

**ASSESSMENT OF THE QUALITY AND SAFETY OF APPLE
CONCENTRATE USED IN FOOD PRODUCTION, AND PROSPECTS
FOR ITS FUNCTIONAL APPLICATION**

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Abstract

This study presents the results of a comprehensive assessment of the quality of apple concentrate produced by SP LLC “Afrosiyab-Meva,” compared with international AIJN standards and technical regulations TR TS 021/2011 and 023/2011. Organoleptic, chemical-analytical, microbiological, and toxicological indicators were analyzed to determine the suitability of the concentrate for use in infant food and export. Additionally, the prospects of enriching apple juice with *Rosa canina* (rosehip) and *Mentha piperita* (peppermint) extracts to enhance the functional properties of the product were considered.

Keywords: apple concentrate, raw material quality, microbiological indicators, safety, AIJN, GOST, infant food, functional beverages

Introduction

The relevance of this study is determined by the growing interest in functional and organic food products, as well as the need to ensure a high level of quality and safety of raw materials for juice production. Apple concentrate (*Malus domestica* Borkh) is a strategically important raw material for the production of juices, nectars, purees, confectionery products, and infant food [3, 12]. In the context of increasingly stringent international requirements, compliance with AIJN standards [6], EU directives, and the technical regulations of the Customs Union has become particularly important.

Analysis of the scientific literature published by both foreign and domestic researchers [8, 9, 19, 20] has shown that attention is paid not only to the chemical-technological characteristics of apple concentrate but also to aspects of its functional enrichment with plant extracts. However, existing publications lack a comprehensive assessment that combines quality indicators of the concentrate with its toxicological and microbiological safety. Additionally, the prospects for the use of the concentrate

in infant food and functional products are insufficiently addressed [10, 17]. This confirms the presence of a research gap. At the same time, certain provisions of the present study are based on the works of authors such as [7, 9], who examined the chemical composition, organoleptic properties, and functional potential of apple concentrates.

Thus, the study aims to fill the existing gap in scientific data and expand the understanding of the potential use of apple concentrate not only as a traditional food raw material but also as a basis for functional beverages. The objective of this study was to conduct a comprehensive assessment of the quality indicators of apple concentrate produced by SP LLC “Afrosiyab-Meva,” as well as to analyze changes in the chemical-technological properties of the beverage when enriched with rosehip and mint extracts.

In this study, apple concentrate with 69–71 °Brix, produced from ripe fruits in Uzbekistan by SP LLC “Afrosiyab-Meva,” was used. For an objective assessment of quality, a comparative analysis was conducted with industry specifications of concentrates from producers in Poland and China. Physico-chemical parameters were determined according to generally accepted international and national methods. The content of soluble solids (Brix) was measured using a refractometry method in accordance with IFU 8 recommendations and GOST 51433. Titratable acidity was determined by the titrimetric method (GOST 51434), and density was measured by pycnometry (GOST 51431). Biologically active components were analyzed using validated analytical methods [11, 15, 18]. Vitamin C content was determined by titration, and the amount of polyphenolic compounds was measured using the Folin–Ciocalteu method. Gas chromatography coupled with mass spectrometry was used for the identification and quantitative analysis of volatile compounds. Microbiological safety was assessed by counting colony-forming units per gram of product (CFU/g) using standard regulatory methods. Thus, the comprehensive approach allowed a comparative analysis of Uzbek apple concentrate with similar products from leading foreign producers, which is an important step for an objective evaluation of competitiveness and compliance with international standards.

The concentrate is a clear, viscous liquid of golden-yellow color, with a typical apple taste and aroma, and no off-flavors. These characteristics serve as markers of the product's freshness and naturalness. The data presented in Table 1 show that the soluble solids content (Brix) is 69–71%, fully complying with both international AIJN requirements and GOST standards [1, 6]. The high concentration of soluble solids ensures the characteristic sweetness and stability of the product during storage. Titratable acidity ranges from 2.0–2.7%, and the data from SP LLC “Afrosiyab-Meva” are within the normal range. Such acidity contributes to the microbiological stability of the concentrate, prevents the growth of undesirable microflora, and forms a

pronounced flavor.

The SCI (sugar-acid index) ranges from 36.5 to 79.2, with a normative value of ≥ 35 , and the actual values significantly exceed the minimum level. This indicates a harmonious balance between sweetness and acidity, making the concentrate suitable for use in blends with other juices and beverages. The wide SCI range also reflects variability in the raw material, which is characteristic of a natural product. The color index measured at 440 nm is 30–70%, indicating that the concentrate complies with international standards. The color range reflects the presence of natural pigments such as flavonoids, carotenoids, and polyphenols, which are associated with antioxidant activity and enhance the organoleptic value of the product.

A comprehensive assessment of the quality of apple concentrate produced by SP LLC “Afrosiyab-Meva” demonstrated its full compliance with international AIJN standards, GOST, and the requirements of technical regulations TR TS 021/2011 and 023/2011. The concentrate is characterized by high organoleptic value, an optimal balance of sugars and acids (SCI), stable color characteristics, and confirmed microbiological safety. Enrichment of apple juice with rosehip and mint extracts leads to a significant increase in vitamin C and polyphenol content, improving the antioxidant potential and organoleptic profile of the beverage. This allows the product to be considered functional, possessing preventive and general health-promoting properties [13, 14]. Thus, “Afrosiyab-Meva” apple concentrate is a high-quality raw material with significant export potential. Its use is advisable both in traditional food production (juices, nectars, infant food) and for the manufacture of functional beverages in the organic/clean label category, aligning with current global trends in the food market.

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