



## ICP/OES analysis of some conditioners marketed in Sudan for heavy metal content

Hassna M<sup>1</sup>, Mubark M<sup>2</sup>, Ahmed H<sup>3</sup>, Abdel Karim M<sup>4\*</sup>

<sup>1-4</sup> Faculty of Science, Sudan University of Science and Technology, Sudan

### Abstract

The safety of cosmetics is becoming nowadays a current issue. This study was designed to detect heavy metals in some conditioners marketed in Sudan for beautification. Three cosmetic articles marketed under different commercial names and extensively used by Sudanese women were analyzed by inductively coupled plasma/optical emission spectroscopy (ICP/OES). (ICP/OES) analysis of test samples revealed absence of potentially harmful mercury, lead, nickel and cadmium. However it showed that a common metal in test samples is calcium. Samples 1 and 2 contained iron. Barium, manganese and copper appeared only in sample 1. Boron appeared only in sample 2, while europium appeared only in 3.

**Keywords:** health hazards, cosmetics, conditioners, ICP/OES analysis, heavy metals

### Introduction

Cosmetics industry has grown rapidly over the past decades. Cosmetics refer to those products used by humans to attain attractive features i.e. they are products used for beautification [1]. However, beside the expansion in cosmetics market, which is influence by continual consumers demand, safety in cosmetics has recently become a major concern [2]. In cosmetics, the most common ingredients are: fragrances, preservatives, ultraviolet absorbers, humectants, emulsifiers and acrylates [3]. Such additives are risk factors in many adverse reactions [1]. Some of these fragrances and preservatives are toxic and overexposure is a risk factor in mutation, cancer and endocrine disruption [1].

Beside fragrances and preservatives, heavy metals are sometimes incorporated to cosmetics. Some of these metals can cause potential damage to the human internal organs. Heavy metals are also associated with various mammalian disorders like respiratory diseases, cancer, kidney failure and intellectual retardation [4].

The antimicrobial- paraben – and its conjugates are common preservatives in cosmetics [5, 6]. Parabens have relatively low toxicity [7]. Fragrance chemicals are used in perfumed cosmetics [8]. Limonene and linalool are very common fragrances. Linalool can be oxidized by atmospheric oxygen to form products that can cause contact allergy<sup>9</sup>. Also during handling and storage, limonene can form allergenic oxidation products [10].

It is known that the presence of heavy metals as impurities in cosmetics is almost unavoidable due to their ubiquitous nature [11]. Some heavy are incorporated in some cosmetics due to

their vital fuction [12]. Among heavy metals: lead, mercury, cadmin, nickel, copper and chromium are frequently found in cosmetics. Though, heavy metals occur in cosmetics in trace amount, but due to their long half-life, they act as cumulative poison.

In continuation of our interest in safety of cosmetics used by Sudanese women, this study was aimed to analyze some cosmetic articles marketed in Sudan for heavy metal content.

### Material and Methods

#### Cosmetics Samples

Three cosmetic articles marketed in Khartoum (Sudan) under different commercial names and frequently used for beautification were purchased from the local market-Khartoum, Sudan.

#### Inductively coupled plasma/optical emission spectroscopy (ICP/OES) analysis

Cosmetic powder (5g) was heated at a temperature of 800 ° C for three hours and then dissolved in 10 ml of 10% HCl. The sample was placed in a 500 ml flask and the volume was adjusted to mark with deionized water. The sample was then directly injected into the spectrophotometer.

**Table 1:** Heavy meals in test samples

Sample No.	Heavy metal						
	Ba	Ca	Fe	Mn	Cu	-	-
1	-	Ca	Fe	-	-	B	-
2	-	Ca	-	-	-	-	Er
3	-	Ca	-	-	-	-	-

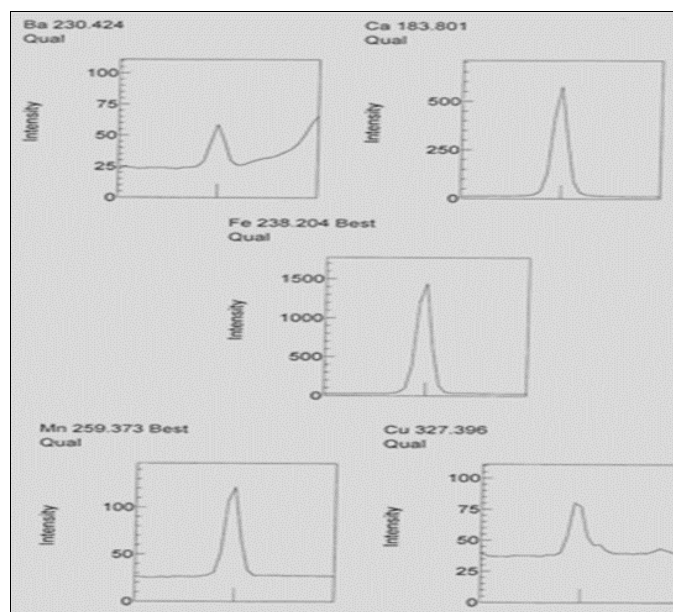


Fig 1: Sample 1: ICP/OES chromatograms

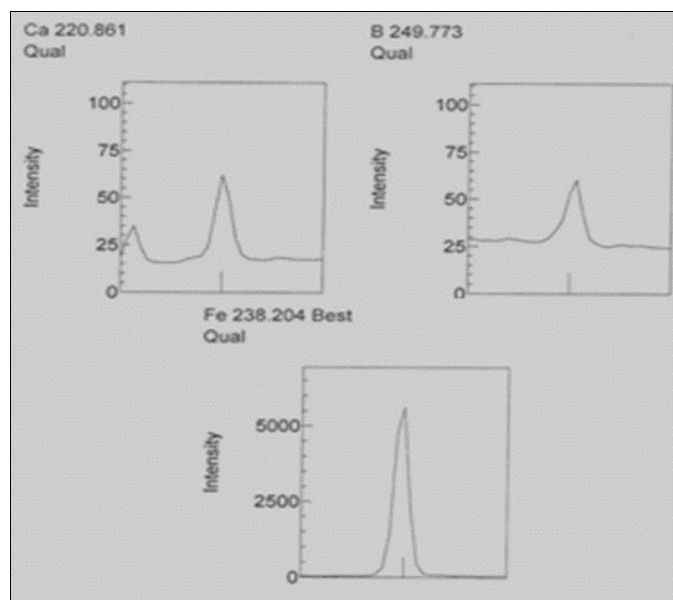


Fig 2: Sample 2: ICP/OES chromatograms

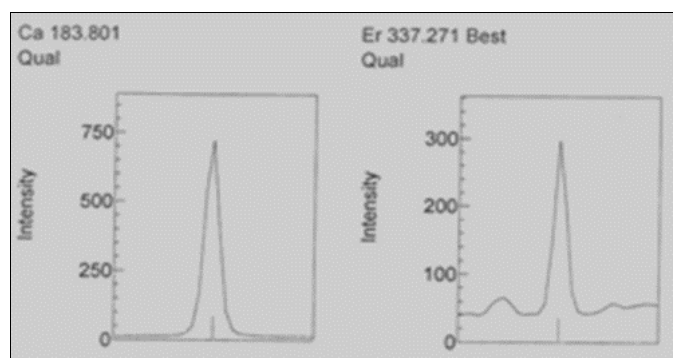


Fig 3: Sample 3: ICP/OES chromatograms

## Results and Discussion

In this study 3 cosmetic samples marketed in Khartoum

(Sudan) as conditioners and used extensively by young Sudanese women for improving appearance have been analyzed for heavy metals content using the inductively coupled plasma/optical emission spectroscopy (ICP/OES). Such heavy metals are classified as cumulative poison. They could be absorbed through the skin and over-exposure can cause serious adverse reactions. The health hazards associated with heavy metal-containing cosmetics have been outlined [13-15]. It is known that the accumulation of heavy metals in human body is a risk factor in reproductive disorders, cardiovascular diseases, cancer, kidney and liver damage [16]. Cadmium, lead, mercury and nickel implicated in some cosmetics are classified as known carcinogenic agents. They are absorbed via dermal contact and are stored in liver and kidney. High levels of lead in human may cause severe contact dermatitis [17]. Lead is associated with increased blood-lead level in women using leaded eye-powders [18, 19]. Lead overexposure is a risk factor in menstrual irregularities, reduced fertility, and hormonal changes [18]. Some cosmetics contain nickel. Nickel and its alloys which are incorporated in some cosmetics are classified as possible carcinogenic agents [18]. On the other hand, mercury-containing cosmetics may cause kidney damage [20]. It has been reported that mercury can reduce skin resistance towards microbial infections [20].

The inductively coupled plasma/optical emission spectroscopy (ICP/OES) is a sensitive analytical tool. (ICP/OES) analysis of test samples revealed absence of mercury, lead, nickel and cadmium. However it showed that a common metal in test samples is calcium. Samples 1 and 2 contained iron. Barium, manganese and copper appeared only in sample 1. Boron appeared only in sample 2, while europium appeared only in 3 (see Table 1 and Figures 1-3).

Europium is a soft metal possessing the lowest density among all lanthanides. It is the most reactive rare earth element. Though, europium salts could be mildly toxic by ingestion, the toxicity of europium has not been fully investigated [21].

Copper is an essential trace element, but excessive intake of copper is associated with gastrointestinal problems, anemia and allergic dermatitis [22]. There is a limited data on the toxicity of boron. The limited data on this topic has only been obtained from human poisoning cases and toxicity studies on animals. However, clinical symptoms of boron toxicity have been outlined [23].

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