DETECTION OF HEAVY METALS FROM MOLLUSCS SHELLS

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ABSTRACT

This work presents aspects regarding some heavy metals (Cd, Pb, Cu and Zn) concentration in shells of different molluscs (Mytilus galloprovincialis, Rapana thomasiana, Mya arenaria, Scapharca) collected from the Romanian Black Sea Coast. The heavy metals were analysed using atomic absorption spectrometry.

INTRODUCTION

Population can be contaminated with organic pollutants and heavy metals by ingestion of contaminated or polluted food and water. Heavy metals and organic pollutants are persistent and non-biodegradable and they can be bioaccumulate through the biologic chains: soil-plant-food and seawater-marine organism-food /1-3/. So, the presence in high amount of organic pollutants and heavy metals in environment represents a potential danger for human health and for environment due to their extreme toxicity. For this reason, accurate monitoring of their concentration plays an important role. The gravity of toxic effect depends on nature, concentration, body resistance and presence of other contaminants /4-7/.

The concentration of toxic elements in food products is varied, depending of their origin, storage conditions and processing technologies.

In literature there are mentioned many methods for heavy metals determination in soils, phosphorus rocks, seawater, plants, biologic materials, steels and cast iron through: inductive coupled plasma - mass spectrometry /8/, inductive coupled plasma - atomic emission spectrometry /9,10/, atomic absorption spectrometry with flame or electrothermal atomization /11/, electrochemically with ultramicroelectrodes /12/, anodic stripping voltammetry /13/.

Because of the large scale dilution of organic contaminants in the aquatic matrices, concentrations of many organic pollutants are below the detection limits of standard analytical and sampling methods. Thus, gas chromatography with specific detection methods such as electron capture detector and HPLC has been frequently used for determination of pesticides and polycyclic aromatic hydrocarbons in water samples /14/.

In this paper we have analysed some heavy metals (Cd, Pb, Cu and Zn) concentration in shells of different molluscs (*Mytilus galloprovincialis, Rapana thomasiana, Mya arenaria, Scapharca*) collected from the Romanian Black Sea Coast. The heavy metals were analysed using atomic absorption spectrometry.

MATERIALS AND METHODS

The shells of molluscs (*Mytilus galloprovincialis, Rapana thomasiana, Mya arenaria, Scapharca*) were collected on the Romanian Black Sea Coast during August 2013.

For to analysed the heavy metals concentrations, the shell samples were washed, dried at 105 ^{0}C, pulverised and then mineralized by wet digestion method (HNO_3 - H_2SO_4). About 0.5g of each sample of shells powder was predigested in 2 mL 65% HNO_3 for 24 hours at room temperature, then 2 mL of 98% H_2SO_4 were added and the mixture was digested in a VELP DK6 heating digester. After cooling, the solution was made up to 25 mL of deionised water. All used reagents were of analytical reagent grade (Merck). The resultant solutions were analysed with an atomic absorption spectrophotometer GBC-AVANTA (air / acetylene flame) for to determine the heavy metals concentration: Cd (λ = 228.8 nm), Cu (λ = 324.7 nm), Zn (λ = 213.9 nm) and Pb (λ = 217 nm). Two replicate determinations were done for each solution.

RESULTS AND DISCUTIONS

The heavy metals concentrations in the samples analysed are presented in the figures below:

μg/g in dry sample

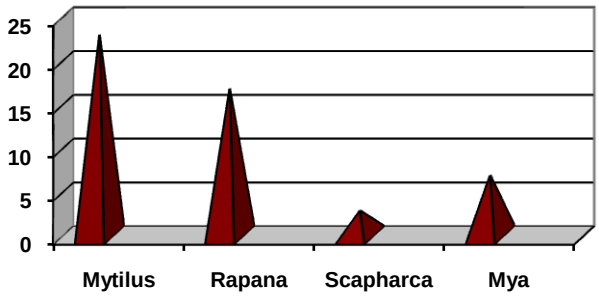

Figure 1. Concentration of Zn in the analysed samples

μg/g in dry sample

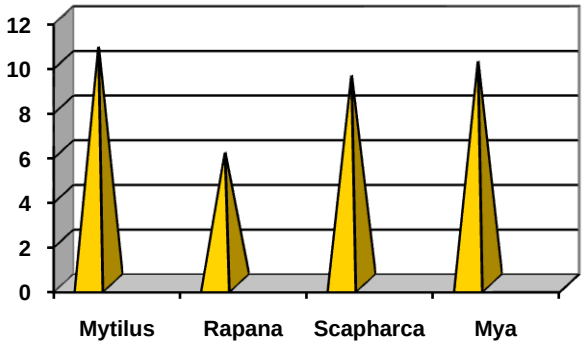

Figure 2. Concentration of Cu in the analysed samples

μg/g in dry sample

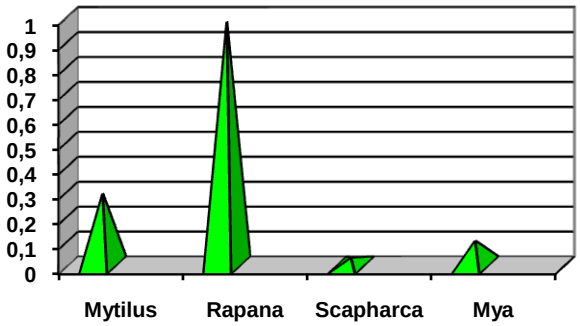

Figure 3. Concentration of Cd in the analysed samples

μg/g in dry sample

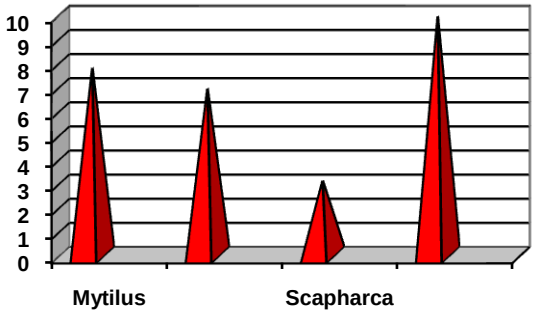

Figure 4. Concentration of Pb in the analysed samples

We remark from Figure 1 a high concentration of Zn in the Mytilus [22.99 μg/g] and Rapana [16.82 μg/g] samples comparing to the other samples.

In the Rapana sample we have detected the lower concentration in Cu [5.88μg/g] (fig. 2). In change in the shells samples of Rapana we have detected the high concentration in Cd [0.94 μg/g] (Figure 3).

The shells of Scapharca have presented the lower concentration in Pb [3.11 μg/g] but in Mya arenaria samples it has detected the highest concentration in Pb [9.93 μg/g] (Figure 4).

CONCLUSIONS

Concentration determination of heavy metals from the Black Sea molluscs presents a major importance because in the seawater are discharged the most effluents with high concentrations of pollutants and molluscs have bioindicator properties. Molluscs are biofilter organisms which retain small particles from seawater, so the presence of some pollutants in molluscs shells indicate a contamination of marine environmental.

The concentration values of heavy metals are generally high and their presence indicates a high degree of pollution and permits the identification of the principal contamination sources. We have detected the highest concentrations Cd in the shells samples of Rapana and Pb in the Mya samples.

We remark that the shells samples of Scapharca have presented the lower concentration in heavy metals.

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