOWYCH

**Summary:** The modern human diet is the subject of research and interest for a large group of specialists. The unlimited capabilities of synthesising new chemical substances and the far-reaching changes in legislation create a space for expanding the list of permissible food additives. Despite the research conducted on new substances, the consumers are afraid that not all additives are sufficiently safe. This is frequently due to lack of access to objective and scientifically-verified information. The most concern is caused by the use of multiple additives in the same food product, which increases the risk of their accumulation in the human body. The objective of this paper is to discuss preservatives added to jams. It involves a discussion of the technological process and indicates the moment that a given preservative is added, showing photographs and findings from an experiment conducted on a single type of jam. The experiment was conducted under domestic conditions.

**Keywords:** jam, experiment, food additives, technology, consumer

**Streszczenie:** Dieta współczesnego człowieka to przedmiot badań i zainteresowania dużej grupy specjalistów. Nieograniczone możliwości syntezy nowych substancji chemicznych i daleko idące zmiany w ustawodawstwie dają pole do rozszerzania listy dopuszczalnych dodatków do żywności. Pomimo badań nad nowymi substancjami istnieje obawa konsumentów, że nie wszystkie dodatki do żywności są wystarczająco bezpieczne. Jest to często wynikiem braku obiektywnych i potwierdzonych naukowo informacji. Najwięcej obaw budzi stosowanie wielu dodatków w jednym produkcie spożywczym, a to zwiększa ryzyko ich kumulacji w organizmie człowieka. Założeniem artykułu jest przybliżenie jakie substancje konserwujące pojawiają się w dżemach. Przedstawienie procesu technologicznego i wskazanie momentu kiedy dana substancja konserwująca jest dodawana oraz przedstawienie zdjęć i wniosków z doświadczenia jakiemu poddano jeden rodzaj dżemu. Doświadczenie to wykonano w warunkach domowych.

**Słowa kluczowe:** dżem, doświadczenie, dodatki spożywcze, technologia, konsument

### Introduction

The use of additive substances with food in Poland is governed by the Regulations of the Minister of Health [1]. Food additives have been divided into five groups according to their technological function. The first group includes substances which keep food from spoiling (preservatives, antioxidants). The second group comprises sensory compounds (aromas, colourings). The third group consists of the additives that affect the product's structure (thickening and gelling agents). The fourth group facilitates food production (enzymes). The last, fifth group, covers enriching, functional and bioactive substances (vitamins and probiotics) [2].

### Jam production technology

Jams intended for consumption serve as tasty additions to meals and are used as an ingredient by the confectionery industry. The ancillary substances are sugar and food acid, which are added to ensure the appropriate gelling conditions. Also, citric acid is typically used. The gelling agents used include pectins with an average gelling speed. The first stage involves cooking the product, which is carried out in vacuum evaporators.

The preliminary actions may differ depending on the raw material used. If fresh or pasteurised fruit is used, sugar syrup is first produced in the evaporator and the fruits are added afterwards. The second stage of cooking takes around 20 to 25 minutes and involves saturating fruits with sugar. This is conducted in a vacuum of 0.8–0.9 atm and the temperature inside the evaporator should be 60–65°C. Towards the end of the cooking process, the jam is heated to 95–100°C, while the negative pressure in the evaporator is gradually decreased. Then, the product is held at the mentioned temperature for around 5 minutes for sterilisation purposes. The third stage of cooking consists of adding a gelling agent, as well as potential deacidification and preservation. While the gelling agent is being added, the jam must be continuously stirred. After the extract reaches the required level of gelling, a solution of citric acid is added and, after being stirred for a short time, the product is bottled immediately. It is very important to observe the specified jam cooking temperatures after adding pectins, because each time the range is exceeded by 10%, the gel forming ability of pectins drops by 15–20%. The jams are then placed and sealed in boiled and dried packaging where they are pasteurised. Pasteurisation is performed at 85°C for 5 minutes. After leaving the pasteuriser, the product should not be warmer than 40°C

## Popular preservative food additives

Food additives are used in the production process of jam. These are defined as substances not normally consumed as food and not typically being food ingredients, but used during production for technological purposes. The FAO/WHO Expert Committee on Food Additives determined the acceptable daily intakes (ADI) for those substances. This value is weighed in  $\text{mg} \times \text{kg}^{-1}$  of human body weight and means the overall amount of substances that can be taken in by the human body from all sources during the day without causing harm. The most popular additives are preservatives and antioxidants. Two main groups of preservatives are used to preserve foods and these are classified according to the methods of obtaining them, i.e.: antiseptics, which are simple compounds that may have their equivalents in nature and antibiotics, which are compounds produced by microbes. The addition of acids to food products is aimed at modifying their flavour and preventing the growth of bacterial flora [3]. Acids and acidity regulators can be added to food products in accordance with the *quantum satis* principle (in Latin: as much as needed, the amount which is enough). This means that a given substance is used in the lowest amount necessary to achieve the appropriate technological effect, as per the good manufacturing practice prepared as a part of the FAO/WHO Codex Alimentarius. Lactic acid E-270 – prevents the growth of microbes, citric acid E-330 – facilitates the gelling of pectins, sodium sorbate E-201 – prevents fungal growth, but is not effective against bacteria, potassium sorbate E-202 – a pH-dependent preservative, starch syrup – obtained from starch hydrolysis to glucose and by-products, guar gum E-412 – used to increase the stickiness of the food product, sucrose – obtained from sugar beets or sugar cane using industrial treatment processes [4].

## Experiment with strawberry jam

To determine whether preservatives affect fruit preserves, three 280 g jars of strawberry jam were purchased. A spoonful of each jam was then placed in three separate test tubes. Two of these remained open and one was sealed. The samples were stored in a household pantry in a temperature that did not exceed  $10^{\circ}\text{C}$  for a period of seven days. Sugar-free organic jam was placed in the sealed test tube number 1. On tasting, the product had a slightly sour flavour, a not-too-firm consistency, dark colour and visible pieces of fruits. It was made with 35g of fruit per 100g of the product, with added lemon juice made from concentrate. Sample 2, as open, contained jam with added sucrose. It was made of 35g of fruit per 100g of the product. In addition, the ingredients include guar gum, gelling agent, citric acid and sugar. This jam was very sweet, had a pleasant smell, it did not contain any pieces of fruits, it had a firm consistency and the colour of a fresh ripe strawberry. The last test tube contained sample 3, which was a low-sugar jam made of 36g of fruit per 100g of the product. Pectins and lemon juice were used as additives. The product had a uniform texture with the colour

of a highly ripe strawberry and a pleasant smell, moderately sweet. The samples were observed for seven days. The pantry used in the experiment is located in a cellared building with a constant temperature and has no access to sunlight. The



Sample 1. Juice formed at the bottom and the jam itself acquired a watery consistency



Sample 2. The jam became stuck to the bottom of the jar and acquired a slightly bitter smell



Sample 3. The jam became stuck to the bottom of the jar and changed its colour to dark brown

described conditions reduced the pace of changes occurring within the products. The first sample to deteriorate – as early as on the third day of the experiment – was sample 1, which had no added preservatives. The other two samples remained intact for seven days, but their consistency and colour would not attract a potential customer. The experiment has demonstrated that preservatives do have an influence on product lifetime, but this is not without consequence to our health.

## Summary

To conclude, we should pose the question whether food additives are indeed harmful to human health. Not long ago, we used to store food in herbs or salt to prevent bacterial growth, or in dark cellars, protected from light. Dried and long-fried fruits could be found in every household pantry. Meanwhile, civilisational progress necessitated the use of preservatives. Manufacturers are not eager to produce foods with short expiry dates or shelf life. Chemical substances have been identified that are better and more effective than traditional methods of preserving food products, while improving their quality and attractiveness. Processing allows us to keep food products available regardless of their growth season. Frozen fruits are one example. Processing increases a product's shelf life. It also improves product safety when e.g. high temperatures are used to eliminate harmful bacteria. Organic food advocates constantly struggle with the manufacturers of foods containing chemical preservatives. However, the latter frequently make the claim that natural origin is no guarantee that food is not

harmful. For instance, it can be polluted with pesticides. The most common ailments and disorders caused by excessive consumption of various food additives include gastric problems, food allergies, and deficiencies of important nutrients, problems with their digestion and absorption, diabetes and many others. As the experiment shows, preservatives serve their purpose well, but only under specific conditions. If we open a jar of jam and leave it on the shelf next to some baked goods, in a few days the bacteria will begin to grow inside regardless of the fact that the product's expiry date is two years. The product was opened and exposed to all kinds of external factors. No preservative is enough to guarantee that a product is healthy.

## Bibliography

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