

Analysis of benzoic acid and sorbic acid in some selected food items available in Sri Lanka

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Background

Food preservation is the process of treating and handling food to stop or slow down spoilage and thus allows for longer storage to prevent food borne diseases (Zeuthen and Sorensen 2000). Nowadays this preservation is often made with the use of chemical preservatives, among which benzoic and sorbic acids, and their respective sodium, potassium and calcium salts, are widely used. Benzoic acid and sorbic acid are used to prevent growth of yeasts, moulds and bacteria that can grow in food items and help to extend their shelf life and safety. The salts of benzoic acid and sorbic acid are more frequently used as they are more soluble than the acid form (Mahindru 2008). To ensure the safety of consumers, international standards as well as Sri Lankan government food preservative regulations have been employed for any form of benzoic acid and sorbic acid that is to be used as a permitted preservative in food products.

There are various methods for the analysis of benzoates and sorbates in food items, such as chromatographic methods and spectroscopic methods. Nowadays, reversed phase HPLC is the most common analytical procedure for the detection and quantification of these preservatives in foods and beverages (Bui and Cooper 1987, Wood 2004).

Objectives

The principle objective of this study is to optimize and validate a simple HPLC method for routine determination of benzoic and sorbic acid in some selected jam and sauce products and to quantify benzoic and sorbic acid in those food items.

Methodology

Chromatographic separation was achieved using a C₁₈ column (ZORBAX Eclipse Plus) using acetate buffer 0.005 M (pH=4.7): methanol (70:30) as the isocratic mobile phase with flow rate of 1.2 ml/min at 30 °C. The column effluents from a 5 µl injection were monitored using a UV detector at 235 nm.

Five samples from jams and sauces declared to contain benzoic and sorbic preservatives on their labels were purchased from different supermarkets located in the city of Colombo, Sri Lanka. Benzoic and sorbic acids in jam and sauce samples were efficiently extracted with methanol after homogenization.

Quantification was based on the external standard method using calibration curves constructed over the concentration range from 5 mg/ dm³ to 100 mg/ dm³ of benzoic acid

and sorbic acid. The linearity of the calibration curves was determined using correlation coefficient value (r^2) of the curve.

In order to verify the accuracy and precision of the analytical procedure, recovery studies were carried out. Recovery percentages were determined by spiking different amounts of standards of analytes to negative samples of each matrix. The accuracy was then calculated from the test results as a percentage of the analyte recovered by the assay. Limit of detection (LOD) and limit of quantification (LOQ) were estimated by successively decreasing the concentration of the prepared standards until the peak with $S/N = 3$ and $S/N = 10$ were obtained.

Results

Chromatographic conditions resulted in an effective separation of the preservatives for all products analysed in a run time of 15 minutes. The average retention time was 7.8 minutes for benzoic acid and 12.1 minutes for sorbic acid. Accordingly the LOD calculated for benzoic acid and sorbic acid were 0.5 mg/dm^3 and 0.2 mg/dm^3 respectively. The LOQ calculated for benzoic acid and sorbic acid were 2.0 mg/dm^3 and 1.0 mg/dm^3 respectively.

Table 1: Percentage recoveries of benzoic acid and sorbic acid in jam and sauce samples.

Sample	Amount spiked (mg/kg)		Amount recovered (mg/kg)		Percentage recovery (%)	
	Benzoic	Sorbic	Benzoic	Sorbic	Benzoic	Sorbic
Jam 1		154		141		92
		213		199		93
		347		312		90
Jam 2	145		134		92	
	221		205		93	
	318		288		91	
Sauce 1		110		91		83
		234		204		87
		317		266		84
Sauce 2	109		94		86	
	219		179		82	
	302		257		85	

Determination of percentage recoveries of benzoic acid and sorbic acid were carried out by spiking selected pre analysed jam and sauce samples with three different concentrations of benzoic and sorbic acid. Table 1 summarizes the percentage recoveries of benzoic acid and sorbic acid in jam and sauce from selected samples.

Higher percentage recoveries, i.e. more than 80%, obtained for both benzoic acid and sorbic acid indicates that the extraction procedure is suitable for the quantification of these preservatives.

Recoveries obtained for sauce samples were lower than other samples. This may be due to the complex sample matrices and poor extraction procedure of two compounds. Higher percentage recoveries may be achieved using other extraction procedures such as solid phase extraction or solvent-solvent extraction.

The levels of benzoic acid and sorbic acid in commercial jam samples varied approximately from 160 mg/kg to 270 mg/kg while levels of benzoic acid and sorbic acid in commercial sauce samples varied approximately within the range of 100 mg/kg – 500

mg/kg. According to the food preservative regulations, the maximum permitted limit for benzoic and sorbic acid in sauces are 250 mg/kg and 1000 mg/kg respectively, while the maximum permitted limit for benzoic acid in jam is 500 mg/kg. Therefore, levels of benzoic acid and sorbic acid in jam and sauce samples, did not exceed the maximum permitted limits prescribed by the food preservative regulations of Sri Lanka.

Conclusion:

The described chromatographic conditions and extraction procedure seems to fulfill the criteria of selectivity, sensitivity, reproducibility and convenience for analysing the benzoic acid and sorbic acid contents in the respective samples under study. Therefore, this simplified methanol extraction procedure followed by HPLC separation can be used for the routine analysis of benzoic and sorbic acid in food samples, as the official AOAC methods for determining these preservatives in food and beverages require extensive sample preparation, lengthy clean up steps and relatively long analysis times. When the amounts of benzoic and sorbic acids present in the analysed samples were considered, major violations of the legislation cannot be seen.

References:

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