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Examination of the Content of Ionic Species in Pectin Fruit Products Using the Ion Chromatography Method

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Objective

In this work, the content of ionic species in commercial pectin products from fruit: jams, marmalades and dietary jam sweetened with fructose from the market of the Republic of Serbia was examined, using the method of ion chromatography. The pH value of these products and total acidity were also tested. Fruit, which is the main ingredient of these products, contains the necessary macro and micro elements, vitamins and other biologically valuable substances, which are very important for the proper functioning of the human body. The elements such as Na, Mg, P, S, Cl, K and Ca are considered essential nutrients and are necessary in amounts in mg/kg per day.

Methods

Ion chromatography (IC), as a modern technique for the separation and quantitative determination of ions in solution, provides the possibility of simultaneous determination of several ions in a short period of time, good reproducibility of results and the possibility of using different detectors. Due to its favourable characteristics in terms of high sensitivity, good selectivity and high precision, IC is widely used as a method for the analysis of all inorganic ions. The pH value and total acidity were determined by the potentiometric method.

Results

The amounts of ionic species range within the limits that cannot endanger human health, and together with other foods, the prescribed minimum doses of these elements are provided for the proper functioning of the body.

In the examined jams and marmalades, potassium is the most abundant element. Cation K^+ is present in amounts of 30-62.5 mg per 100 g of product, followed by Ca^{2+} (3.0-6.75 mg/100 g), Na^+ (1.45-3.25 mg/100 g), while Mg^{2+} is below the detection limit in all samples (< 0.125 mg/100 g). The content of cations K^+ , Ca^{2+} and Na^+ and especially magnesium in jams and marmalades is lower than the average content of the mentioned elements in the fresh fruit from which they are produced. The reason for this may be that part of certain elements was not present in the extract that was analyzed because it was in the form of water-insoluble salts, therefore, alternative methods of sample preparation should be considered for the determination of these cations in such a complex matrix. Potassium is most abundant in dietary apricot jam, followed by plum jam, while calcium and sodium are most abundant in mixed fruit marmalade. During the analysis of cationic species in jams and marmalades, no major variations were recorded, in contrast to anions, where the values vary in a wider range. The most abundant anion in the examined products is SO_4^{2-} (14-87.5 mg/100 g), followed by Cl^- (3.25-42.5 mg/100 g), NO_3^- (2.2-9.25 mg/100 g), PO_4^{3-} (< 0.25 mg/100 g). The pH value in jams and marmalades varies in the range from 3.29 to 3.85. The highest value (pH 3.85) in extra apricot jam, while the lowest in mixed fruit marmalade (pH 3.29). The total acidity of the tested jams and marmalades is in the range from 0.53% to 1.71% calculated as citric acid, with the lowest percentage in rosehip marmalade and the highest in dietary apricot jam.

Conclusions

The determination of minerals in food products is important because of their role in the human body. The intake of sufficient amounts of mineral materials is necessary for the proper performance of many functions in the human body. These elements participate in the construction of bones and soft tissues, heart function, regulation of osmotic pressure, protein biosynthesis, transport through the cell membrane, they activate many enzymes, etc.

In order to determine the correlation between ionic speciation and pH, i.e. the distribution of ionic species depending on the acidity of the solution, as well as the relationship between cationic and anionic species, Pearson correlation analysis was performed, as well as the principal component analysis (PCA).

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