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Levels of some trace elements and other metals in many brands of cosmetic products in Iraq markets

Abstract- *Seventy five samples of care products that of different classes (facial blush, dried powder for face, and shadows of eye) analyzed to their contents of five elements (Cu, Co, Ni, Cd and Pb) in our work. The work has been done by using atomic absorption and combinations, digestion of acid. The concentrations of metals and elements in part per million for facial blush were Co (10.2 ± 2.7), Cu (0.038 ± 0.01), Ni (24.6 ± 7.1), Cd (4.90 ± 1.93) and pb (75.1 ± 13.1), for dried powder for face were Co (213 ± 89.65), Cu (0.137 ± 0.02), Ni (24.6 ± 7.1), Cd (5.1 ± 1.82) and Pb (295.1 ± 101.2), and for eye shadows were Co (15.1 ± 2.7), Cu (0.038 ± 0.01), Ni (32.7 ± 5.1), Cd (5.40 ± 1.12) and Pb (17.9 ± 3.51). Levels of analyzed elements are not seen to be humans toxic, time of exposure might be a cause of elements accumulation in the body and cause diseases. At the above levels.*

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1. Introduction

Metallic elements with high density as compared to water are the main definition of trace elements [1]. Toxicity and heaviness are inter-related, metalloids are a type of heavy metals, like arsenic, that has the ability at low level of exposure to induce toxicity [2]. Trace elements may be a name of heavy metals when their levels less than 10 part per million [3].

Products of cosmetic are defined in order of food, and drug administration (FDA), that they are articles rubbed, intended to be poured, sprinkled, or applied to the human, introduced into sprayed on the body, for cleansing, beautifying, promote the appearance and altering the attractiveness [4]. FDA was excluded soap from this classification. Personal products care is the term were referring to variety cosmetic products in the counties. Products have been used by ancients for hundreds of years ago [5]. Products of personal care have active materials that depend on care products application. Some cosmetics ingredients are inadvertent and manufacturing of these products require some toxic metals and other elements. Inorganic mercury is one of some harmful ingredients are added in whitening creams [6], other elements considered essential for humans [7]. Ingredients can be harmful if exceeded in standard levels. Others are toxic in multiple levels. Elements with wide spread presence and their high toxicity is one of the causes their dangerous, like mercury (Hg), lead (Pb), cadmium (Cd), arsenic (As), and antimony (Sb), and studied widely by many researchers [8]. Less toxic essential elements have been less studied. Levels of these elements have been studied barely with exception of chromium, copper, and cobalt because of the known health concerns [6]. Presence of heavy metals in cosmetics have been studied in multi methods like, flame atomic absorption spectroscopy (AAS) [9], inductively, coupled plasma mass spectrometry (ICP-MS) [10-12], and atomic emission spectroscopy (AES) [13], microwave digestion was followed the acids wet- digestion and considered the classical sample preparation method, or methods more recent. The study has many elements, and other was little, the study and composition of the cosmetics elements that sold in many Iraqi markets were studied by AAS following mixing of acids digestion. The components of the studied elements compared to a levels set by world health organization's evaluation the safety level of cosmetics used from Iraq customers. This is first study to evaluate elements levels in products of personal care for Iraqi customers.

2. Practical methods

I. Collection of Samples

Three classes (seventy five samples) of facial care products available in Iraq bough from markets. Some samples of the cosmetic were popular brands, some of which were produced locally and others imported. Most of the imported products examined were from the USA, China, Korea, India, France, Italy, Taiwan and the United

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Kingdom. The choice of brands was carefully made to reflect the types used by different income classes. The facial cosmetics were classified into three broad groups, namely, (1) blushes, (2) face powders (3) eye shadows. The samples were stored under conditions similar to those of the retail shops until the analysis was completed.

II. Reagents

All reagents, nitric acid (HNO_3 69% w/w), hydrochloric acid (HCl 37% w/w) and hydrogen peroxide (H_2O_2 30% w/w) were suprapur® (Merck, Darmstadt, Germany). The calibration standards were prepared by diluting 1000 mg L^{-1} commercial standards of Co, Cu, Ni, Cd, Pb. with 0.25 mol/ L nitric acid.

III. Sample preparation

A mass of 1.0 g of each sample was placed into a teflon vessel and treated with 20 mL of concentrated nitric acid, 10 mL of hydrochloric acid and 5 ml of hydrogen peroxide. The samples were covered and left to stand overnight. The following day, the samples were heated to 125 °C for 2 h. The clear supernatant solutions were cooled, filtered the solution and made up to 25 mL with 0.25 mol/ L nitric acid, and in similar procedure prepare of four blanks without samples.

IIII. Analysis of samples

All measurements were carried out with a model analyst 800 Atomic Absorption Spectrophotometer (Perkin-Elmer, Shelton, USA).

The analyzing of digested samples were done triplicate for Co, Cu, Ni, Cd and Pb, by means of flame atomic absorption spectrometry. Analyzing of standard calibration, Blank were done in a same procedure of samples. In each batch of analyses, analyzing were done to 3–4 blanks. Before doing statistical method the blank signal (average) was subtracted from sample signal.

IIIII. statistical methods and control

glasses and sample vials were soaked in a solution of 10% nitric acid followed by thorough rising with distilled deionized water. The instrument was calibrated after every ten runs. In the absence of a certified reference material, a spike recovery method and an independent inter-laboratory comparison were used to validate the analytical procedure. The laboratory study was done at the University of Technology, Applied chemistry laboratories. All statistical analyses were carried by using SPSS software version 15.0 (SPSS Inc, Chicago, IL, USA) as in table (1).

3. Results and Discussion

During 2016-2017 a seventy five samples of cosmetic bought from Iraqi supermarkets. Samples were detected for their components of 5 elements (Cu, Co, Ni, Cd and Pb). The elements levels in ppm are shown in table 1.

Table (1): Concentrations of Co, Cu, Ni, Cd and Pb in three broad groups of cosmetics.

product	Co (mean ± SD)	Cu (mean ± SD)	Ni (mean ± SD)	Cd (mean ± SD)	Pb (mean ± SD)
Facial brush	10.2 ± 2.7	0.038 ± 0.01	24.6 ± 7.1	4.90 ± 1.93	75.1 ± 13.1
face powders	213 ±8.965	0.137 ± 0.02	27.6 ± 3.9	5.1 ± 1.82	295.1 ± 10.12
eye shadows	15.1 ± 2.7	0.038 ± 0.01	32.7 ± 5.1	5.40 ± 1.12	17.9 ± 3.51

All results are in ppm, S.D.: standard deviation.

Table (2): levels of Co, Cu, Ni, Cd and Pb in lipstick according to Federal Drug Administration (FDA) [4].

Element	Co	Cu	Ni	Cd	Pb
Levels in ppm	0.2	10	5	0.09	10

Dermal exposure is believed that the significant route because the skin exposure directly to many of these products. Oral exposure may came from the heavy metal found products causing impurities in area of the mouth and also from touch of mouth with contaminated hand [14]. The touching of these metal ions to sensitive body part, may be absorbed and form complexes with carboxylic acid (–COOH), amine ($–NH_2$), and thiol (–SH) of proteins resulting in a defect in many functions and some time cells death and lead to many diseases. Chelating agent also called U.S. National Toxicology Program as an example is one of metal intoxication treatments, that chelating compounds forms complexes via binds the metal ions and excreted out of the body [15].

The levels limit in cosmetics has not been established for these components (products and food, water of drinking, air), accumulation of harmful components due to occupational exposure might cause health problems. So, used the allowed levels established, by many health organizations for the exposure to these components. By considering 2-5 grams is the application of the lotions, body creams or facial creams, sunscreens with a total absorption and breakthrough of elements in skin, the absorbed amount by using these products were compared with the upper levels allowed limits. Body exposure of one gram

per day or less was assumed for facial dried powder, and less amounts for eye-shadows are usually applied.

All three transition metals Co, Cu, Ni are essential to humans. The biological role of Co in vitamin B12, it is necessary for methylation and different rearrangement reactions [16, 17]. Also, copper is necessary for many functions including transferring of electron (azurin and plastocyanin), transfer, of oxygen atom (e.g. oxygenases), and respiration, (cytochrome c oxidase) [7]. Ni is necessary for acetyl coenzyme synthase, hydrogenases, and urease functions [7]. Although of their biological importance and their role in organisms. Allergy was most health problems these metals. Cu is considered the weak allergen element, and the others metals like Ni are more allergenic effects so which was named allergen of the year in 2008, by the American Contact Dermatitis Society, (ACDS) [18]. The three element were suggested to play a role in breast cancer [19]. The major functions of copper metalloproteins involve oxidation – reduction reactions; most known copper containing enzymes bind and react directly with molecular oxygen. Copper is an integral component of many metalloenzymes, including ceruloplasmin cytochrome C oxidase, superoxide dismutase, dopamine -β- hydroxylase, ascorbate oxidase, lysyl oxidase and tyrosinase [20].

Many damages may be occurs at acute exposure such as brain, kidney, and diseases of gastrointestinal, while exposure for long periods effects on the blood, central nervous system (CNS), blood pressure, and metabolism of vitamin D [21]. Lead has the ability to inhibit the calcium action with proteins, and this is important mechanisms which lead effect is through biochemical processes [22]. In the skeleton, lead is occupied place of calcium. Lead binds to biomolecules, in many mechanisms and interfering with thereby with their function. Pb binds to enzymes through –SH and $–NH_2$ groups, and change the configuration, and effect the activities. Pb has complementary role, with cations that essential metals for binding sites, and hence the activity of enzyme was altered, or the transport of Ca, the essential cations [23].

Many researchers have proven that intoxication of lead causes a damage of cell via reactive oxygen species (ROS) formation [24].

In addition, others [25] showed that malondialdehyde levels (MDA) in blood has a significant correlation with Pb levels in the workers blood of exposed. Many studies proven that some enzymes have the antioxidants activities like erythrocyte glutathione peroxidase, and superoxide dismutase (SOD), of workers highly exposed to lead than other workers [26]. New studies showed that induction of oxidative stress as a many cellular or molecular functions may due to lead toxicity and aggregation of cells cancer [27], active transcription stress genes [28], damage of DNA [29], phosphatidylserine externalization and caspase-3 activation [30].

Cadmium may cause lungs and digestive system irritant, so inhaling or ingestion may cause death. Symptoms of acute ingestion like abdominal pain, vomiting, nausea, increase saliva, cramps of muscle, consciousness loss and convulsions usually appear between 15 to 30 minutes [31]. Depression can be a cause of highly exposure to cadmium that influence the norepinephrine, serotonin levels and acetylcholine levels [32], also proliferative lesions of prostat due to exposure and may cause adenocarcinomas [33].

Two-dimensional gel electrophoresis studies showed that there was a response to cadmium exposure so stress response systems, this including heat and cold shock, oxidative stress, intense response [34]

Cadmium in its compounds considers carcinogens for human through many regulatory agencies IARC [35] and the NTP, and showed a significant signs that cadmium is a harmful and cancerogenic for human, this findings is based directly on previous findings that an association of exposure to cadmium and cancer of lungs, as well as the pulmonary system of very strong rodent data is the target site [35]. As a result cadmium exposure is the main cause of human carcinogenesis and the lung is the most appropriate site affect. Lungs were not the unique target site of cadmium carcinogenic effect in animals; other effects include sites of injection, adrenals, testes, and the hemopoietic system [36]. Other studies, showed that occupation or environment exposure to cadmium has association with development of prostate, stomach, and liver cancers, hematopoietic system cancer [37].

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