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MODERN FOOD PRESERVATIVES AND THEIR IMPACT ON HEALTH

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Abstract
This article analyzes modern food preservatives and their impact on human health. Preservatives are widely used to extend the shelf life of food products and prevent the growth of microorganisms. The article provides a detailed examination of the differences between natural and chemical preservatives, their types, benefits, and potential negative effects. Market analysis indicates a growing demand for natural preservatives, as consumers are increasingly cautious about artificial additives. The article also includes information on the international classification of food preservatives, including the "E" coding system. In conclusion, natural preservatives are considered safer for health, and their use is expected to expand in the future.

Keywords: Food preservatives, natural preservatives, chemical preservatives, food safety, artificial additives, microorganisms, shelf life, health risks, antioxidants, E codes.

Introduction:

Modern food preservatives are chemical or natural substances used to extend the shelf life of products, prevent the growth of microorganisms, and preserve taste. Food is not just sustenance; it is a complex combination of molecules contributing to taste, texture, aroma, and nutritional value. Preservatives are so widespread that listing foods without them is easier than listing those that contain them. The use of preservatives is not new; they were used in the past through natural means before being replaced by synthetic analogs with technological advancements. Historically, substances like vinegar or lactic acid were used as preservatives. Manufacturers do not use preservatives to intentionally harm consumers but rather to extend the usability of their products. The key aspect of preservatives is their valuable ability to kill bacteria that spoil food and make it unsuitable for consumption. They are widely used in the modern food industry.

The size of the modern food preservatives market is estimated to be $3.4 billion in 2024, with an expected annual growth rate (CAGR) of 3% until 2031. The main factors driving market growth include the increasing demand for long-lasting processed foods due to fast-paced lifestyles, the need to reduce food waste, and the desire to ensure

food safety. However, consumer concerns about artificial preservatives and the growing demand for natural alternatives may slightly limit market expansion.
From 2025 to 2034, the preservatives market is expected to grow at a rate of 4.51%, reaching $4.85 billion by 2034. Currently, artificial preservatives dominate the market (approximately 70%), but demand for natural and "clean label" preservatives is rising. Among artificial preservatives, sodium benzoate, sorbic acid, and antioxidants (such as BHA and BHT) are the most commonly used.

Types of Food Preservatives:

1. **Natural Preservatives:** These are substances derived from plants, animals, or minerals that inhibit microbial growth and oxidation, effectively extending the shelf life of food while reducing the need for synthetic additives. The most common natural preservatives include:

- **Salt and Sugar:** Salt is used in drying and curing meat and fish products, drawing out moisture and making the environment unsuitable for microorganisms. Sugar is used in jams, jellies, and sweet beverages to increase osmotic pressure and prevent bacteria and mold growth.

- **Vinegar and Citric Acid:** Vinegar is used for pickling and marinating, creating an acidic environment that slows the growth of bacteria and mold. Citric acid is used in fruit juices, canned goods, and beverages to lower pH levels and inhibit microbial growth.

- **Plant and Spice Extracts:** Rosemary extract acts as a powerful antioxidant, preventing fats from oxidizing and extending their freshness. Garlic and onion have antibacterial properties and are widely used as natural preservatives. Cinnamon has antifungal and antibacterial properties, making it useful in beverages and confectionery.

- **Honey:** Due to its high osmotic pressure, honey prevents bacterial growth and has been used as a natural preservative throughout history.

- **Oils and Antioxidants:** Tocopherols (Vitamin E) prevent fat oxidation, slowing spoilage. Ascorbic acid (Vitamin C) helps preserve the color of fruit juices and canned goods while acting as an antioxidant.

Countries such as the USA, China, and Brazil are conducting scientific research to improve the effectiveness of natural preservatives, as consumers are becoming more cautious about artificial additives.

2. **Chemical Preservatives:** These are synthetic substances used to prevent food spoilage by inhibiting or stopping the growth of bacteria, mold, and yeast. They play a crucial role in extending the shelf life of food products and are also used in pharmaceuticals, cosmetics, and wood preservation. The most commonly used chemical preservatives include:

- **Sulfites (Sulfur Dioxide - SO_2):** Used in beverages, dried fruits, and heat-sensitive products. They prevent discoloration but have a strong odor and may cause allergic reactions in some individuals.

- **Benzoates (Benzoic Acid and Sodium Benzoate):** Used in carbonated drinks, fruit juices, pickles, and sauces. They are effective against yeast and mold but can negatively impact the respiratory system.

- **Sorbic Acid and Sorbates:** Used in cheese, beverages, fish, and baked goods. They inhibit microbial growth by disrupting enzyme systems.

- **Parabens (p-hydroxybenzoic Acid):** Found in soft drinks, fish products, and salads. Effective against bacteria and fungi, but their long-term effects are still being studied.

- **Nitrates and Nitrites:** Used in red meat products (sausages, canned meats) to prevent botulism and maintain meat color. However, some may form carcinogenic nitrosamines.

- **Propionates (Propionic Acid and Its Salts):** Protect baked goods and cheeses from mold growth.

Advantages and Disadvantages of Chemical Preservatives:

- **Advantages:**
  - Extend shelf life.
  - Prevent bacterial and mold growth.
  - Cost-effective and efficient.

- **Disadvantages:**
  - May cause allergic reactions and health concerns.
  - Excessive consumption can be harmful.
  - Increasing consumer opposition to artificial preservatives.

International Codex Alimentarius Classification: Food additives are classified with an "E" code, grouped as follows:

- **E100–E199:** Colorants.
- **E200–E299:** Preservatives.
- **E300–E391:** Antioxidants and acidity regulators.
- **E400–E481:** Stabilizers, emulsifiers, and thickeners.
- **E500–E585:** Other additives.
- **E600–E699:** Flavor and aroma enhancers.
- **E700–E899:** New types of additives.
- **E900–E999:** Glazing agents, sweeteners, and flour bleaching agents.
- **E1100–E1105:** Enzymes.

Having an "E" code does not necessarily mean an additive is synthetic or chemical. For example, **E160** (carotenoids), **E162** (beetroot pigment), **E170** (calcium carbonate), and **E300** (ascorbic acid) are beneficial additives. However, in Uzbekistan, the use of artificial food additives in children's products is discouraged according to sanitary regulations.

Some chemical additives pose significant health risks, such as asthma, kidney stones, and even cancer. The most harmful additives that should never be consumed include:

- **E216, E217, E239, and Formaldehyde (E240).**

Conclusion

Chemical preservatives play a crucial role in the food industry by extending shelf life and preventing microbial growth. However, some pose health risks, such as allergic reactions (sulfites), respiratory issues (benzoates), and potential carcinogenic effects (nitrites). As a result, consumers and manufacturers are increasingly focusing on natural alternatives like vinegar, citric acid, and salt. Future scientific research is expected to develop safer and more effective natural preservatives. Meanwhile, the World Health Organization (WHO) recommends that consumers limit or avoid preservatives to maintain a healthy lifestyle.

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