

Determination Of Some Heavy Metals In Selected Cosmetic Products Sold At Iraqi Markets

Riyadh Mohammed Jihad

Department of Chemistry, Collage of Education for women, University of Anbar, Iraq
Corresponding Email: edw.riyadhjihad@uoanbar.edu.iq

ABSTRACT

The content of arsenic, lead and cadmium in different items of cosmetics was estimated using flame atomic absorption spectrometry. Twenty samples with four brands (lipstick, foundation, eyeliner and eyeshadow) were chosen from cosmetic stores in Anbar, Iraq. After they have been analyzed, The results revealed that the level of lead in the lipstick, foundation, eyeliner and eyeshadow was within the range of 3.16 - 9.47 , 1.05 - 9.47 , 3.16 - 8.00 and 6.84 - 9.68 $\mu\text{g}\cdot\text{g}^{-1}$, respectively. The content of lead and cadmium in items used is lower than the permissible limits according to a health Canada establishment. While the arsenic concentration in all items used in this study is higher than the permissible limits according to a health Canada establishment.

Keywords: Heavy metals, cosmetic products, lead, cadmium, arsenic.

Correspondence:

Nik Syuhailah Nik Hussin

1Faculty of Entrepreneurship and Business, Universiti Malaysia Kelantan, Locked Bag 36, Pengkalan Chepa,

16100 Kota Bharu, Kelantan, Malaysia

*Corresponding author: Nik Syuhailah Nik Hussin email-address:

niksyuhailah@umk.edu.my

INTRODUCTION

Environmental pollution is one of the most serious global challenges. In the last decades, cosmetics and pharmaceuticals have considered as one of the most important pollutants. ^(1,2) Any substance intended to be placed in contact with the external parts of the human body to improve appearance is called cosmetic. ⁽³⁾ The heavy metals are found in cosmetics with different levels as ingredients or contaminants. ⁽⁴⁾ Insinuation to metals may leads to nervous system toxicity. ^(5,6) The accumulation of heavy metals in the body may have a negative effect. ⁽⁷⁾ Biopsies of cancerous breast show higher accumulations of some heavy metals than non-cancerous biopsies. ⁽⁸⁾ Lead is a potential impurity in many color cosmetics, including lipstick. also, it has ability to make hormonal changes. ⁽⁹⁾ Alsaffer and Hussein ⁽¹⁰⁾ revealed that in forty samples of various brands of eyeshadow used in Iraq, lead, cadmium, nickel and copper were found in varying concentration in the samples. The level of some heavy metals in different brands of cosmetic products used in Saudi Arabia ⁽¹¹⁾, Nigeria ^(12,13) and Pakistan ⁽¹⁴⁾ has been reported.

This study was aimed to estimate the concentration of some heavy metals in cosmetics in Anbar province, Iraq. It has been determined the concentration of lead, cadmium and arsenic in lipsticks, foundations, eyeliners and eyeshadows.

METHODOLOGY

Sample collection: Twenty samples of cosmetic preparations were collected from Iraqi local markets. Total four different brands (coded Lp, Fd, EL and Esh) and total five samples for each brand were taken for study. The information of these items used in present study is summarized in Table 1.

Sample preparation: standard solutions of certain heavy metals have been prepared from 1000 ppm stock solution of GFS Fishers' AAS reference standard. The stock solutions were serially diluted to give concentrations as below:

Lead: A calibration curve with concentrations of (0, 1, 2, 4, 6, 8, 10 $\mu\text{g}\cdot\text{mL}^{-1}$) was prepared.

Cadmium: A calibration curve with concentrations of (0, 0.25, 0.5, 1, 2, 4, 8, $\mu\text{g}\cdot\text{mL}^{-1}$) was prepared.

Arsenic: A calibration curve with concentrations of (0, 0.5, 1, 2, 4, 6, 8, $\mu\text{g}\cdot\text{mL}^{-1}$) was prepared.

Sample digestion and chemical analysis:

0.5 gm of each item was digested with 10 ml of aqua regia (3:1 HCl:HNO₃). This samples were heated for thirty minutes. After heating the samples were cooled to room temperature and they were diluted to 50 ml with distilled water, then they were filtered through whatmann no. 41 filter paper. The sample solutions were analyzed for Pb, Cd and As using flame atomic absorption spectrophotometer (Analytik jena AG - novAA 350 – Flame Atomic Absorption Spectrometer). The parameters of the instrument were listed in Table 2.

Table 1 information of cosmetics.

Sample code	Type	Brand name	Color	Country
Lp1	Lipstick	Bravo	Red	Ireland
Lp2	Lipstick	Neon HD	Brown	Korea
Lp3	Lipstick	True lover	Brown	Mexico
Lp4	Lipstick	Ever beauty	Brown	UAE
Lp5	Lipstick	Ushas	Pink	China
Fd1	Foundation	Cream beauty city	Light brown	China
Fd2	Foundation	Flormar	Light brown	Turkey
Fd3	Foundation	HD make up for ever	Light brown	France
Fd4	Foundation	MAC	Light brown	USA
Fd5	Foundation	Tester max factor	Light brown	Ireland
EL1	Eyeline	Nitro	Black	Canada
EL2	Eyeline	Flormar	Black	Turkey
EL3	Eyeline	Moda	Black	Turkey

Determination Of Some Heavy Metals In Selected Cosmetic Products Sold At Iraqi Markets

EL4	Eyeliners	Pretty by flormar	Black	Turkey
EL5	Eyeliners	Kiss beauty thick	Black	China
Esh1	Eyeshadow	Romantic beauty	Brown	China
Esh2	Eyeshadow	Romantic bird	Blue	China
Esh3	Eyeshadow	Outdoor girl	Brown	China
Esh4	Eyeshadow	Diamond beauty	Pink	China
Esh5	Eyeshadow	Baked eyeshadow	Green	China

Table 2 instrumental conditions for analysis.

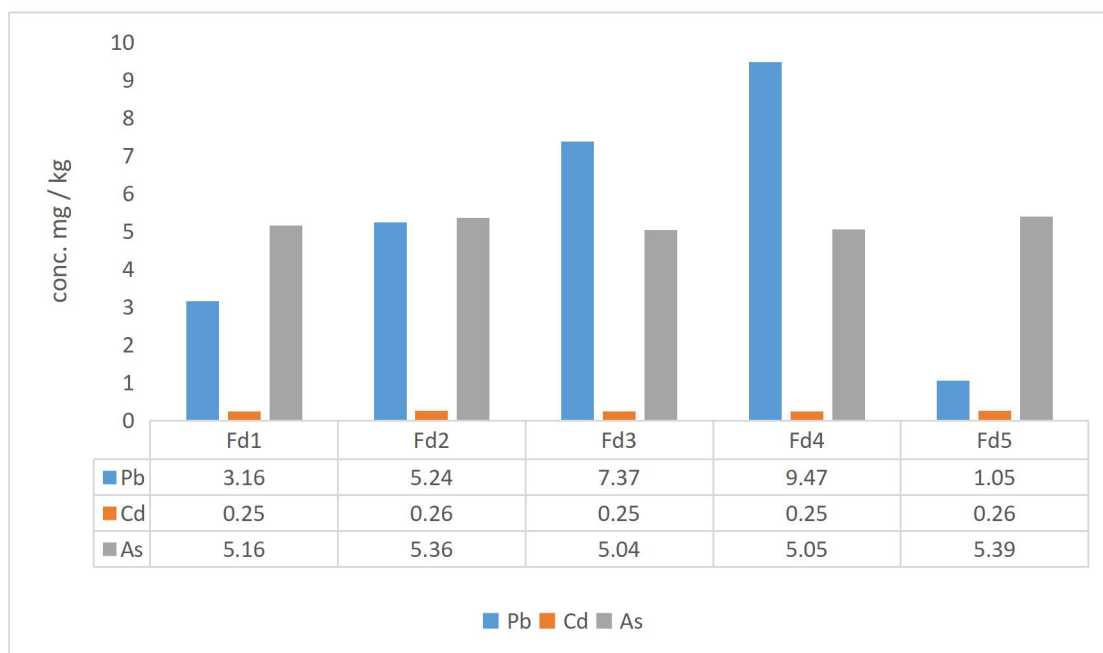
Metals	λ_{\max} (nm)	Current (mA)	Slit width (nm)	Flame type
Pb	283.3	2	1.4	C ₂ H ₂ -Air
As	193.7	5	0.5	C ₂ H ₂ -Air
Cd	228.8	2	1.4	C ₂ H ₂ -Air

RESULT AND DISCUSSION

Twenty samples of four different brands (lipstick, foundation, eyeliner and eyeshadow) were investigated in this study. The values are expressed as an average for three determinations. Figure 3 shows the lead, cadmium and arsenic levels in lipsticks used in Iraq. The concentration of lead ranged between 3.16 – 9.47 mg/kg. Sample Lp4 had the highest lead concentration and sample Lp1 had the lowest. The cadmium concentrations varied from 0.46 to 0.51 mg/kg. Samples Lp1

cosmetics' samples analyzed showed that arsenic, lead and cadmium were detected in all brands with varying concentrations.

and Lp4 had the highest cadmium concentration and sample Lp3 had the lowest. The concentration of arsenic ranged between 4.69 – 4.97 mg/kg. Sample Lp4 had the highest lead concentration and sample Lp5 had the lowest.



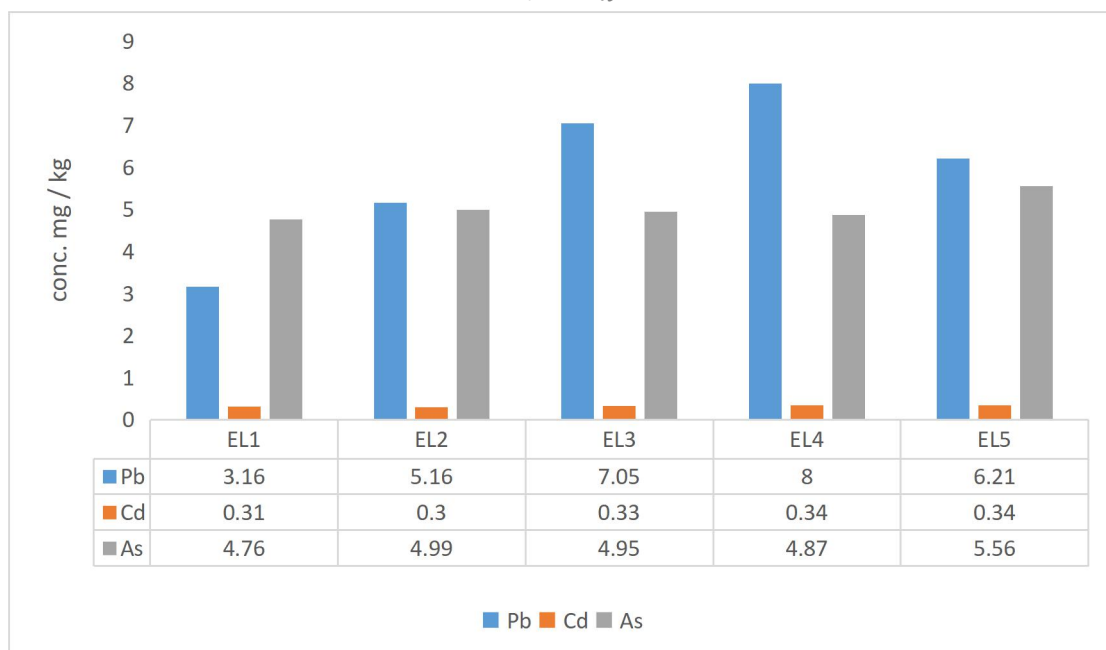
values are expressed as an average for three determinations

Figure 4 data on heavy metals in foundation samples.

Data presented in figure 4 reveals that the lead, cadmium and arsenic levels in foundation samples used in Iraq. The lead concentration varied from 1.05 to 9.47 mg/kg. Sample Fd4 had the highest lead concentration and sample Fd5 had the

lowest. The cadmium concentration ranged between 0.25 – 0.26 mg/kg. The arsenic concentration varied from 5.04 to 5.39 mg/kg. Sample Fd5 had the highest lead concentration and sample Fd3 had the lowest.

Determination Of Some Heavy Metals In Selected Cosmetic Products Sold At Iraqi Markets

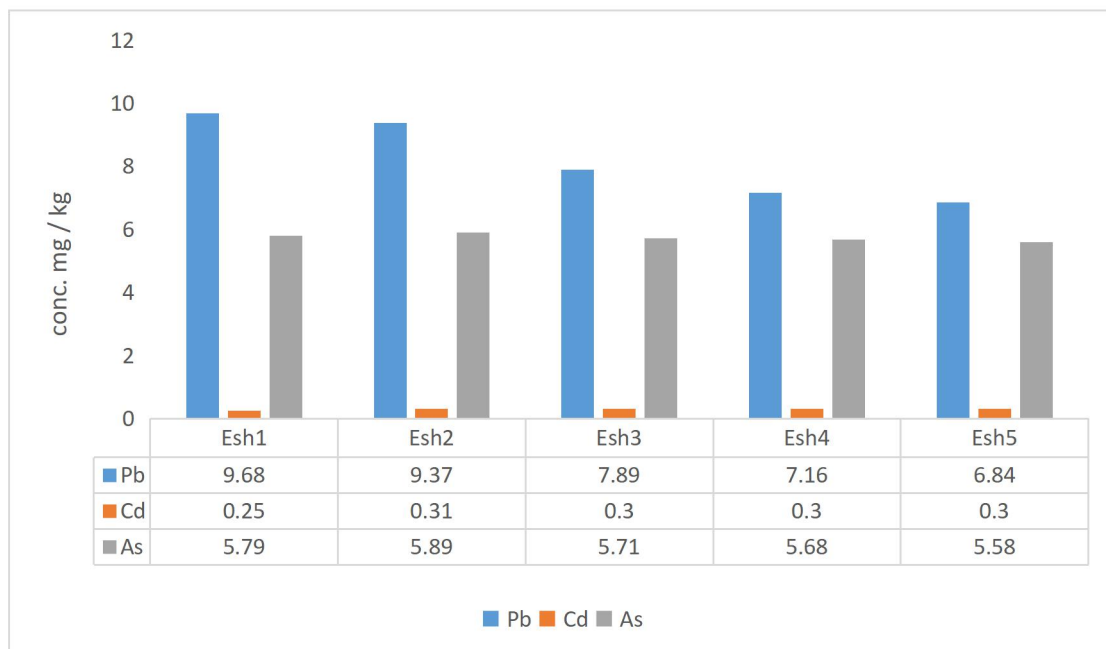


values are expressed as an average for three determinations.

Figure 5 data on heavy metals in eyeliner samples.

The results obtained as an average of three determinations of the lead, cadmium and arsenic levels in eyeliners used in Iraq are given in figure 5. The concentration of lead ranged between 3.16 – 8.00 mg/kg. Sample EL4 had the highest lead concentration and sample EL1 had the lowest. The cadmium

concentrations varied from 0.30 to 0.34 mg/kg. Samples EL4 and EL5 had the highest cadmium concentration and sample EL2 had the lowest. The concentration of arsenic ranged between 4.76 – 5.56 mg/kg. Sample EL5 had the highest lead concentration and sample EL1 had the lowest.



values are expressed as an average for three determinations

Figure 6 data on heavy metals in eyeshadow samples.

The lead, cadmium and arsenic levels in eyeshadow samples used in Iraq are shown in figure 6. The concentration of lead ranged between 6.84 – 9.68 mg/kg. Sample Esh1 had the highest lead concentration and sample Esh5 had the lowest. On the other hand, the cadmium concentrations varied from

0.25 to 0.31 mg/kg. Samples Esh2 had the highest cadmium concentration and sample Esh1 had the lowest. The concentration of arsenic ranged between 5.58 – 5.89 mg/kg. Sample Esh2 had the highest lead concentration and sample Esh5 had the lowest.

Determination Of Some Heavy Metals In Selected Cosmetic Products Sold At Iraqi Markets

Table 3 Concentration (mg/kg) of heavy metals in different brands of cosmetics.

Sample		Pb	As	Cd
Foundation	Mean ± SD	5.28 ± 3.33	5.20 ± 0.17	0.25 ± 0.001
	Median	5.24	5.16	0.25
	Range	8.42	0.35	0.003
Lipstick	Mean ± SD	6.90 ± 2.72	4.83 ± 0.11	0.49 ± 0.02
	Median	7.26	4.86	0.50
	Range	6.32	0.29	0.04
Eyeliner	Mean ± SD	5.91 ± 1.86	5.03 ± 0.31	0.32 ± 0.02
	Median	6.21	4.87	0.33
	Range	4.84	0.80	0.03
Eyeshadow	Mean ± SD	8.19 ± 1.28	5.73 ± 0.12	0.29 ± 0.02
	Median	7.89	5.71	0.30
	Range	2.84	0.31	0.05

The mean ± SD concentration of Pb in eyeshadow samples (8.19 ± 1.28) is higher than in lipsticks (6.90 ± 2.72), foundations (5.28 ± 3.33) and eyeliners (5.91 ± 1.86) as showed in Table 3. This lead values used in this study did not exceed the 10 ppm limits as level in a health Canada establishment of heavy metal impurity limits.⁽¹⁵⁾ While 100 % of all the samples exceeded the Germany limits for cosmetics.⁽¹⁶⁾

Arsenic was detected in all studied samples. The mean ± SD concentration of As in eyeshadow samples (5.73 ± 0.12) is higher than in lipsticks (4.83 ± 0.11), foundations (5.20 ± 0.17) and eyeliners (5.03 ± 0.31). The studied samples showed results higher than 3 ppm which is the permissible arsenic level in cosmetics according to a health Canada establishment.⁽¹⁵⁾ Also all the samples exceeded the Germany limits for cosmetics.⁽¹⁶⁾

the mean ± SD concentration of Cd in lipstick samples (0.49 ± 0.02) is higher than in eyeshadows (0.29 ± 0.02), foundations (0.25 ± 0.001) and eyeliners (0.32 ± 0.02). This cadmium values used in this study did not exceed the 3 ppm limits as level in a health Canada establishment of heavy metal impurity limits.⁽¹⁵⁾ Although all the samples exceeded the Germany limits for cosmetics.⁽¹⁶⁾ Based on the results obtained, lead concentration in used cosmetic products differs with different manufacturers.

CONCLUSION

In this study, twenty products with four different brands (lipstick, foundation, eyeliner and eyeshadow) of cosmetics sold in Iraqi markets were determined. These products were contained toxic heavy metals; Pb, Cd and As in varying concentrations. According to the health Canada establishment, lead and cadmium were under the permissible limit. While the arsenic concentration was above the permissible limit. Therefore, the continued used of items contaminated with such toxic heavy metals may cause deleterious effects to the human health.

REFERENCES

- Juliano C, Magrini GA. Cosmetic ingredients as emerging pollutants of environmental and health concern. A mini-review. *Cosmetics*. 2017 Jun;4(2):11.
- Bilal M, Mehmood S, Iqbal H. The beast of beauty: environmental and health concerns of toxic components in cosmetics. *Cosmetics*. 2020 Mar;7(1):13.
- Sharma G, Gadiya J, Dhanawat M. A Textbook of Cosmetic Formulations. Department of Pharmacy, Mewar University, Rajasthan-312. 2016;901.
- Chen X, Sullivan DA, Sullivan AG, Kam WR, Liu Y. Toxicity of cosmetic preservatives on human ocular surface and adnexal cells. *Experimental Eye Research*. 2018 May 1;170:188-97.
- Engwa GA, Ferdinand PU, Nwalo FN, Unachukwu MN. Mechanism and health effects of heavy metal toxicity in humans. In *Poisoning in the Modern World-New Tricks for an Old Dog?* 2019 Jun 19. IntechOpen.
- Singh R, Gautam N, Mishra A, Gupta R. Heavy metals and living systems: An overview. *Indian journal of pharmacology*. 2011 May;43(3):246.
- Ali H, Khan E, Ilahi I. Environmental chemistry and ecotoxicology of hazardous heavy metals: environmental persistence, toxicity, and bioaccumulation. *Journal of chemistry*. 2019 Mar 5;2019.
- Jouybari L, Naz MS, Sanagoo A, Kiani F, Sayehmiri F, Sayehmiri K, Dehkordi AH. Toxic elements as biomarkers for breast cancer: a meta-analysis study. *Cancer management and research*. 2018;10:69.
- Jaishankar M, Tseten T, Anbalagan N, Mathew BB, Beeregowda KN. Toxicity, mechanism and health effects of some heavy metals. *Interdisciplinary toxicology*. 2014 Jun 1;7(2):60-72.
- Alsaifari NM, Hussein HJ. Determination of heavy metals in some cosmetics available in locally markets. *IOSR J Environ Sci Toxicol Food Technol*. 2014;8(1):9-12.
- Salama AK. Assessment of metals in cosmetics commonly used in Saudi Arabia. *Environmental monitoring and assessment*. 2016 Oct 1;188(10):553.
- Sani A, Gaya MB, Abubakar FA. Determination of some heavy metals in selected cosmetic products sold in kano metropolis, Nigeria. *Toxicology reports*. 2016 Jan 1;3:866-9.
- Nasirudeen MB, Amaechi AU. Spectrophotometric determination of heavy metals in cosmetics sourced from Kaduna Metropolis, Nigeria. *Science World Journal*. 2015;10(3):1-5.
- Ullah H, Noreen S, Rehman A, Waseem A, Zubair S, Adnan M, Ahmad I. Comparative study of heavy metals content in cosmetic products of different countries marketed in Khyber Pakhtunkhwa, Pakistan. *Arabian Journal of Chemistry*. 2017 Jan 1;10(1):10-8.
- Health Canada, consumer product safety, guidance on heavy metal impurities in cosmetics, 2011.
- Salted BR, Roach D. *Bundesgesundheitsblatt-Gesundheitsforschung-Gesundheitsschutz*, 2017.