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# Mercury Content in Edible Part of *Otolithes Ruber* Marketed in Hamedan, Iran

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***Abstract*****—**In this research the level of mercury is analyzed in muscle tissue of *Otolithes ruber* retailed in Hamedan, Iran were determined by flame atomic absorption spectrometry after wet digestion. Analysis of mercury was carried out by spectrophotometrically. The average concentration of Hg in muscle tissue of *Otolithes ruber* was 0.030±0.026 µg/g so lower than to compare with the Maximum Allowable Concentration determined by FAO/WHO Codex Alimentarius Commission.

***Keywords*****—**mercury, *Otolithes ruber*, edible part, Hamedan

## I. Introduction

MANUFACTURE , traffic, utilization and disposal of many modern products cause trace metal release into the aquatic environment and increasing attention is paid on how humans be affected by this. Biomonitoring of trace elements is essential to assess ecosystem health [5], [12], [15], [24], [25]. Heavy metals can be categorized as: potentially toxic (aluminium, arsenic, cadmium, antimony lead, mercury) probably essential like nickel, vanadium, cobalt and essential like copper, zinc, selenium etc. [22], [26], [32], [37], [38]. The essential metals can also be toxic when excessively elevated intake is of concern. There has been a growing interest to find out the heavy metal contamination level of public food supplies, particularly fish and fishery products. Marine organisms, especially fish, accumulate contaminants from the aquatic environment and therefore fish are used as good indicators of heavy metals in aquatic systems [20], [29]. Therefore fish is the main source of trace elements like mercury in human diet. Approximately 90% of human health risk related to fish consumption is associated to mercury-contaminated fish [9], [11], [30]. In the other hand, fishes are widely consumed because it has high protein content, low saturated fat and also contains omega fatty acids known to support good health. Fishes are constantly exposed to heavy metals because of pollution from chemicals and contamination in waters. Fish muscle is commonly analysed to determine contaminant concentrations and to assess the health risks because it is the main part consumed by humans. The levels of contaminants especially heavy metals in fish are of particular interest because of the potential risk to humans who consume them [8]. The accumulation of heavy metals of fish was size specific, with higher concentrations of metals generally found in smaller fish. Contamination of heavy metals also varied as a function of the different localities.

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The heavy metal levels of fish and other fishery products are widely documented in the literature [1], [2], [4], [6], [7], [13], [17], [29], [33], [34], [36], [38].

Hamedan is generally transported by the heavy vehicles from Persian Gulf. No data exist on trace metal levels of fish species retailed in Hamedan, Iran. According to neurotoxic effect of mercury, it is listed as one of the six, most dangerous chemical substances by International Program of Chemical Safety (IPSC) [10], [28]. So the present study was carried out to determine the levels of Hg in muscle tissue of one of important commercially available fish species (*Otolithes ruber*) in Hamedan, Iran.

## II. Materials And Methods

### *A. Chemical and reagents*

All chemical reagents were of analytical grade, purchased from Merck (Germany). All solutions were prepared with de-ionized water. Stock standard solution of Hg(II) (1000 mg/L) were prepared by dissolving the appropriate amount of metal salts/oxid dissolving in doubly distilled water and diluting to 1000 ml in volumetric flask.

### *B. Apparatus*

Mercury absorbance measurements were carried out on a Scinco's PDA UV-Vis. Spectrophotometer (photodiode array) equipped with 1.0-cm quartz cells. Voltammetric measurements were carried out using a polarographic processor; model 746 VA (Metrohm), in combination with a polarographic stand model, 747 VA (Metrohm). The electrode stand consist of a hanging mercury drop electrode (HMDE) as working electrode, a double junction Ag/AgCl (3M KCl, saturated AgCl, and 3M KCl in the bridge) as reference electrode and platinum wire, with considerably larger surface area than that of HMDE, as auxiliary electrode. Potentials quoted are relative to Ag/AgCl reference electrode. Stirring was carried out by a large Teflon road with 2000 rpm speed. A 780 pH Meter (Metrohm), equipped with a combined Ag/AgCl glass electrode was used for pH measurements. Eppendorf reference variable micropipettes were used to pipette microlitre volume of solutions. All glassware was soaked overnight in 10% (v/v) nitric acid, followed by washing with 10% (v/v) hydrochloric acid, and rinsed with double distilled water and dried before using.

### *C. Sample preparation*

Although voltammetric techniques are inherently precise and accurate, the results obtained using these techniques may be invalidated due to contamination caused by poor sample handling and preparation. Therefore, stringent conditions should be routinely used for analysis, particularly when dealing with trace concentrations. For example, all reagents, standard solutions, etc., should be ultra-pure, and all glassware

needs to be scrupulously cleaned. Similarly, stringent conditions should also be used for sampling and the pretreatment of samples; these two stages should be simplified as much as possible to minimize the potential for sample loss and contamination. Different complex matrices of the analytical sample require prior mineralization for most analytical methods, and this step is critical in the whole analytical procedure for the determination of metal concentration. Sample digestion techniques, such as microwave, and conventional acid digestion method for heavy metal determination have been used widely for the dissolution of target elemental analyses. These digestions techniques, however, require the use of concentrated mineral acids and high temperatures. Fish samples were cleaned with sterile distilled water and then dissected. Two grams of muscle tissue of the fish was removed and weighed for the analysis of Mercury. For estimation of Mercury content 2 g of muscle tissue was taken in a 100-ml Borosil beaker. To this, 2 ml of $HNO_3$ and 1 ml of $HClO_4$ was added and kept for digestion on a hot plate at 100°C till complete digestion was achieved (Complete digestion involves removal of organic matter by reacting with acids.). It was ensured that the residue obtained after digestion was free from organic matter which acts as impurities in Mercury analysis [14], [23], [27]. Residue was reconstituted using 1 M of 10 ml Hydrochloric acid (HCl) for further analysis.

### *D. Sample analysis*

To quantify the concentration of Hg(II) in muscle tissues of *Otolithes rubber* species by anodic stripping voltammetry, in the electrochemical cell 5 mL of each sample solution and 1 mL acetate-acetic acid buffer solution were transferred and diluted to 10 mL by doubly distilled water. The solution was deaereated by passing pure nitrogen for 5 min. The deposition potential was applied to a fresh mercury drop while the solution was stirred. After the deposition step and further 10 sec. (equilibrium time) the voltammograms were recorded. Different concentrations of the standard metal ion were added to the cell, while keeping the deposition time constant. The solution was stirred and purged with nitrogen for 1 min. after each spike. The concentration of Hg(II) in the muscle tissues of *Otolithes rubber* are analyzed by spectrophotometric method [21].

## III. Results And Discussions

The analysis of Hg was done by spectrophotometric method. Toxic metals contamination in edible parts of fish species is particular interest because of the potential risk to human health who consumes fish and fishery products. The result of this study shows that the average concentration of Mercury in muscle tissue of *Otolithes rubber* was 0.030±0.026 µg/g. This result is similar to other reports such as Rezayi *et al.*, 2011; Emami Khansari *et al.*, 2005; Voegborlo *et al.*, 1999. Therefore the average concentration of Mercury was lower than to compare with the Maximum Allowable Concentration determined by FAO/WHO Codex Alimentarius Commission [18], [19]. So seem consumption the edible parts of *Otolithes rubber* that marketed in hamedan to be safe for consumers.

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