

Sodium analysis in sweeteners by neutron activation analyses technique

I M M A Medeiros^{1,2}, C B Zamboni¹, D N S Giovanni¹, J A G Medeiros²

¹Centro do Reator de Pesquisa – CRPq, Instituto de Pesquisas Energéticas e Nucleares, IPEN – CNEN/SP, São Paulo-SP, 05508000, Brasil.

²Universidade Cidade de São Paulo – UNICID, São Paulo-SP, 03071000, Brasil

Email: jageiros@ipen.br, ilca.medeiros@ipen.br, czamboni@ipen.br, daltongiovanni@gmail.com

Abstract. Evaluation of Sodium in sweeteners is important in nutritional investigations and for consumers: excessive sodium consumption is one of the major risk factors, responsible for hypertension and cardiovascular diseases. In this study, twelve brands acquired in markets of São Paulo city were analysed by Instrumental Neutron Activation Analyses technique (INAA). The aim was to verify compliance with ANVISA recommendation in relation to sodium level. The results were compared with the amounts recommended and with the tolerable intake limit (< 0.4 g/kg). The sodium concentration in sweeteners samples showed low content for most of the brands. The results shown that for the general population, it is not risk.

1. Introduction

The body needs only a small amount of sodium (less than 500 milligrams per day) to function properly (this amount is less than $\frac{1}{4}$ teaspoon). According to the World Health Organization (WHO), sodium intake should not exceed 2 grams per day. However, no one even comes close to eating that amount. Sodium content more than 75% comes from processed and prepackaged products, such as sweeteners, condiments, sauces and soft drinks may contain high doses. Sodium may appear in labels such as sodium benzoate, saccharin sodium, and monosodium glutamate.

O In 2010, it was proposed by the Ministry of Health and ANVISA (representative entities of the public health of Brazil) an increase in the efforts to reduce sodium consumption by the Brazilian population to less than 1700 mg / person / day [1]. Since then, processed foods have been evaluated intensively based on sodium content (more than 75 % of the sodium in food comes from processed and prepackaged products). Among the processed products, sweetener intake has increased significantly in the last decade: sweetener consumption in the American population (adult) increased from 27% to 41%; among children, it was 9% to 25% (an increase of more than 200%). In Brazil, there are no official statistics, but according to “*Food Guide for the Brazilian Population*” ([Guia Alimentar para a População Brasileira](#) [2], the trend is the same.

Evaluation of this ion in sweeteners is important in nutritional investigations and for consumers: excessive sodium consumption is one of the major risk factors, responsible for hypertension and cardiovascular diseases [3]. In this study, twelve brands acquired in markets of São Paulo city were analyzed by Instrumental Neutron Activation Analyses technique (INAA).



2. Experimental

Each sample was sifted and homogenized. Each sample (mass ~80 mg) was prepared in triplicate. Each sample was sealed into individual polyethylene bags, together with the Certified Reference Material Sample and Standard and were irradiated for 300s, in a pneumatic station at the nuclear reactor (IEA-R1, 3.5-4.5 MW, pool type), IPEN/CNEN-SP, Brazil, with a thermal neutron flux (ranging from 5.6×10^{12} to 6.2×10^{12} n cm⁻² s⁻¹). After the irradiation, the activated materials were gamma-counted for 900s using an HPGe (Model GEM-6019), coupled to an MCA ORTEC (Model 919E). The gamma ray spectra analysis was performed using the ATIVAÇÃO software. The NIST 1573a reference material was used as standard and for analytical quality control.

3. Results and Discussion

The INAA method was validated using reference material (NIST 1573a): the accuracy of the method was evaluated by Zscore test [4] and the repeatability of the methods was evaluated by RSD values. These results are presented in Table1.

Table 1. The analysis of the reference material

Reference Material (Mean $\pm$ 1SD, mg kg ⁻¹)	136 $\pm$ 4
Present Study (Mean $\pm$ 1SD, mg kg ⁻¹)	135 $\pm$ 9
RSD, %	6.7
Z-score values	0.3

The Na concentrations were presented in Table 2. The results were expressed by: Mean Value (MV), Standard Deviation ($\pm$ 1SD), Minimum (min) and Maximum (max). Figure 1 was elaborated to show the comparison with the tolerable intake limit.

Table 2. Na concentrations in Sweetener brands by INAA

Sweetener Brands		
Na, gkg ⁻¹	Aspartame n= 6	Sucralose n=6
MV	0.739	0.207
$\pm$1SD	1.508	0.204
min	0.013	0.019
max	3.811	0.493

n: number of samples

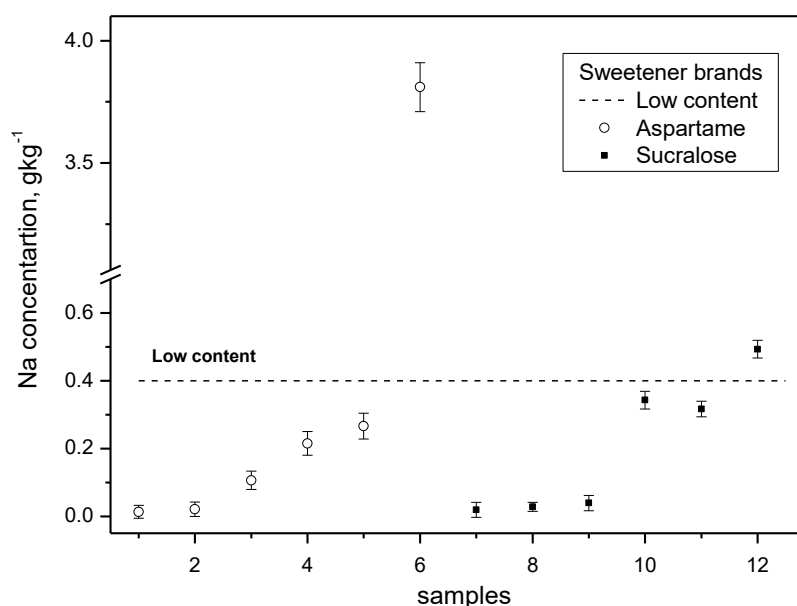


Figure 1. Na concentration in sweeteners samples

According to Table 1, the Z value = 0.3 indicated that our result was satisfactory ($|Z \text{ score}| < 2$) and is within the range of certified data at 95% confidence level as well as the repeatability of the method, RSD = 6.7 % (RSD < 10 %). Related to Table 2, the Na concentration in sweeteners samples showed a low content ($< 0.4 \text{ g kg}^{-1}$) according to ANVISA recommendations. Only two brands (sucralose) are above the recommended (0.4 g kg^{-1}), but only one (3.8 g kg^{-1}) shows significant difference, about 10 times above the recommended. However, patients with Metabolic Syndrome (~ 2000 million people in Brazil) may be at risk [5,6].

4. Conclusion

The sodium concentration in sweeteners samples showed to be low content. The results shown that for the general population, it is not risk.

5. Acknowledgments

The authors would like to acknowledge the CNPq and FAPESP for the financial support.

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