DETERMINATION OF MERCURY, NICKEL AND COPPER IN SOME TYPES OF CANNED FISH AND MEAT

Areej, Kh. A. *, Angham, O. Z. **, and adem, A. A. ***

* ** Department of Environment and Pollution Engineering, College of Technical , Basrah,Iraq.

***, Departmentt. of Chemistry, College of Science , University of Basrah.Basrah,Iraq

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ABSTRACT

In this study, three heavy metals (mercury, nickel and copper) in twenty eight canned fish and meat samples were determined by atomic absorption spectrophotometer. The metal contents, expressed in ppm (mg/ L), varied from 0.01 to 3 ppm in canned fish and from 0.001 to 2 ppm in canned meat for mercury, from 0.0001 to 0.0003 ppm in canned fish and from 0.0001 to 0.0007 ppm in canned meat for a nickel, and from 0.001 to 0.01 ppm in canned fish and from 0.001 to 0.1 ppm in canned meat for copper. The results of this study showed the concentration of mercury in fish and meat samples exceed normal levels, and statistical analysis of results by ANOVA showed significant differences between fish and meat in some samples for mercury.

INTRODUCTION

Over the last few decades, there has been growing interest in determining heavy metal in canned food and attention was drawn to the measurement of contamination levels in public food supplies, particularly fish and meat. Toxicology and environmental studies have prompted interest in the determination of toxic elements in food. [1].

The ingestion of food is an obvious means of exposure to metals, not only because many metals are natural components of food stuffs but also because of environmental contamination and contamination during processing [2].

Toxic metal is defined as that metal, which is neither essential nor has a beneficial effect, on the contrary, it displays severe toxicological symptoms at low levels and it defined as a metal with a specific weigh more than 5g/ cm^3. With increasing industrialization, more and more metals are entering into the environment [3]

As well as these metals stay permanently because they cannot be degraded in the environment. They enter into the food material and from there their ultimately intake their passage into the tissue So heavy metals often has the direct physiologically toxic effect and are stored or incorporated in living tissue [4]

There is increasing concern about the quality of foods in several parts of the world; the determination of toxic elements in food has prompted studies on toxicological effects of them in food. [5]

The risk associated with the exposure to heavy metals present in food products had aroused widespread concern in human health. Improvements in the food production and processing technology had increased the chances of contamination of food with various environmental pollutants, especially heavy metals [6]

Therefore this study was undertaken to determine the levels of heavy metals (mercury, copper and nickel) in canned fish and meat as well as to compare the levels of these chemical residues with a standard curve.

MATERIALS AND METHODS

Apparatus:

All glassware was soaked overnight in 10% (v/v) nitric acid, followed by washing with 10% (v/v) hydrochloric acid, and rinsed with deionized distilled water and dried before using [5].

A Shimadzu Model 12-630-AA Atomic Absorption/ Flame Emission equipped was used to determine mercury concentration, while copper and nickel concentrations determined by CO-LTD (UK) Model 986- AA Atomic Absorption Spectrophotometer.

Sample preparation and digestion:

Twenty eight cans of fish and meat samples were dried in oven at 105^0C for 24h, then this sample transferred to desiccators, to remove moisture, then samples leaved to matching with room temperature.

The tissue crush by ceramic mortar, then 1g weight from tissue powder and put it in 25 ml glass volumetric flasks and vent closed by a glass plug during digestion.

The sample is then taken and digested promptly as follows, the 1gm was weighed into a 25ml glass volumetric flask, and 4.5ml of concentrate HNO_3 and 1.5ml of concentrate $HClO_4$ were slowly added, the flask was then shaken well to blend between powder of tissue and acids, the flask was covered by watch glass and left for 24h under the exhaust fan to complete the digestion process.

After that, samples were warm at 70^0C for 2-3h in block digestion, the flasks take out block the digestion , 2-3ml of deionized distilled water was added.

Then the opening flasks warmed again in block digestion at 70^0C until the volume of solution reduced to 2ml .

The samples transferred to a flask (50 ml) and complete the volume of deionized distilled water. The solution put in clean plastic tube and centrifuge was used with 3500r/m to 30m,

the filtered solution put again in flask (50 ml) and this solution was ready for measurement by atomic absorption spectrophotometer.[7].

2.3 Statistical analysis:

Data collected were subjected to one way analysis of variance (ANOVA) ($P<0.01$) to assess where heavy metals varied significantly between standard solution and samples and between fish samples and meat [8].

RESULTS AND DISCUSSION

Hg, Ni and Cu were determined in twenty eight samples of canned fish and meat. The results indicate that the concentration varied from 0.01 to 3 ppm for mercury in fish samples and from 0.001 to 2 ppm in meat samples, statistical analysis of results showed ($P<0.01$) between fish and meat in some samples, the limits set by US- EPA for mercury was 0.50 µg/g in fish [9].

Any study doesn't record mercury exist in meat samples [10]. The results indicate the concentration of mercury in fish and meat samples exceed normal levels (fig 1,2 and 3). Bioaccumulation of Hg by fish and shellfish in canned food item can be a rich source of metals, and of the serious contamination of foods that occurs from time to time during commercial handling and processing, most countries monitor the levels of toxic elements in foods [11].

As well as the results indicate that the concentration varied from 0.0001 to 0.0003 ppm for nickel in fish samples and from 0.0001 to 0.0007 ppm in meat samples, statistical analysis of results showed no ($P<0.01$) between fish and meat in some samples, the limits set by US-EPA for nickel was 1.0 µg/g in fish [9], while 0.014 mg/kg in meat samples [10]. In this study we showed the concentration of nickel in fish and meat samples doesn't exceed normal levels (fig 4,5 and 6).

And the results indicate that the concentration varied from 0.001 to 0.01 ppm for copper in fish samples and from 0.001 to 0.1 ppm in meat samples, statistical analysis of the results showed no ($P<0.01$) between fish and meat in some samples, the limits set by US- EPA for nickel was 120.0 µg/g in fish [9], while 2.1 mg/kg in meat samples [10]. In this study we showed the concentration of copper in fish and meat samples don't exceed normal levels (fig 7,8 and 9). The main source of contamination of foods with copper was Copperware used to store or cook foods. Copper, although not essentially toxic, could cause public health hazards in high concentrations [12].

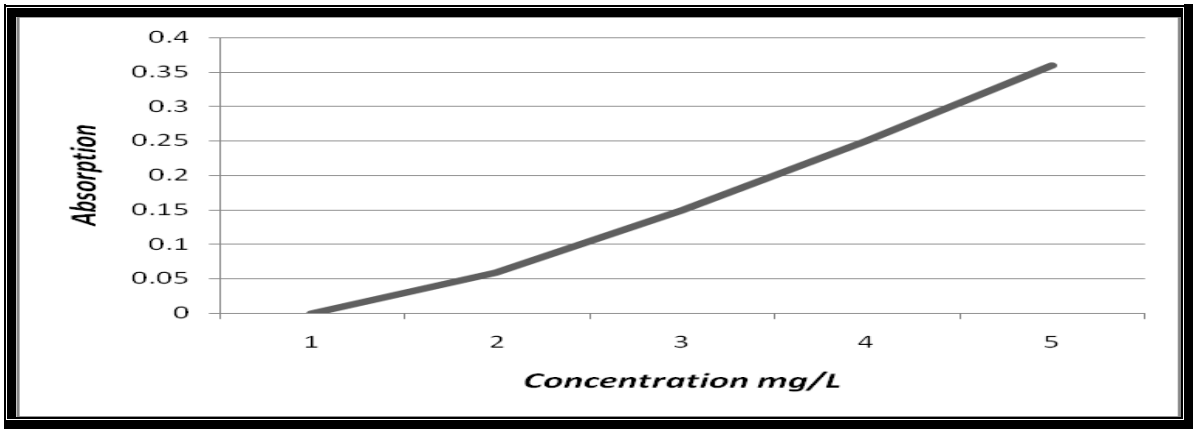

Fig (1) Standard curve of mercury

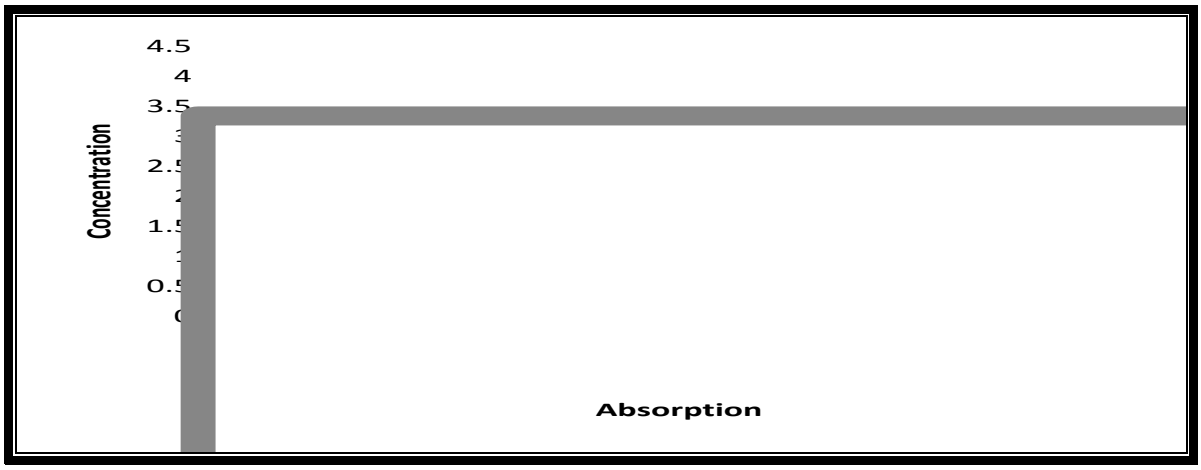

Fig (2) The concentration of mercury in fish samples

Fig (3) The concentration of mercury in meat samples

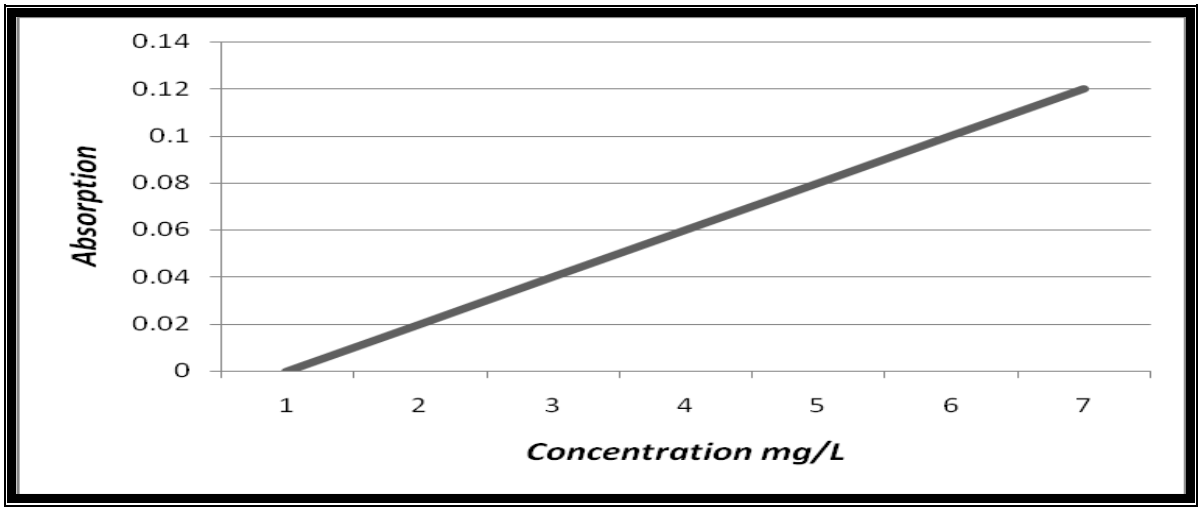

Fig (4) Standard curve of nickel

Fig (5) The concentration of nickel in fish samples

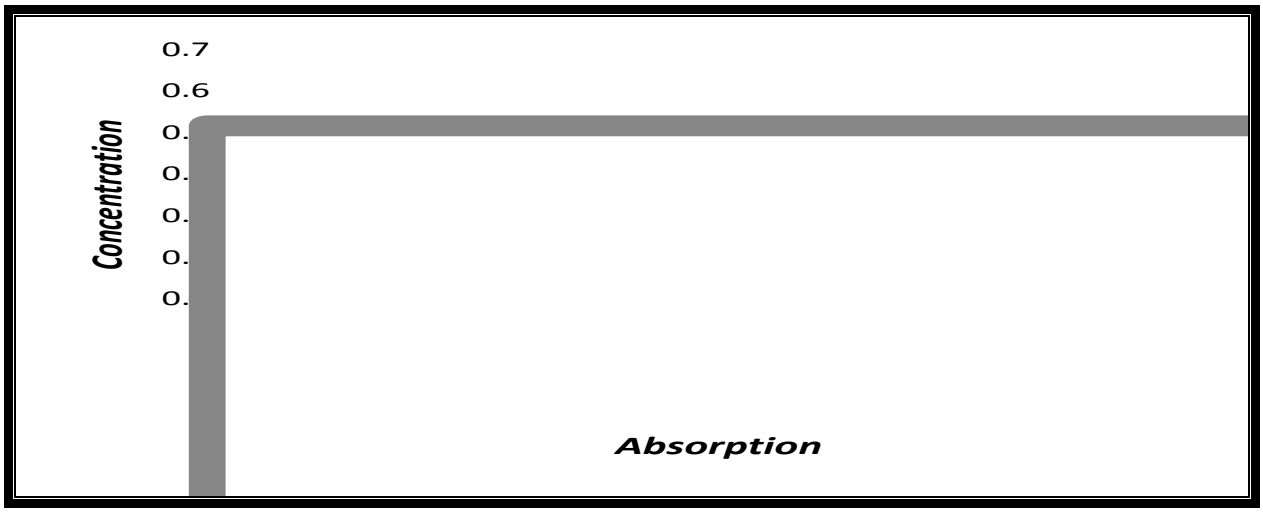

Fig (6) The concentration of nickel in meat samples

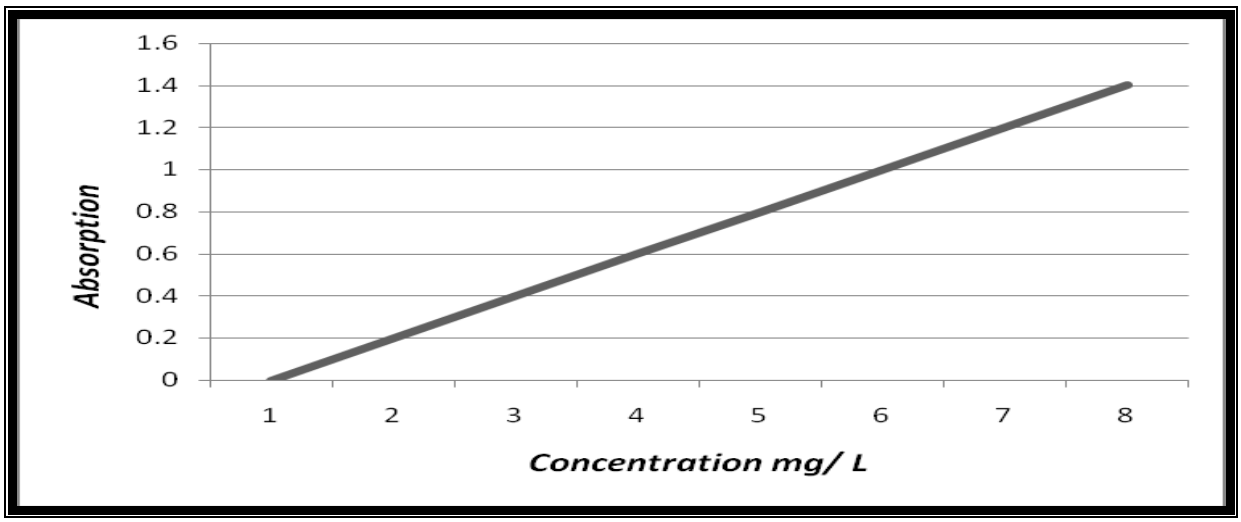

Fig (7) Standard curve of copper

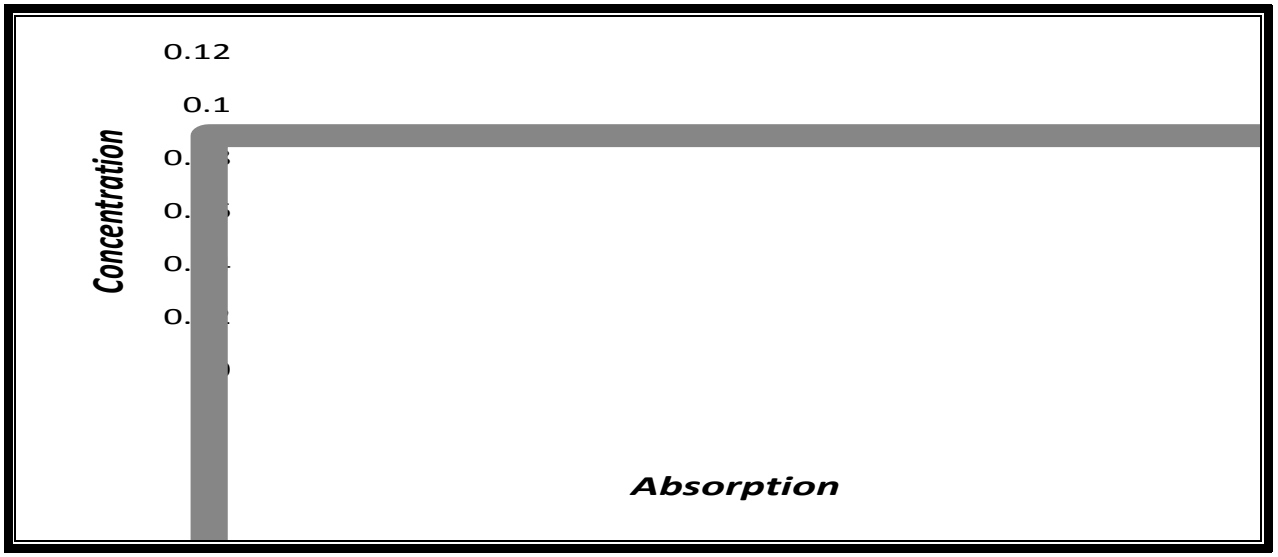

Fig (8) The concentration of copper in fish samples

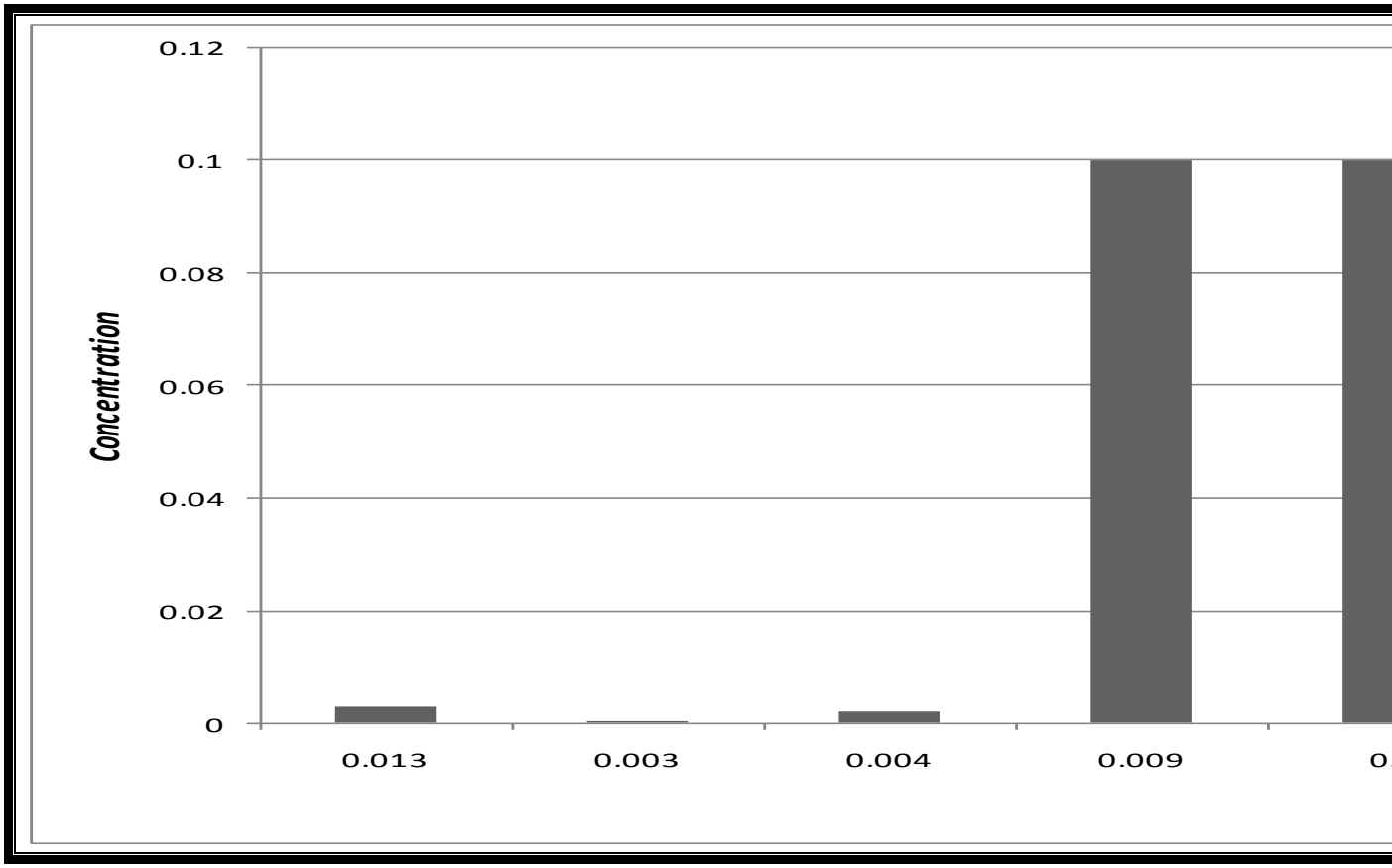

Fig (9) The concentration of copper in meat samples

CONCLUSIONS

From the results of this study, the concentrations of mercury in canned fish and meat samples, which is hazardous metal, exceeded the normal levels. But none of the samples had nickel and copper content exceeding the normal levels. Hence the results of this study demonstrate the need for a systemic control of toxic heavy metals in canned food before and after canned, and determine other toxic metals in canned food specially in canned fish and meat because the human directly consumed these types of foods.

تحديد الزئبق، النيكل والنحاس في بعض عينات الأسماك واللحم المعلب

* اريج خضير عباس ** انغام عمير صاحي *** ناظم عبدالنبي عواد

قسم هندسة تقنيات البيئة والتلوث، الكلية التقنية ،البصرة.العراق

قسم الكيمياء، كلية العلوم، جامعة البصرة،البصرة،العراق

الخلاصة

حددت ثلاث معادن ثقيلة (الزئبق، النيكل والنحاس) في ثمانية وعشرون عينة اسماك ولحوم معلبة باستخدام جهاز الامتصاص الذري. تراكيز المعادن حددت باجزاء من المليون وهو ما يعادل (ملغم/ لتر) ، اذ تراوحت من 0,01 الى 3 جزء بالمليون في السمك المعلب ومن 0,001 الى 2 جزء بالمليون في اللحم المعلب لمعدن الزئبق، ومن 0,0001 الى 0,0003 جزء بالمليون في السمك المعلب ومن 0,0001 الى 0.0007 جزء بالمليون في اللحم المعلب لمعدن النيكل، ومن 0,001 الى 0,01 جزء بالمليون في السمك المعلب ومن 0,001 الى 0.1 جزء بالمليون في اللحم المعلب لمعدن النحاس، كما واظهرت النتائج ان تركيز الزئبق في عينات الاسماك واللحوم المعلبة قد تجاوز المستويات الطبيعية. فضلا عن ذلك بين التحليل الاحصائي للنتائج وجود فروق معنوية بين عينات الاسماك واللحوم لمعدن الزئبق.

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