

APPLICATION AND PERFORMANCE OF PHYSICOCHEMICAL METHODS IN THE QUALITY ASSESSMENT OF CANNED FOOD PRODUCTS

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Abstract

This paper discusses the effectiveness of physicochemical analysis methods used to assess the quality of canned food products. The evaluation of quality indicators is carried out by determining the content of moisture, pH, acidity, fat, protein, and other components. The study demonstrates that physicochemical methods play a crucial role in ensuring product safety, determining shelf life, and assessing suitability for consumption. The results of the research contribute to improving quality control processes in the food industry and enhancing the reliability of industrial food safety monitoring systems.

Keywords: Quality management; canned products; physicochemical methods; food quality; pH level; oxidation degree; industrial control; food safety.

Introduction

In the modern food industry, canned products play a crucial role due to their long shelf life, ease of transportation, and the ability to provide consumers with access to a wide range of fruits, vegetables, meat, and fish products throughout the year. The canning process serves to extend the shelf life of products by inhibiting or significantly reducing the activity of microorganisms. Product quality is one of the key factors that strongly influences consumer preferences and the formation of market competitiveness [1].

Food quality is defined as a set of properties that reflect the organoleptic characteristics of a product, its ability to meet the nutritional needs of the human body, ensure safety for health, and maintain reliability during production and storage. The main characteristics determining the usefulness of food products and their ability to satisfy human nutritional needs include nutritional value, physical and sensory properties, and storage stability [2].

Nutritional value represents an important characteristic describing the beneficial properties of a product, including its energy, biological, physiological, and organoleptic value, digestibility, and overall quality. The energy value of food products is determined by the content of fats, proteins, and carbohydrates. Biological value is associated with the presence of biologically active substances such as essential amino acids, vitamins, macro- and microelements, and essential unsaturated fatty acids. These components are not synthesized by the enzymatic systems of the human body and therefore cannot be replaced by other nutrients. Physiological



value is determined by the ability of food products to influence the digestive system, nervous system, cardiovascular system, and the body's resistance to diseases [3].

The safety and suitability of canned products for consumption are directly dependent on their physicochemical and microbiological properties. Product quality is particularly influenced by the technologies used during the canning process, the degree of sterilization, the packaging environment, and the quality of raw materials. Therefore, the determination of indicators such as moisture content, pH value, salt concentration, and oxygen level is essential for assessing the quality and storage stability of canned products [4].

In food quality expertise, three main groups of indicators are distinguished: organoleptic, physicochemical, and sanitary-hygienic indicators. Organoleptic indicators are common to all groups of food products, and for some products they are considered the most important. The general organoleptic indicators for most food products include appearance, color, taste, odor (aroma), and consistency. Specific indicators include, for example, the pattern (eye formation) of cheese, the appearance of sausage cuts, the porosity of bread, and clarity for certain beverages [5].

Physicochemical quality indicators are specific to each group of food products. However, commonly used physicochemical parameters include moisture content (%), dry matter, fat, sugar, salt, and, depending on product composition, the content of other components (%), as well as acidity (total, titratable, and volatile). In current regulatory documents, physicochemical indicators that serve as safety parameters for specific products are clearly defined. The effectiveness of applying physicochemical methods to canned products is particularly high in preserving their beneficial properties and ensuring long-term storage stability.

The Main Part

Physicochemical analysis is a method of chemical thermodynamics that studies the relationship between the physical properties of substances and their composition. In physicochemical analysis, various physical properties of products are examined, most commonly phase transition temperatures and other thermal properties (thermal conductivity, heat capacity, thermal expansion), electrical properties (electrical conductivity, dielectric permittivity), optical properties (refractive index), density, viscosity, and hardness. The evaluation of the effectiveness of physicochemical analysis methods in assessing the quality of canned products involves analyzing their accuracy and practical significance. The increasing demand for food safety in modern conditions further enhances the relevance of this topic. The correct selection and application of analytical methods ensure the suitability of products for consumption.

Physicochemical methods are highly effective and can be classified into the following main types:

Methods for determining moisture content. Moisture directly affects the microbiological stability and shelf life of canned products. The most commonly used methods include the drying (gravimetric) method and the Karl Fischer titration method.

Determination of pH level. The pH value can be determined using pH meters or indicator papers. pH control is essential for evaluating product safety and stability.



Determination of salt content. Salt influences both the shelf life and organoleptic properties of canned products. One of the most reliable methods is argentometric titration, in which sodium chloride is titrated with silver nitrate using appropriate indicators. Based on the titration results, the salt content of the product is calculated.

The presence of oxygen in canned products intensifies oxidation processes. In addition, it is necessary to create a safe environment for anaerobic microorganisms. It should be noted that the application of physicochemical analysis methods in industrial and manufacturing sectors provides positive results in implementing quality management systems and preserving product quality. In particular, the physicochemical and microbiological characteristics of canned and bottled fruit juices often comply with international standards. However, the presence of microorganisms in some samples may be associated with non-compliance with sanitary and hygienic conditions, contamination of raw materials, or insufficient thermal sterilization. Therefore, regular quality control of fruit juices and the implementation of quality management systems in production processes are essential.

Physicochemical methods can provide highly effective and accurate results in evaluating the quality of canned products. These methods help determine storage conditions, microbiological status, and chemical composition of products. However, they should be applied in combination with organoleptic evaluation, as physicochemical methods alone cannot fully reflect the overall quality of a product. From this perspective, the implementation of a quality management system in the food industry, particularly in the production of canned products, helps to comprehensively control and optimize all stages of production.

The introduction of a quality management system can significantly improve the effectiveness of quality assessment, as it ensures continuous improvement of product quality and reduces potential errors in production processes. A Quality Management System (QMS) includes control and monitoring of all stages of the production process. Its primary objective is the continuous improvement of product quality. QMS ensures quality control at every stage of production, from raw materials to the final product. International standards such as ISO 9001 and HACCP play an important role in enhancing the effectiveness of quality management systems. These standards ensure the correct and efficient application of physicochemical methods used in the production of canned products.

When physicochemical methods (such as pH measurement, determination of oxidation level, and water activity measurement) are integrated with a quality management system, any issues arising during the production process can be promptly identified and eliminated. Through QMS, applying each physicochemical method at specified intervals and under controlled conditions, validating analytical methods, and documenting results can significantly increase overall efficiency. This approach contributes to extending shelf life, ensuring food safety, and improving the overall quality of products.

Advantages of integrating physicochemical methods with a quality management system include:

- **Continuous monitoring and control.** A quality management system ensures continuous monitoring. In the production of canned products, parameters such as pH level, oxidation degree, and other indicators are continuously monitored using physicochemical methods. The



results of this monitoring help optimize production processes and maintain high product quality.

- **Minimization of errors.** Proper application of physicochemical methods reduces potential errors during production. For example, deviations in pH level or excessive oxidation can negatively affect product quality; however, a quality management system enables rapid detection and correction of such deviations.

Conclusions

The combined application of quality management systems and physicochemical methods significantly enhances the effectiveness of quality assessment of canned products. These approaches enable continuous monitoring and optimization of product quality throughout the production and storage stages. However, certain limitations exist in the implementation of quality management systems and the application of analytical methods. These limitations can be effectively addressed through proper management practices and efficient allocation of resources.

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