Chlorine determination in fresh and salt water fishes by ion selective electrode after digestion by microwave-induced combustion

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Abstract

Chlorine was determined in fishes from fresh and salt water by ion selective electrode after digestion by MIC method.

Introduction

Fishes are a rich source of proteins, vitamins and minerals, which are essential for the human organism.[1,2] However, in view of this, Cl is usually present in relatively high concentrations in the environment, especially in marine environments, and may potentially be incorporated in the fish.[3] This mineral has important functions in the human organism, but an excessive consumption can cause deleterious health effects, such as metabolic acidosis.[3] Thus, considering that fishes are widely consumed, it is important the determination of Cl in this type of food. However, for Cl determination, special attention should be given to the sample preparation step, due to high risks of contamination of the samples, and losses of analyte by volatilization when using acid solutions. In this context, an alternative for sample preparation is microwave-induced combustion (MIC), which has been successfully applied for the digestion of organic samples for further determination of halogens. The digests obtained by the MIC method should be suitable for analysis by potentiometry with ion selective electrode (ISE) for Cl determination.[4] Thus, in this study, the MIC method was used for digestion of fresh and sea water fishes for subsequent determination of Cl by ISE.

Results and Discution

Fish samples of species *Genidens genidens, Plagioscion squamosissimus, Urophycis brasiliensis* and *Hoplias malabaricus*, were purchased at a local market (Pelotas-RS). They were washed with ultrapure water, ground and dried. For introduction of samples in the MIC system, they were weighed out at 450 mg and wrapped in polyethylene film, which was sealed by heating. Afterward, the samples were placed in quartz holders containing a filter paper moistened with 50 μL of 6 mol L^{-1} NH_4NO_3. The holders were introduced into quartz vessels containing 6 mL of 25 mmol L^{-1} NH_4OH, which was used as absorbing solution. The vessels were closed, pressurized with 20 bar of O_2 and the samples were irradiated according the following program: 1400 W/50 s; 0 W/3 min; 1400 W/4 min; 0 W/20 min. Chlorine determination was performed by ISE. For accuracy evaluation a certified reference material (CRM) ERM BB422 (muscle fish) was used.

The obtained value (3.74 ± 0.22 μg g^{-1}) was in agreement with certified value (3.5 ± 0.06 μg g^{-1}) in the CRM. Furthermore, the accuracy was also evaluated by comparison of obtained results with those obtained by ion chromatography, and agreements between 90 and 96% were observed for all evaluated samples. The relative standard deviation was lower than 6% for all analysis. Chlorine concentrations in salt and fresh water fishes are shown in Tab.1.

Table 1. Concentration of Cl in salt and fresh water fishes obtained by ISE, after digestion by MIC (μg g^{-1}, n=3).

Sample	Concentration
*Genidens genidens**	2572 ± 133
*Plagioscion squamosissimus**	2995 ± 65
*Urophycis brasiliensis**	4325 ± 120
Hoplias malabaricus	907 ± 28

*fish of salt water

Based on the obtained results, concentrations of Cl in salt water fishes were higher than Cl concentration in fresh water fishes, as expected. The Cl concentration, demonstrates that there is a significant variation in the concentration of the mineral between the evaluated species. In this way, considering the absence of this type of study, it is important to develop methods to determine Cl, which can be used as a reference for the monitoring this element in a variety of fishes. Moreover, considering this preliminary results, other fishes should be analyzed, in order to evaluate the chlorine content in this type of food.

Conclusions

The MIC/ISE method was suitable for Cl determination in fishes of salt and fresh water, showing high accuracy and precision (RSDs lower than 5%). Moreover, it was possible to observe that fishes are one important food source of Cl, especially salt water fishes.

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