J Biochem Tech (2019) 10(3): 66-75
ISSN: 0974-2328

Determination of Some Toxic and Nontoxic Metals on Cheaper Brands of Cosmetic Products

Faten M. Ali Zainy

Received: 27 May 2019 / Received in revised form: 20 September 2019, Accepted: 22 September 2019, Published online: 27 September 2019

Abstract

Background: Growth in the demand for cosmetics has resulted in the emergence of various cheap products. **Aims:** The study aims to assess the toxic and nontoxic metals in cheaper blusher and eye shadow cosmetic brands. **Methods**: A total of 70 samples (39 cheap blushers and 31 cheap eye shadow samples) belonging to different brands and sources were analyzed using ICP-MS instrument to determine and compare their toxic (Pb, Mn, Cd, Ag, Au, Cu, Cr, Ni, and Ba) and nontoxic (Fe, Al, Zn, and Ti) metals composition with respect to their colors. Samples were digested with concentrated nitric acid before introducing to the ICP-MS technique. **Results**: Fe was present with a high concentration in most blusher samples reaching 14311.63 ppm, while Al reached to 1378.50 ppm only. Pb, Ag, Au, and Ni were absent in most samples. On eye shadow samples, iron was present strongly with a concentration reaching to 9930.95 ppm on green samples but absent in violet- and white-colored eye shadow samples. Al was present in most of the samples with level reaching to 2484.38 ppm. The gold-colored eye shadow samples were rich in Fe and Al levels reaching to 1943.87 and 1745.27 ppm, respectively. Mn concentration reached to 2033.33 ppm in blue-colored eye shadow samples, while Cu concentration reached to 3134.35 ppm in violet-colored eye shadow samples. Ti was present in all samples with low concentration. **Conclusion**: Women must avoid using cheaper brands to prevent exposure to the high concentrations of toxic materials which cause a negative effect on human health.

Key words: Blusher, Color Cosmetic, Chemical analysis, Cheaper Brands, Eye Shadow, Heavy Metals, ICP, Safety testing, Toxic Metals

Introduction

In the contemporary world today, the utilization of personal and beauty products continues to escalate on a daily basis (Nouioui *et al.*, 2016). This is evident from the industry worth of US $532.43 billion in 2017, which is predicted to reach a figure of US $805.61 billion by 2023 (Orbis Research, 2018). Its ability to conceal the skin imperfections, to cleanse, and to enhance the features of the individual promotes its usage, making it available in various forms such as lipsticks, foundation, concealer, mascara, eyeliners, eye shadow, nail polish, creams, lotions, and perfumes. Along with it, actors often use it to change their physical appearances (Arnocky *et al.*, 2016). The market is predicted to increase at a compound annual growth rate (CAGR) of around 6% from 2019 to 2023 (Business Wire, 2019).

The increased use of cosmetic products also posits some concerns related to the ingredients integrated into it. Since cosmetics are directly applied to the human skins, its ingredient quality and the characteristics make skin vulnerable to it. Al-Qutob *et al.* (2013) revealed that though the skin serves as the protecting shield against the exogenous contamination, there are still some ingredients which penetrate into the skin and are able to produce systemic exposure

An earlier study by Ullah *et al.* (2017) has highlighted that over the past decades the term heavy metal has been widely used associated with contamination, potential toxicity or ecotoxicity. Heavy metal pollutants are a source of growing concern due to health risks on living organisms and humans (Al-Enazi, 2017). The existence of heavy metals in a product beyond the permissible thresholds would result in serious side effects on brain, kidney, developing fetus, as well as vascular and immune systems (Nafees *et al.*, 2018). The heavy metals can disturb the balance of the intracellular iron pool by competing with iron transporters or iron-regulated enzymes (Al-Amodi *et al.*, 2018). Due to carcinogenicity and mutation, cadmium and lead are of the key heavy metals reported as serious for living organisms (Borzou, 2017). The inclusion of the metal poses a substantial health concern, as it serves as a primary source for chronic health diseases such as cancer, reproductive, cardiovascular, kidney, renal problems, and more. Moreover, some cosmetics are implied as endocrine disruptors and respiratory toxins (Iwegbue *et al.*, 2016). A recent study by Iwegbue *et al.* (2016) demonstrated that the cosmetic use also results in various allergic reactions, sensitization, and dermatitis, which serve as the exposing points of the metals in humans, notably through the application of the eye cosmetics such as eye shadows, kajal, and more.

Tchounwou *et al.* (2012) highlighted arsenic, cadmium, lead, and mercury. They described these as heavy metals which in their standard state have a specific gravity (density) of more than about 5 g/cm^3 (Arsenic, 5.7; cadmium, 8.65; lead, 11.34; and mercury, 13.549). Whereas, metals like copper, nickel, chromium, and iron are essential in very low concentration for the survival of all forms of life, but, when present in higher concentration can cause metabolic anomalies (Omolaoye *et al.*, 2010). These heavy metals have been indicted in varying concentrations in various

Faten M. Ali Zainy

Chemistry Department, Faculty of Science, University of Jeddah, P.O. Box 80327, Jeddah 21589, Saudi Arabia.

Email: fmzainy @ uj.edu.sa

cosmetics. Some of these metals have been banned as intentional ingredients coupled with their known or probable negative effect (Sukender *et al.*, 2012), yet these heavy metals are still being found in alarming amount (Import Alerts, 2009). Eye shadows and lipsticks have been reported to contain a relatively high concentration of heavy metals (Faruruwa and Bartholomew, 2014).

In Nigeria, very high levels of trace metals were reported in locally produced facial makeup (Ajayi *et al.*, 2002). Research work on Chinese-made eye shadows imported into Nigeria showed the presence of Ni, Cu, Zn, Co, Mn, and Cr in varying concentrations in all the samples with the exception of one (Diamond pink) not having chromium in it (Omolaoye *et al.*, 2012).

Some of the heavy metals have been used as cosmetics' ingredients in the past, examples include preservative thimerosal (mercury), the progressive hair dye lead acetate and a number of tattoos' pigments such as red cinnabar (mercuric sulfide) (Omolaoye *et al.*, 2012). Presently, titanium dioxide and zinc oxide are widely used in sunscreens. Some metals are used as colorants. For instance, chromium is used in a small number of products as colorant; iron oxide is the common colorant in eye shadows, blushes, and concealers; some aluminum compounds are colorants in lip glosses (Campaign for Safe Cosmetics, 2009). The presence of these metals as impurities, contaminants, or by-products is still of grave concern.

The concentrations conditions of handling, exposure, and non-regulations on the heavy metal contents of the cheaper brands' products could possibly affect the quality of these cosmetics. Considering the application of the eye shadow, the study by Sahu *et al.* (2014) demonstrated that among 49 diverse products comprising of 88 eye shadows, 75 percent had at least one of the ingredients i.e. cobalt, nickel, lead, chromium, and arsenic in quantity >5 ppm, where >1 ppm was present in all of these.

Various studies have reported the presence of toxic metals in the eye shadow (Ibrahim *et al.*, 2016; Mustafa and Aziz, 2016). Since the pigmentation in the eye shadow is skin, so its integration of the toxic and water-soluble compounds can moist into the skin and drive the elements' percutaneous absorption which occurs in the form of pigment impurities. Machado *et al.* (2017) highlighted that its excipients also impact skin's absorption capability. Omolaoye *et al.* (2012) stated that the increase in cosmetic application can improve the toxic metal absorption as a result of eating in case of lipstick and sweating in overall face makeup.

In the context of Middle Eastern countries, Saudi Arabia stands at the forefront of the cosmetic country with 11% of annual growth in the personal and beauty sector (Chęś, 2016). This growth also raises certain concerns related to the availability of toxic metal-inclusive cosmetics. Moreover, the demand for cosmetic products continues to increase which results in the importing of cheap makeup and eye shadow brands with poor safety, regulatory, and manufacturing practice. In this regard, Al-Saleh *et al.* (2009) found a lead range of 0.27-3760 ppm for lipsticks and 0.42-58.7 ppm for eye shadows. Also, Pb and Cd were found in lipsticks and eye shadows (Nourmoradi *et al.*, 2013).

Moreover, heavy metals are not listed as ingredients in some cosmetics due to lack of manufacturer testing or regulatory oversight (Ullah *et al.*, 2017). It is possible that the companies are not even aware that the products are contaminated and these contaminants likely get into the products when poor quality ingredients are used. Reflecting upon this, the current study intends to determine some toxic and nontoxic metals in selected cheaper brands of blusher and eye shadow products in Saudi Arabia. The rationale behind undertaking this research is the increasing demand for the product and its increasing industrial growth. Also, this work is designed to bridge the information gap about the metal content of different cheaper products of blusher and eye shadow based on their color (blusher: brown, orange, pink, and red; eye shadow: blue, gold, green, pink, violet, and white) and as well as different importing destinations such as KAS, USA, Turkey, China, and Egypt.

Methodology

Study Design

A quantitative research design was applied for the determination of the toxic and nontoxic metals in selected cheaper brands of blusher and eye shadow products in Saudi Arabia and Egypt. The selection of the design was based on its representation in the numerical form, which allows better comprehension by the reader.

Study Sample

For determining the toxic and nontoxic metals in selected cheaper brands of blusher and eye shadow products in Saudi Arabia, seventy cosmetic products were purchased from local markets of Jeddah, Saudi Arabia, and Cairo, Egypt. These products comprised of thirty-one eye shadows and thirty-nine blushers. The sources of these products differ such as KSA, USA, Turkey, China and Egypt (Table 1). All samples were available at cheap prices ranging from 0.66 $ up to 20 $.

Table 1: Cosmetics collection

Type	KSA	USA	Turkey	China	Egypt	Total
Eye shadow	6	7	5	13	0	31
Blusher	6	4	7	12	10	39
Total	12	11	12	25	10	70

Among the 39 blushers, the study included 17 cheap brands from different sources, which offer four colors; for 31 eye shadows, 10 cheap brands from different sources were used with six colors in each (Table 2 and 3). The selection was done for the determination and comparison of the products' toxic (Pb, Mn, Cd, Ag, Au, Cu, Cr, Ni, and Ba) and nontoxic (Fe, Al, Zn, and Ti) metal composition with respect to their colors.

Table 2: Different colors of eye shadow

Color	Samples	The total account of samples
Blue	7,11,14,17,19,26	6
Gold	1,6,8,20,23,30	6
Green	2,3,9,13,16,21	6
Pink	18,25,29	3
Violet	5,10,24,31	4
White	4,12,15,22,27,28	6

Table 3: Different colors of Blusher

Color	Samples	The total account of samples
Brown	4,5,13,14,19,25,27,31	8
Orange	1,7,10,12,15,17,21,24,28,32	10
Pink	2,6,9,11,16,18,20,23,26,29, 30,33,35,36,38	15
Red	3,8,22,34,37,39	6

Sample Analysis

Determination of accurate content of heavy metals among the cosmetic products is crucial as there is a narrow range between their safe and toxic levels. For this, various methods were used such as inductively coupled plasma mass spectrometry (ICP-MS), sector field inductively coupled plasma mass spectrometry (SF-ICP-MS), plasma fission spectrograph, and inductively coupled plasma optical emission spectrometry (Zainy, 2017). Though, for the particular study, ICP-MS was selected based on its effective determination of the analytes having low concentration, which permits cosmetics assessment of toxic as well as possibly toxic components (Grosser *et al.*, 2011). Therefore, Samples were digested with concentrated nitric acid before introducing to ICP-MS technique.

Result and Discussion

Table 4 presents the results of the eye shadow contents. Based on the results, the concentrations of iron were high for most of the samples. The concentration of iron reached to 9930.95 ppm for green samples, whereas in the violet and white-colored eye shadow samples, it was absent. Moreover, the presence of Al was found for almost all the samples (reaching 2484.38 ppm). Similarly, the gold-colored eye shadow samples were rich in Fe (1943.87 ppm) and Al (1745.27 ppm). In the blue colored-eyeshades, the Mn concentration reached to 2033.33 ppm. In the violet samples, the Cu concentration reached to 3134.35 ppm. Also, all the samples had a small concentration of Ti.

Table 4: The results of eye shadow samples (mg/Kg + SD).

Sample no.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
1	ND	581.45 ± 0.09	ND	91.41 ± 0.01	ND	5.32 ± 0.01	ND	4116.87 ± 0.16	31.43 ± 0.01	1.77 ± 0.01	ND	24.90 ± 0.01	ND
2	ND	537.32 ± 0.06	3.52 ± 0.01	90.14 ± 0.01	ND	ND	ND	1006.57 ± 0.05	8.69 ± 0.00	1.17 ± 0.01	0.47 ± 0.06	25.59 ± 0.01	ND
3	ND	372.79 ± 0.05	ND	64.71 ± 0.00	ND	ND	ND	97.55 ± 0.00	1.47 ± 0.00	0.00	ND	11.03 ± 0.01	ND
4	ND	343.87 ± 0.06	ND	92.16 ± 0.01	ND	ND	ND	581.13 ± 0.02	5.15 ± 0.00	1.23 ± 0.01	ND	36.52 ± 0.01	ND
5	ND	282.92 ± 0.05	ND	95.55 ± 0.02	3.22 ± 0.00	ND	ND	98.52 ± 0.00	4.95 ± 0.00	ND	49.23 ± 0.03	12.87 ± 0.01	47.03 ± 0.14
6	ND	429.61 ± 0.02	2.43 ± 0.01	90.29 ± 0.02	ND	ND	73.54 ± 0.02	116.02 ± 0.01	1.46 ± 0.00	ND	ND	12.14 ± 0.01	ND
7	ND	376.70 ± 0.02	0.24 ± 0.01	75.24 ± 0.00	ND	0.73 ± 0.02	62.62 ± 0.00	91.75 ± 0.00	2.18 ± 0.00	0.97 ± 0.02	4.85 ± 0.02	10.92 ± 0.02	ND
8	ND	646.57 ± 0.05	ND	69.36 ± 0.02	ND	0.74 ± 0.01	ND	1943.87 ± 0.11	5.86 ± 0.00	ND	ND	8.82 ± 0.00	ND
9	ND	302.38 ± 0.05	0.24 ± 0.01	73.10 ± 0.01	0.24 ± 0.00	226.91 ± 0.01	ND	9930.95 ± 0.85	19.52 ± 0.00	1.19 ± 0.01	ND	20.00 ± 0.00	ND
10	ND	1630.00 ± 0.01	ND	66.82 ± 0.01	ND	0.23 ± 0.01	ND	196.36 ± 0.03	2.73 ± 0.00	0.00	ND	8.64 ±0.01	ND
11	ND	1056.02 ± 0.08	5.32 ± 0.01	53.70 ± 0.01	ND	0.46 ± 0.00	ND	444.91 ± 0.02	2033.33 ± 0.05	2.32 ± 0.01	2.78 ± 0.03	3.47 ± 0.01	ND
12	ND	638.05 ± 0.05	0.98 ± 0.02	56.83 ± 0.01	ND	0.98 ± 0.01	ND	121.95 ± 0.00	4.63 ± 0.00	0.49 ± 0.01	7.07 ± 0.03	16.10 ± 0.01	ND
13	ND	1869.36 ± 0.05	ND	74.27 ± 0.03	ND	9.56 ± 0.01	47.30 ± 0.02	311.03 ± 0.05	4.41 ±0.00	1.47 ± 0.00	6.86 ± 0.04	2.45 ± 0.01	1105.15 ± 0.48
14	ND	2484.38 ± 0.14	ND	63.84 ± 0.01	ND	1.79 ± 0.02	ND	284.38 ± 0.01	3.35 ± 0.00	ND	ND	2.46 ± 0.01	1005.80 ± 0.05
15	ND	1471.62 ±	ND	80.41 ±	ND	ND	100.23 ±	58.33 ±	ND	1.35 ±	2.70 ±	7.88 ±	ND

		0.15		0.01			0.02	0.00		0.00	0.01	0.01	
16	ND	875.11 ± 0.05	0.47 ± 0.01	72.77 ± 0.01	ND	1.88 ± 0.00	ND	1298.36 ± 0.07	1.17 ± 0.00	2.11 ± 0.00	11.50 ± 0.03	131.46 ± 0.03	ND
17	ND	1770.05 ± 0.20	1.35 ± 0.02	68.92 ± 0.01	ND	ND	1083.12 ± 0.08	609.23 ± 0.05	ND	ND	ND	12.39 ± 0.00	ND
18	ND	508.00 ± 0.06	2.75 ± 0.02	69.00 ± 0.01	ND	ND	ND	109.00 ± 0.01	4.25 ± 0.00	1.75 ± 0.01	1.00 ± 0.01	3.75 ± 0.01	ND
19	ND	820.00 ± 0.02	0.91 ± 0.01	70.00 ± 0.00	ND	2.73 ± 0.01	3.64 ± 0.02	126.36 ± 0.01	2.05 ± 0.00	0.68 ± 0.00	1.36 ± 0.02	3.18 ± 0.02	ND
20	ND	1745.27 ± 0.05	1.80 ± 0.01	66.67 ± 0.01	ND	ND	123.65 ± 0.04	141.22 ± 0.01	2.48 ± 0.00	1.80 ± 0.00	11.93 ± 0.02	8.56 ± 0.01	ND
21	ND	324.02 ± 0.03	1.46 ± 0.01	52.18 ± 0.01	ND	ND	ND	403.88 ± 0.04	ND	1.21 ± 0.01	ND	55.34	ND
22	ND	633.70 ± 0.01	ND	72.69 ± 0.01	ND	ND	ND	206.61	26.21 ± 0.00	1.76 ± 0.00	1.10 ± 0.04	1.98 ± 0.01	ND
23	ND	500.24 ± 0.04	0.48 ± 0.02	57.69 ± 0.01	ND	ND	ND	357.21 ± 0.1	30.53 ± 0.00	1.92 ± 0.00	ND	9.38 ± 0.00	ND
24	ND	361.46 ± 0.10	ND	72.44 ± 0.00	0.49 ± 0.00	ND	8134.15 ± 0.47	36.59 ± 0.01	2.20 ± 0.01	1.46 ± 0.02	29.51 ± 0.01	ND	ND
25	ND	475.25 ± 0.02	ND	83.17 ± 0.02	ND	ND	ND	226.98 ± 0.01	15.35 ± 0.00	1.98 ± 0.01	ND	12.38 ± 0.01	ND
26	137.62 ± 0.00	369.55 ± 0.07	2.23 ± 0.00	56.93 ± 0.01	ND	ND	90.84 ± 0.04	94.06 ± 0.00	ND	3.96 ± 0.02	ND	11.88 ± 0.01	ND
27	ND	1390.14 ± 0.06	2.89 ± 0.02	82.93 ± 0.01	ND	0.72 ± 0.01	ND	123.08 ± 0.00	10.10 ± 0.00	ND	ND	18.75 ± 0.01	ND
28	ND	885.25 ± 0.04	0.25 ± 0.01	267.00 ± 0.01	ND	ND	ND	53.75 ± 0.00	ND	ND	ND	ND	ND
29	ND	499.06 ± 0.02	ND	62.91 ± 0.01	ND	2.82 ± 0.01	ND	116.90 ± 0.01	ND	0.94 ± 0.00	ND	ND	ND
30	ND	505.09 ± 0.04	0.46 ± 0.00	56.48 ± 0.01	ND	ND	ND	62.5 ± 0.00	0.46 ± 0.00	1.16 0.00	ND	4.86 ± 0.01	ND
31	ND	2119.81 ± 0.04	ND	26.42 ± 0.00	ND	ND	ND	134.91 ± 0.00	0.71 ± 0.00	1.18 ± 0.01	ND	0.21 ± 0.01	ND

ND: not detected

No. of determination: 3

Table 4-a (Blue): The results of eye shadow samples.

Sample no.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
7	ND	376.70 ± 0.02	0.24 ± 0.01	75.24 ± 0.00	ND	0.73 ± 0.02	62.62 ± 0.00	91.75 ± 0.00	2.18 ± 0.00	0.97 ± 0.02	4.85 ± 0.02	10.92 ± 0.02	ND
11	ND	1056.02 ± 0.08	5.32 ± 0.01	53.70 ± 0.01	ND	0.46 ± 0.00	ND	444.91 ± 0.02	2033.33 ± 0.05	2.32 ± 0.01	2.78 ± 0.03	3.47 ± 0.01	ND
14	ND	2484.38 ± 0.14	ND	63.84 ± 0.01	ND	1.79 ± 0.02	ND	284.38 ± 0.01	3.35 ± 0.00	ND	ND	2.46 ± 0.01	1005.80 ± 0.05
17	ND	1770.05 ± 0.20	1.35 ± 0.02	68.92 ± 0.01	ND	ND	1083.12 ± 0.08	609.23 ± 0.05	ND	ND	ND	12.39 ± 0.00	ND
19	ND	820.00 ± 0.02	0.91 ± 0.01	70.00 ± 0.00	ND	2.73 ± 0.01	3.64 ± 0.02	126.36 ± 0.01	2.05 ± 0.00	0.68 ± 0.00	1.36 ± 0.02	3.18 ± 0.02	ND
26	137.62 ± 0.00	369.55 ± 0.07	2.23 ± 0.00	56.93 ± 0.01	ND	ND	90.84 ± 0.04	94.06 ± 0.00	ND	3.96 ± 0.02	ND	11.88 ± 0.01	ND

Table 4 -b (Gold): The results of eye shadow samples.

Sample No.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
1	ND	581.45 ± 0.09	ND	91.41 ± 0.01	ND	5.32 ± 0.01	ND	4116.87 ± 0.16	31.43 ± 0.01	1.77 ± 0.01	ND	24.90 ± 0.01	ND
6	ND	429.61 ± 0.02	2.43 ± 0.01	90.29 ± 0.02	ND	ND	73.54 ± 0.02	116.02 ± 0.01	1.46 ± 0.00	ND	ND	12.14 ± 0.01	ND

8	ND	646.57 ± 0.05	ND	69.36 ± 0.02	ND	0.74 ± 0.01	ND	1943.87 ± 0.11	5.86 ± 0.00	ND	ND	8.82 ± 0.00	ND
20	ND	1745.27 ± 0.05	1.80 ± 0.01	66.67 ± 0.01	ND	ND	123.65 ± 0.04	141.22 ± 0.01	2.48 ± 0.00	1.80 ± 0.00	11.93 ± 0.02	8.56 ± 0.01	ND
23	ND	500.24 ± 0.04	0.48 ± 0.02	57.69 ± 0.01	ND	ND	ND	357.21 ± 0.1	30.53 ± 0.00	1.92 ± 0.00	ND	9.38 ± 0.00	ND
30	ND	505.09 ± 0.04	0.46 ± 0.00	56.48 ± 0.01	ND	ND	ND	62.5 ± 0.00	0.46 ± 0.00	1.16 0.00	ND	4.86 ± 0.01	ND

Table 4-c (Green): The results of eye shadow samples.

Sample no.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
2	ND	537.32 ± 0.06	3.52 ± 0.01	90.14 ± 0.01	ND	ND	ND	1006.57 ± 0.05	8.69 ± 0.00	1.17 ± 0.01	0.47 ± 0.06	25.59 ± 0.01	ND
3	ND	372.79 ± 0.05	ND	64.71 ± 0.00	ND	ND	ND	97.55 ± 0.00	1.47 ± 0.00	0.00	ND	11.03 ± 0.01	ND
9	ND	302.38 ± 0.05	0.24 ± 0.01	73.10 ± 0.01	0.24 ± 0.00	226.91 ± 0.01	ND	9930.95 ± 0.85	19.52 ± 0.00	1.19 ± 0.01	ND	20.00 ± 0.00	ND
13	ND	1869.36 ± 0.05	ND	74.27 ± 0.03	ND	9.56 ± 0.01	47.30 ± 0.02	311.03 ± 0.05	4.41 ±0.00	1.47 ± 0.00	6.86 ± 0.04	2.45 ± 0.01	1105.15 ± 0.48
16	ND	875.11 ± 0.05	0.47 ± 0.01	72.77 ± 0.01	ND	1.88 ± 0.00	ND	1298.36 ± 0.07	1.17 ± 0.00	2.11 ± 0.00	11.50 ± 0.03	131.46 ± 0.03	ND
21	ND	324.02 ± 0.03	1.46 ± 0.01	52.18 ± 0.01	ND	ND	ND	403.88 ± 0.04	ND	1.21 ± 0.01	ND	55.34	ND

Table 4-d (Pink): The results of eye shadow samples.

Sample no.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
18	ND	508.00 ± 0.06	2.75 ± 0.02	69.00 ± 0.01	ND	ND	ND	109.00 ± 0.01	4.25 ± 0.00	1.75 ± 0.01	1.00 ± 0.01	3.75 ± 0.01	ND
25	ND	475.25 ± 0.02	ND	83.17 ± 0.02	ND	ND	ND	226.98 ± 0.01	15.35 ± 0.00	1.98 ± 0.01	ND	12.38 ± 0.01	ND
29	ND	499.06 ± 0.02	ND	62.91 ± 0.01	ND	2.82 ± 0.01	ND	116.90 ± 0.01	ND	0.94 ± 0.00	ND	ND	ND

Table 4-e (Violet): The results of eye shadow samples.

Sample no.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
5	ND	282.92 ± 0.05	ND	95.55 ± 0.02	3.22 ± 0.00	ND	ND	98.52 ± 0.00	4.95 ± 0.00	ND	49.23 ± 0.03	12.87 ± 0.01	47.03 ± 0.14
10	ND	1630.00 ± 0.01	ND	66.82 ± 0.01	ND	0.23 ± 0.01	ND	196.36 ± 0.03	2.73 ± 0.00	0.00	ND	8.64 ± 0.01	ND
24	ND	361.46 ± 0.10	ND	72.44 ± 0.00	0.49 ± 0.00	ND	8134.15 ± 0.47	36.59 ± 0.01	2.20 ± 0.01	1.46 ± 0.02	29.51 ± 0.01	ND	ND
31	ND	2119.81 ± 0.04	ND	26.42 ± 0.00	ND	ND	ND	134.91 ± 0.00	0.71 ± 0.00	1.18 ± 0.01	ND	0.21 ± 0.01	ND

Table 4-f (White): The results of eye shadow samples.

Sample no.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
4	ND	343.87 ± 0.06	ND	92.16 ± 0.01	ND	ND	ND	581.13 ± 0.02	5.15 ± 0.00	1.23 ± 0.01	ND	36.52 ± 0.01	ND
12	ND	638.05 ± 0.05	0.98 ± 0.02	56.83 ± 0.01	ND	0.98 ± 0.01	ND	121.95 ± 0.00	4.63 ± 0.00	0.49 ± 0.01	7.07 ± 0.03	16.10 ± 0.01	ND
15	ND	1471.62 ± 0.15	ND	80.41 ± 0.01	ND	ND	100.23 ± 0.02	58.33 ± 0.00	ND	1.35 ± 0.00	2.70 ± 0.01	7.88 ± 0.01	ND
22	ND	633.70 ±	ND	72.69 ±	ND	ND	ND	206.61	26.21 ±	1.76 ±	1.10 ±	1.98 ±	ND

		0.01		0.01					0.00	0.00	0.04	0.01	
27	ND	1390.14 ± 0.06	2.89 ± 0.02	82.93 ± 0.01	ND	0.72 ± 0.01	ND	123.08 ± 0.00	10.10 ± 0.00	ND	ND	18.75 ± 0.01	ND
28	ND	885.25 ± 0.04	0.25 ± 0.01	267.00 ± 0.01	ND	ND	ND	53.75 ± 0.00	ND	ND	ND	ND	ND

Table 5 presents an analysis of the cheap blushers. Based on the ICP-MS instrument findings, a high concentration of Fe was found on most blusher samples which a level reaching to 14311.63 ppm. The Al concentration reached to 1378.50 ppm. However, Pb, Ag, Au, and Ni were not present in most of the samples.

Table 5: The results of eye Blusher samples (mg/Kg + SD).

Sample no.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
1	ND	474.54 ± 0.06	ND	54.13 ± 0.02	ND	ND	12.38 ± 0.03	1050.23 ± 0.01	4.82 ± 0.00	ND	ND	7.11 ± 0.00	ND
2	ND	522.55 ± 0.06	ND	71.57 ± 0.03	ND	ND	1.96 ± 0.01	470.83 ± 0.05	7.35 ± 0.00	ND	ND	1.23 ± 0.00	ND
3	ND	557.58 ± 0.05	ND	127.01 ± 0.03	ND	ND	ND	2196.45 ± 0.16	244.79 ± 0.04	ND	ND	1.66	ND
4	ND	235.05 ± 0.09	ND	166.82 ± 0.04	ND	2.10 ± 0.01	ND	5203.27 ± 0.07	118.46 ± 0.01	0.23 ± 0.02	ND	17.06 ± 0.01	ND
5	ND	438.14 ± 0.09	4.65 ± 0.02	36.98 ± 0.00	0.93 ± 0.01	1.16 ± 0.02	19.77 ± 0.03	14311.63 ± 1.30	16.98 ± 0.00	ND	0.70 ± 0.03	31.86 ± 0.01	ND
6	ND	1404.05 ± 0.05	2.93 ± 0.01	218.69 ± 0.04	0.23 ± 0.04	ND	2.93 ± 0.03	191.67 ± 0.02	2.93 ± 0.00	ND±	ND	2.48 ± 0.00	511.49 ± 0.29
7	ND	253.77 ± 0.11	1.18 ± 0.01	250.00 ± 0.03	0.47 ± 0.00	ND	7.08 ± 0.02	8082.55 ± 0.36	1.42 ± 0.00	ND	ND	12.97 ± 0.01	ND
8	ND	85.68 ± 0.10	3.16 ± 0.01	254 ± 0.05	0.97 ± 0.01	0.73 ± 0.00	0.97 ± 0.04	10.28 ±0.16	7.28 ± 0.00	ND	ND	3.16 ± 0.00	148.30 ± 0.07
9	1.13 ± 0.00	1186.65 ± 0.05	ND	159.96 ± 0.01	ND	ND	5.20 ± 0.03	59.73 ± 0.00	0.45 ± 0.00	ND	ND	6.34 ± 0.01	ND
10	0.91 ± 0.00	649.54 ± 0.05	2.28 ± 0.02	160.73 ± 0.03	ND	ND	11.87 ± 0.02	576.71 ± 0.01	ND	ND	ND	4.80 ± 0.01	ND
11	ND	12.18 ± 0.13	4.50 ± 0.04	25.75 ± 0.01	0.25 ± 0.00	ND	26.50 ± 0.03	6.06 ± 0.27	3.75 ± 0.00	ND	ND	11.25	ND
12	ND	625.36 ± 0.08	ND	ND	0.24 ± 0.00	ND	9.18 ± 0.02	2402.42 ± 0.09	3.14 ± 0.00	ND	2.42 ± 0.03	8.21 ± 0.01	ND
13	ND	ND	ND	30.54 ± 0.01	0.99 ± 0.00	1.72 ± 0.01	31.03 ± 0.01	10263.55 ± 0.80	6.16 ± 0.00	ND	ND	0.25 ± 0.01	ND
14	ND	56.34 ± 0.10	0.73 ± 0.02	34.63 ± 0.01	ND	0.24 ± 0.01	1.22 ± 0.01	4565.85 ± 0.26	5.12 ± 0.00	ND	ND	4.15 ± 0.00	ND
15	ND	1244.47 ± 0.02	0.40 ± 0.02	17.37 ± 0.00	ND	ND	ND	622.37 ± 0.11	2.11 ± 0.00	0.79 ± 0.00	ND	2.5 ± 0.00	ND
16	ND	585.00 ± 0.07	0.25 ± 0.01	151.50 ± 0.04	ND	ND	110 ± 0.03	1141.75 ± 0.08	6.25 ± 0.00	ND	6.50 ± 0.03	7.75 ± 0.00	ND
17	ND	445.78 ± 0.06	ND	135.92 ± 0.06	ND	1.64 ± 0.01	1.17 ± 0.02	5068.08 ± 0.61	7.98 ± 0.00	ND	ND	4.93	173.24 ± 0.21
18	ND	1350.92 ± 0.01	0.69 ± 0.01	200.46 ± 0.02	ND	ND	ND	1652.98 ± 0.07	6.88 ± 0.00	0.46 ± 0.01	ND	0.46 ± 0.00	ND
19	ND	312.21 ± 0.13	3.05 ± 0.01	25.12 ± 0.01	0.94 ± 0.00	ND	6.57 ± 0.02	12953.05 ± 0.77	23.94 ± 0.00	ND	ND	1.17 ± 0.01	ND
20	ND	443.56 ± 0.02	3.96 ± 0.01	96.29 ± 0.02	ND	ND	1.24 ± 0.03	2888.61 ± 0.16	11.14 ± 0.00	ND	ND	4.95 ± 0.01	ND
21	0.67 ± 0.00	173.67 ± 0.01	ND	107.52 ± 0.02	ND	ND	ND	311.97 ± 0.02	27.88 ± 0.01	2.21 ± 0.01	ND	2.21 ± 0.00	ND
22	0.24 ± 0.01	171.43 ± 0.04	ND	113.81 ± 0.01	ND	ND	ND	343.81 ± 0.02	30.71 ± 0.01	1.91 ± 0.01	ND	0.95 ± 0.01	ND
23	0.45 ±	505.43 ±	ND	96.15 ±	ND	ND	3.62 ±	106.11 ±	15.16 ±	ND	ND	28.96 ±	ND

	0.00	0.11		0.02			0.04	0.01	0.00			0.01	
24	ND	612.25 ± 0.07	1.25 ± 0.00	131.50 ± 0.04	ND	ND	ND	1216.00 ± 0.11	15.50 ± 0.00	0.25 ± 0.01	ND	30.25 ± 0.01	ND
25	ND	366.28 ± 0.05	ND	93.12 ± 0.02	ND	0.23 ± 0.00	6.88 ± 0.02	1802.75 ± 0.06	17.66 ± 0.00	ND	ND	27.98 ± 0.01	ND
26	ND	1031.50 ± 0.07	2.00 ± 0.01	122.00 ± 0.02	ND	ND	ND	192.00 ± 0.00	3.50 ± 0.00	ND	ND	ND	ND
27	ND	468.84 ± 0.19	2.90 ± 0.01	45.65 ± 0.01	1.21 ± 0.00	ND	8.45 ± 0.02	9545.89 ± 0.56	7.73 ± 0.00	ND	ND	4.35 ± 0.01	ND
28	0.25 ± 0.00	143.69 ± 0.08	ND	43.43 ± 0.01	ND	ND	0.20 ± 0.02	ND	ND	ND	ND	8.84 ± 0.04	ND
29	ND	263.92 ± 0.08	3.77 ± 0.02	36.32 ± 0.01	ND	ND	23.59 ± 0.04	ND	ND	ND	ND	0.094 ± 0.01	ND
30	0.50 ± 0.00	457.75 ± 0.01	ND	84.75 ± 0.02	ND	1.50 ± 0.01	ND	549.25 ± 0.05	0.50 ± 0.00	1.50 ± 0.00	ND	1.50 ± 0.01	ND
31	ND	80.50 ± 0.11	ND	119.75 ± 0.02	0.25 ± 0.00	ND	0.25 ± 0.04	7192.50 ± 0.67	7.75 ± 0.00	1.00 ± 0.01	ND	ND	ND
32	0.50 ± 0.01	867.57 ± 0.05	ND	110.40 ± 0.04	ND	ND	5.20 ± 0.04	180.69 ± 0.02	27.48 ± 0.01	ND	ND	50.50 ± 0.02	ND
33	ND	507.81 ± 0.10	ND	35.61 ± 0.03	ND	ND	6.83	233.17 ± 0.03	22.68 ± 0.01	ND	4.88 ± 0.09	22.20 ± 0.01	ND
34	0.23 ± 0.00	544.55 ± 0.02	ND	38.18 ± 0.02	ND	10.91 ± 0.01	7.50 ± 0.04	649.09 ± 0.04	21.36 ± 0.00	0.23 ± 0.01	45.23 ± 0.02	35.23 ± 0.00	ND
35	1.47 ± 0.00	666.18 ± 0.08	3.92 ± 0.02	98.78 ± 0.04	ND	2.21 ± 0.01	ND	41.42 ± 0.00	20.34 ± 0.01	ND	5.64 ± 0.03	0.49 ± 0.01	ND
36	ND	1378.50 ± 0.06	ND	58.50 ± 0.01	ND	ND	7.25 ± 0.03	494.50 ± 0.04	16.75 ± 0.06	ND	25.25 ± 0.03	2.00 ± 0.00	3952.50 ± 0.33
37	0.73 ± 0.00	1037.62 ± 0.04	ND	133.74 ± 0.04	185.92 ± 0.01	4.13 ± 0.01	17.23 ± 0.04	658.01 ± 0.03	43.69 ± 0.01	4.61 ± 0.01	55.58 ± 0.01	ND	ND
38	0.69 ± 0.01	498.84 ± 0.03	ND	41.44 ± 0.00	ND	ND	12.96 ± 0.02	238.19 ± 0.02	14.58 ± 0.00	0.93 ± 0.01	ND	ND	ND
39	ND	362.67 ± 0.06	1.15 ± 0.02	113.59 ± 0.02	ND	ND	ND	990.32 ± 0.03	16.13 ± 0.00	0.46 ± 0.01	ND	ND	ND

ND: not detected

No. of determination: 3

Table 5-a (Brown): The results of eye Blusher samples (mg/Kg + SD).

Sample no.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
4	ND	235.05 ± 0.09	ND	166.82 ± 0.04	ND	2.10 ± 0.01	ND	5203.27 ± 0.07	118.46 ± 0.01	0.23 ± 0.02	ND	17.06 ± 0.01	ND
5	ND	438.14 ± 0.09	4.65 ± 0.02	36.98 ± 0.00	0.93 ± 0.01	1.16 ± 0.02	19.77 ± 0.03	14311.63 ± 1.30	16.98 ± 0.00	ND	0.70 ± 0.03	31.86 ± 0.01	ND
13	ND	ND	ND	30.54 ± 0.01	0.99 ± 0.00	1.72 ± 0.01	31.03 ± 0.01	10263.55 ± 0.80	6.16 ± 0.00	ND	ND	0.25 ± 0.01	ND
14	ND	56.34 ± 0.10	0.73 ± 0.02	34.63 ± 0.01	ND	0.24 ± 0.01	1.22 ± 0.01	4565.85 ± 0.26	5.12 ± 0.00	ND	ND	4.15 ± 0.00	ND
19	ND	312.21 ± 0.13	3.05 ± 0.01	25.12 ± 0.01	0.94 ± 0.00	ND	6.57 ± 0.02	12953.05 ± 0.77	23.94 ± 0.00	ND	ND	1.17 ± 0.01	ND
25	ND	366.28 ± 0.05	ND	93.12 ± 0.02	ND	0.23 ± 0.00	6.88 ± 0.02	1802.75 ± 0.06	17.66 ± 0.00	ND	ND	27.98 ± 0.01	ND
27	ND	468.84 ± 0.19	2.90 ± 0.01	45.65 ± 0.01	1.21 ± 0.00	ND	8.45 ± 0.02	9545.89 ± 0.56	7.73 ± 0.00	ND	ND	4.35 ± 0.01	ND
31	ND	80.50 ± 0.11	ND	119.75 ± 0.02	0.25 ± 0.00	ND	0.25 ± 0.04	7192.50 ± 0.67	7.75 ± 0.00	1.00 ± 0.01	ND	ND	ND

Table 5 -b (Orange): The results of eye Blusher samples (mg/Kg + SD).

Sample no.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
1	ND	474.54 ±	ND	54.13 ±	ND	ND	12.38 ±	1050.23 ±	4.82 ± 0.00	ND	ND	7.11 ±	ND

		0.06		0.02			0.03	0.01				0.00	
7	ND	253.77 ± 0.11	1.18 ± 0.01	250.00 ± 0.03	0.47 ± 0.00	ND	7.08 ± 0.02	8082.55 ± 0.36	1.42 ± 0.00	ND	ND	12.97 ± 0.01	ND
10	0.91 ± 0.00	649.54 ± 0.05	2.28 ± 0.02	160.73 ± 0.03	ND	ND	11.87 ± 0.02	576.71 ± 0.01	ND	ND	ND	4.80 ± 0.01	ND
12	ND	625.36 ± 0.08	ND	ND	0.24 ± 0.00	ND	9.18 ± 0.02	2402.42 ± 0.09	3.14 ± 0.00	ND	2.42 ± 0.03	8.21 ± 0.01	ND
15	ND	1244.47 ± 0.02	0.40 ± 0.02	17.37 ± 0.00	ND	ND	ND	622.37 ± 0.11	2.11 ± 0.00	0.79 ± 0.00	ND	2.5 ± 0.00	ND
17	ND	445.78 ± 0.06	ND	135.92 ± 0.06	ND	1.64 ± 0.01	1.17 ± 0.02	5068.08 ± 0.61	7.98 ± 0.00	ND	ND	4.93	173.24 ± 0.21
21	0.67 ± 0.00	173.67 ± 0.01	ND	107.52 ± 0.02	ND	ND	ND	311.97 ± 0.02	27.88 ± 0.01	2.21 ± 0.01	ND	2.21 ± 0.00	ND
24	ND	612.25 ± 0.07	1.25 ± 0.00	131.50 ± 0.04	ND	ND	ND	1216.00 ± 0.11	15.50 ± 0.00	0.25 ± 0.01	ND	30.25 ± 0.01	ND
28	0.25 ± 0.00	143.69 ± 0.08	ND	43.43 ± 0.01	ND	ND	0.20 ± 0.02	ND	ND	ND	ND	8.84 ± 0.04	ND
32	0.50 ± 0.01	867.57 ± 0.05	ND	110.40 ± 0.04	ND	ND	5.20 ± 0.04	180.69 ± 0.02	27.48 ± 0.01	ND	ND	50.50 ± 0.02	ND

Table 5-c (Pink): The results of eye Blusher samples (mg/Kg + SD).

Sample no.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
2	ND	522.55 ± 0.06	ND	71.57 ± 0.03	ND	ND	1.96 ± 0.01	470.83 ± 0.05	7.35 ± 0.00	ND	ND	1.23 ± 0.00	ND
6	ND	1404.05 ± 0.05	2.93 ± 0.01	218.69 ± 0.04	0.23 ± 0.04	ND	2.93 ± 0.03	191.67 ± 0.02	2.93 ± 0.00	ND±	ND	2.48 ± 0.00	511.49 ± 0.29
9	1.13 ± 0.00	1186.65 ± 0.05	ND	159.96 ± 0.01	ND	ND	5.20 ± 0.03	59.73 ± 0.00	0.45 ± 0.00	ND	ND	6.34 ± 0.01	ND
11	ND	12.18 ± 0.13	4.50 ± 0.04	25.75 ± 0.01	0.25 ± 0.00	ND	26.50 ± 0.03	6.06 ± 0.27	3.75 ± 0.00	ND	ND	11.25	ND
16	ND	585.00 ± 0.07	0.25 ± 0.01	151.50 ± 0.04	ND	ND	110 ± 0.03	1141.75 ± 0.08	6.25 ± 0.00	ND	6.50 ± 0.03	7.75 ± 0.00	ND
18	ND	1350.92 ± 0.01	0.69 ± 0.01	200.46 ± 0.02	ND	ND	ND	1652.98 ± 0.07	6.88 ± 0.00	0.46 ± 0.01	ND	0.46 ± 0.00	ND
20	ND	443.56 ± 0.02	3.96 ± 0.01	96.29 ± 0.02	ND	ND	1.24 ± 0.03	2888.61 ± 0.16	11.14 ± 0.00	ND	ND	4.95 ± 0.01	ND
23	0.45 ± 0.00	505.43 ± 0.11	ND	96.15 ± 0.02	ND	ND	3.62 ± 0.04	106.11 ± 0.01	15.16 ± 0.00	ND	ND	28.96 ± 0.01	ND
26	ND	1031.50 ± 0.07	2.00 ± 0.01	122.00 ± 0.02	ND	ND	ND	192.00 ± 0.00	3.50 ± 0.00	ND	ND	ND	ND
29	ND	263.92 ± 0.08	3.77 ± 0.02	36.32 ± 0.01	ND	ND	23.59 ± 0.04	ND	ND	ND	ND	0.094 ± 0.01	ND
30	0.50 ± 0.00	457.75 ± 0.01	ND	84.75 ± 0.02	ND	1.50 ± 0.01	ND	549.25 ± 0.05	0.50 ± 0.00	1.50 ± 0.00	ND	1.50 ± 0.01	ND
33	ND	507.81 ± 0.10	ND	35.61 ± 0.03	ND	ND	6.83	233.17 ± 0.03	22.68 ± 0.01	ND	4.88 ± 0.09	22.20 ± 0.01	ND
35	1.47 ± 0.00	666.18 ± 0.08	3.92 ± 0.02	98.78 ± 0.04	ND	2.21 ± 0.01	ND	41.42 ± 0.00	20.34 ± 0.01	ND	5.64 ± 0.03	0.49 ± 0.01	ND
36	ND	1378.50 ± 0.06	ND	58.50 ± 0.01	ND	ND	7.25 ± 0.03	494.50 ± 0.04	16.75 ± 0.06	ND	25.25 ± 0.03	2.00 ± 0.00	3952.50 ± 0.33
38	0.69 ± 0.01	498.84 ± 0.03	ND	41.44 ± 0.00	ND	ND	12.96 ± 0.02	238.19 ± 0.02	14.58 ± 0.00	0.93 ± 0.01	ND	ND	ND

Table 5-d (Red): The results of eye Blusher samples (mg/Kg + SD).

Sample no.	Ag	Al	Au	Ba	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Ti	Zn
3	ND	557.58 ± 0.05	ND	127.01 ± 0.03	ND	ND	ND	2196.45 ± 0.16	244.79 ± 0.04	ND	ND	1.66	ND

8	ND	85.68 ± 0.10	3.16 ± 0.01	254 ± 0.05	0.97 ± 0.01	0.73 ± 0.00	0.97 ± 0.04	10.28 ±0.16	7.28 ± 0.00	ND	ND	3.16 ± 0.00	148.30 ± 0.07
22	0.24 ± 0.01	171.43 ± 0.04	ND	113.81 ± 0.01	ND	ND	ND	343.81 ± 0.02	30.71 ± 0.01	1.91 ± 0.01	ND	0.95 ± 0.01	ND
34	0.23 ± 0.00	544.55 ± 0.02	ND	38.18 ± 0.02	ND	10.91 ± 0.01	7.50 ± 0.04	649.09 ± 0.04	21.36 ± 0.00	0.23 ± 0.01	45.23 ± 0.02	35.23 ± 0.00	ND
37	0.73 ± 0.00	1037.62 ± 0.04	ND	133.74 ± 0.04	185.92 ± 0.01	4.13 ± 0.01	17.23 ± 0.04	658.01 ± 0.03	43.69 ± 0.01	4.61 ± 0.01	55.58 ± 0.01	ND	ND
39	ND	362.67 ± 0.06	1.15 ± 0.02	113.59 ± 0.02	ND	ND	ND	990.32 ± 0.03	16.13 ± 0.00	0.46 ± 0.01	ND	ND	ND

The results of the study revealed a high concentration of non-toxic metals among the two categories of cosmetic products. A high concentration of Fe among the cheap cosmetic products. These results are in line with the study of Omolaoye *et al.* (2012) which evaluated the heavy metal content in the cosmetics available in China. The similar findings have been reported by the study of Faruruwa and Bartholomew (2014) which assessed the heavy metal content among Nigerian cosmetics. Likewise, Dalmázio and Menezes (2011) assessed the Brazilian cosmetic products and reported Fe concentrations of 11.63–103.4 mg g^{-1} for eye shadows, 4.259–24.26 mg g^{-1} for facial concealer/lipstick, and 13.77–36.0 mg g^{-1} for compact face powder. Despite it comprises of the insignificant toxic characteristics, increased use of it can lead to cellular death or colorectal cancer as an outcome of its cumulative effects (Tchounwou *et al.*, 2012).

The high concentration of aluminum was also highlighted in this study. The presence of aluminum among cosmetic products is considered hazardous to health based on its toxicity not only at the environmental level but also on therapeutic level (Dalmázio and Menezes 2011). Al-Saleh *et al.* (2009) studied the cosmetic products and reported aluminum as the agent causing adverse effects on human health. The concentration of certain metals was found to be high for a specific color, such as copper.

Ti was present in all samples in low concentrations. Similar findings were reported by Jacobs *et al.* (2010) who stated that its use must remain limited as the use of such products can damage the skin cells. The study results revealed that the consumer of cheaper cosmetics must not excessively use these products as this can cause an adverse effect on their skin. Moreover, the lack of listing of these products also serves as a hindering block in determining the concentration of the toxic and nontoxic metals in the product, which may be the result of ineffective regulatory oversight and testing at the manufacturing stage. The use of inorganic-base ingredients must be eradicated in order to eliminate the possible hazards.

The study findings are limited given its selection of only blushers and eye shadows which are offered at cheap prices. Along with it, the results cannot be generalized for other countries as it was region-specific i.e. Saudi Arabia and Egypt, as the countries differ in terms of their socio-economical dynamics. This also serves as an area of exploration for future studies that can assess diverse toxic and non-toxic components of products in other regions. Also, future studies can only focus on locally manufactured cosmetic products.

Conclusion

In this study, an analysis of the cheap eye shadow and blushes was carried out. Based on the analysis, the study found the presence of the metal components in the cosmetics. It further revealed that the increase and constant use of such cosmetics can increase the metal levels in the human body which can exceed the standard limits of metal in the human body. Moreover, it suggests that an imperative testing program should be initiated in the country on an immediate basis for assessing the cosmetic products which are imported, as it allows assessing the toxic compound overabundance essential for safeguarding consumer health. In addition, it also recommends introducing strategies that improve the consumer general awareness particularly for the cheap products that are imported in significant quantity to the Saudi and Egyptian markets.

Acknowledgments

The author is very thankful to all the associated personnel in any reference that contributed in/for the purpose of this research. Further, this research holds no conflict of interest and is not funded through any source.

References

Ajayi, O. O., Oladipo, M. O. A., Ogunsuyi, H. O., & Adebayo, A. O. (2002). Determination of the minor and trace elements in Biriniwa's tin pyrite and ornamental lead/zinc ore using neutron activation analysis. *Bulletin of the Chemical Society of Ethiopia*, *16*(2), 207-211.

Al-Amodi, H. S., Zaghloul, A., ALrefai, A. A., & Adly, H. M. (2018). The Hematological Changes in Dental Staff: Their Relation to Mercury Vapor. *International Journal of Pharmaceutical Research & Allied Sciences*, *7*(2).

Al-Enazi, N. M. (2017). Biosorption of Pb2+ from water solution by using of Chroococcus minutus and Chlorococcum aegyptiacum as biosorbents. *International Journal of Pharmaceutical Research & Allied Sciences*, *6*(2).

Al-Qutob, M. A., Alatrash, H. M., & Abol-Ola, S. (2013). Determination of different heavy metals concentrations in cosmetics purchased from the Palestinian markets by

ICP/MS. A*dvances in Environmental Sciences. 5*(3): 287-93.

Al-Saleh, I., Al-Enazi, S., & Shinwari, N. (2009). Assessment of lead in cosmetic products. *Regulatory Toxicology and Pharmacology*, *54*(2), 105-113.

Arnocky, S., Perilloux, C., Cloud, J. M., Bird, B. M., & Thomas, K. (2016). Envy mediates the link between social comparison and appearance enhancement in women. *Evolutionary Psychological Science*, *2*(2), 71-83.

Borzou, A. (2017). Use of Modified Fiber with Monomer 2-Hydroxy Propyl Methacrylate to Remove Lead Ions from Wastewater. *International Journal of Pharmaceutical Research & Allied Sciences*, *6*(4).

Business Wire. (2019). Global Cosmetic Skin Care Market 2019-2023, Presence of premium brands drives growth, Technavi. Available at: https://www.businesswire.com/news/home/20190108005659/en/Global-Cosmetic-Skin-Care-Market-2019-2023-Presence

Campaign for Safe Cosmetics. (2009). A report on Heavy metals in face paints. Available at: http://www.safecosmetics.org.

Chęś, A. (2016). The middle eastern market of cosmetics and toiletries: characteristics underlying demand and potential for growth. *Studia Ekonomiczne*, *303*, 114-133.

Dalmázio, I., & Menezes, M. A. D. B. (2011). Multi-elemental profile of some Brazilian make-up products by instrumental neutron activation analysis. International Nuclear Atlantic Conference.

Faruruwa, M. D., & Bartholomew, S. P. (2014). Study of heavy metals content in facial cosmetics obtained from open markets and superstores within Kaduna metropolis, Nigeria. *Am. J. Chem. Appl*, *1*(2), 27-33.

Grosser, Z., Davidowski, L., Thompson, L., & Food, T. U. S. (2011). The determination of metals in cosmetics. *PerkinElmer Appl. Note*, *1*, 1-6.

Ibrahim, S. Y., Fawzi, M. M., Saad, M. G., & Rahman, S. M. A. (2016). Determination of heavy metals and other toxic ingredients in henna (Lawsonia inermis). *J Environ Anal Toxicol*, *6*(364), 2161-0525.

Import Alerts. 2009. Available at: http://www.fda.gov/forindustry/color additives/compliance-enforcement/enforcement news/ucm/12 3909.htm. (Accessed 2-2-2019)

Iwegbue, C. M., Bassey, F. I., Obi, G., Tesi, G. O., & Martincigh, B. S. (2016). Concentrations and exposure risks of some metals in facial cosmetics in Nigeria. *Toxicology Reports*, *3*, 464-472.

Jacobs, J. F., Van de Poel, I., & Osseweijer, P. (2010). Sunscreens with titanium dioxide (TiO 2) nano-particles: a societal experiment. *Nanoethics*, *4*(2), 103-113.

Machado AC, Lopes PS, Raffier CP, Haridass IN, Roberts M, Grice J, & Leite-Silva VR. (2017). Skin Penetration. In: Sakamoto K, Lochhead R, Maibach H, Yamashita Y. Cosmetic science and technology: theoretical principles and applications. *Elsevier*. 741-55.

Mustafa, A. M. A., & Aziz, M. E. M. A. (2016). Determination of Heavy Metal Impurities in Facial Makeup Cosmetic Products in Sudanese Markets, Using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). *The Journal of Middle East and North Africa Sciences*, *10*(3923), 1-6.

Nafees, S., Nafees, H., Rehman, S., Rahman, S. Z., & Amin, K. M. Y. (2018). Microbial Load, Pesticides Residue, Aflatoxin Estimation and Heavy Metals Analysis of a Single Unani Drug Badranjboya (Melissa Officinalis). *Pharmacophore*, *9*(4).

Nouioui, M. A., Mahjoubi, S., Ghorbel, A., Ben Haj Yahia, M., Amira, D., Ghorbel, H., & Hedhili, A. (2016). Health risk assessment of heavy metals in traditional cosmetics sold in Tunisian local markets. *International scholarly research notices*, *2016*.

Nourmoradi, H., Foroghi, M., Farhadkhani, M., & Vahid Dastjerdi, M. (2013). Assessment of lead and cadmium levels in frequently used cosmetic products in Iran. *Journal of environmental and public health*, *2013*.

Omolaoye, J., Uzairu, A., & Gimba, C. (2010). Heavy metal assessment of some eye shadow products imported into Nigeria from China. *Archives of Applied Science Research*, *2*(5), 76-84.

Orbis Research. (2018). Global Cosmetics Products Market expected to reach USD 805.61 billion by 2023 – Industry Size & Share Analysis. Accessible at: https://www.reuters.com/brandfeatures/venture-capital/article?id=30351

Sahu MR, Saxena MP, Johnson S, Mathur, HB, & Agarwal HC. (2014). Heavy metals in cosmetics. 1-26. Available at: http://www.environmentportal.in/files/file/Heavy_Metals_in_Cosmetics_Report.pdf

Sukender, K., Jaspreet, S., Sneha, D., & Munish, G. (2012, March). AAS estimation of heavy metals and trace elements in Indian herbal cosmetic preparations. In *International Science Congress Association* (Vol. 2, No. 3, pp. 46-51).

Tchounwou, P. B., Yedjou, C. G., Patlolla, A. K., & Sutton, D. J. (2012). Heavy metal toxicity and the environment. In *Molecular, clinical and environmental toxicology* (pp. 133-164). Springer, Basel.

Ullah, H., Noreen, S., Rehman, A., Waseem, A., Zubair, S., Adnan, M., & Ahmad, I. (2017). Comparative study of heavy metals content in cosmetic products of different countries marketed in Khyber Pakhtunkhwa, Pakistan. *Arabian Journal of Chemistry*, *10*(1), 10-18.

Zainy, F. M. A. (2017). Heavy metals in lipstick products marketed in Saudi Arabia. *Journal of Cosmetics, Dermatological Sciences and Applications*, *7*(04), 336-348.