Indian Journal of Forensic Medicine and Pathology
Volume 14 Number 3, July - September 2021 | Special Issue
DOI: http://dx.doi.org/10.21088/ijfmp.0974.3383.14321.17



ORIGINAL ARTICLE

# Evaluation of the Concentration of Heavy Metals in Lipsticks using ICP-OES

[1]Kamna Sharma, [2]Sally Lukose

## ABSTRACT

**CONTEXT:** Lipstick is a universal cosmetic, and it can be colored and textured in different ways. It has a fatty base which spreads easily to the surface. They are applied on a sensitive surface of the human body and finally ingested via skin, hence they must be made to the highest safety specifications. Presently, most of the women and adolescent using lipstick in their daily routine to enhance their beauty.

**AIMS:** In present study, an attempt has been made to determine the concentration of lead, nickel, and cobalt in lipstick samples.

**MATERIALS AND METHOD:** The lipstick samples were purchased from online and local markets. The concentration of heavy metals in the samples were determined using ICP-OES.

**RESULTS:** The levels of heavy metals in the sample brands were found to be significant. The results obtained in the study has been alarming specially in case of lead, which was found to be as high as 15ppm, nickel 5ppm and cobalt 5ppm in different brands.

**CONCLUSIONS:** The application of lipstick with excessive high content of heavy metals leads to serious health hazards and hence be used judiciously.

**KEY MESSAGES:** The long term usage of lipstick containing the harmful heavy metals above the stipulated quantity poses a high health risk to users and hence should be used judiciously.

KEYWORDS | lipstick, heavy metals, ICP-OES, toxicity

**Author's Credentials:**
[1]*Research Scholar, Galgotias University, Greater Noida 244001, Uttar Pradesh, India.*

[2]*Professor, School of Allied Health Sciences, Sharda University, Greater Noida, Uttar Pradesh 244001, India.*

**Corresponding Author:**
*Sally Lukose, Professor, School of Allied Health Sciences, Sharda University, Greater Noida, Uttar Pradesh 244001, India.*

**Email:**
*sally.lukose@sharda.ac.in*

How to cite this article
*Sharma Kamna. Evaluation of the Concentration of Heavy Metals in Lipsticks using ICP-OES. Indian J Forensic Med Pathol.2021;14(3 Special):539-542.*

## INTRODUCTION

Lipstick is a type of cosmetic product used for coloring the lips. It is small stick of wax lip coloring enclosed in a cylindrical case. The basic composition found in lipstick are wax, oil, alcohol, and pigments. Wax enables the mixture to form the shape of cosmetic. Oil such as minerals, castor or may be vegetable oil are added to the wax. Fragrance and pigment along with wide range of other ingredients can also be used to make the product smoother or glossy. In prehistoric time lipsticks were made only available natural resources like fruit and vegetable juices. Evidence and origin of lipstick existed 5000 yrs ago in Babylon, paste made up of crushing precious stones was used (Ullah *et al.,* 2013). The application of same was done by chewing betel leaf in ancient times. The use of lip color was common among Egyptians, Syrians, Persian and Greek. Later in 16th century, it was introduced in England by Queen Elizabeth I.

There are different types of lipstick available in market like sheer, matte, creamy, lip balms, glossy, moisturizing, long wearable and non-transferable etc depending upon the demands of the consumers. The time-to-time variation in the product is incorporated depending upon the latest trends. There are lot of organic ingredients which can be used like Organic waxes, oils and plant butters, such as beeswax,

cocoa butter, mango seed butter, shea butter, avocado butter, coconut oil and avocado oil etc.

It consists of number of toxic chemicals such as methylparaben, polyparaben, Retinyl palmitate, dyes, tocophenyl acetate.

| CHEMICAL | USES |
|---|---|
| Methylparaben | Antifungal and preservative |
| Polyparaben | Prevents growth of harmful bacteria |
| Retinyl palmitate | Antioxidants |
| Dyes | Coloring agents |

**Table 1:** The concentration of lead, nickel, and cobalt in Lipstick brands.

As per US Food Drug and Cosmetic Act defines cosmetics as any articles which are intended to be rubbed, poured sprinkled, or sprayed on, introduced into or otherwise applied to the human body or any other part for cleansing, beautifying, promoting attractiveness or altering the appearance.

## MATERIALS AND METHOD

### OBJECTIVE

Analysis and estimation of Lead, Nickel and Cobalt in lipstick samples purchased from local markets.

### HYPOTHESIS

1. Lipstick samples collected from the local market would contain lead, nickel & cobalt that can cause skin diseases.
2. Quantitative estimation of lead, nickel and cobalt can be done using ICP-OES will give significant results.

### SAMPLE TYPE AND SIZE

Lipstick samples were collected from the local markets for the study. In all 10 branded lipstick samples were taken for analysis of heavy metals such as lead, nickel and cobalt.

### SAMPLE PREPARATION

All the apparatus were thoroughly washed and rinsed using normal water followed by immersing the same in 5% solution of HNO3 for an overnight, later by rinsing with deionized water before using the same.

1. 1 gm/ 1 ml of lipstick was taken in a beaker.
2. The beaker was then heated in muffle furnace at 450°c.
3. After the sample was turned into ash, the digestion was done.
4. 4. For of the digestion of the sample, hydrochloric acid and nitric acid were taken in proportion of 1:3.
5. 25 ml of acid digestion was added to the beaker and heated on a tripod stand till the solution was clear.

### INSTRUMENT USED

The Vista-MPX simultaneous ICP-OES with axially viewed plasma was used for this work. The instrument was fitted with the 3-channel peristaltic pump option for easy introduction of ionization buffer to the sample via a post-pump Y-piece.

### WORKING PRINCIPLE

- Firstly, the sample is introduced into the chamber, in a liquid form which is sprayed using nebuliser. Due to the high temperature inside the chamber atomizes and ionizes the sample, creating positively charged atomic ions.
- The larger droplets are then removed from the gas chamber, and the remaining smaller droplets are transferred into the central passage of an argon plasma.
- The droplets are then dried, deteriorated, and dissociated into an individual atom in the chamber.
- These atoms are then converted into cations via interface before they enter into the vacuum system.
- Electrostatic lenses keep the ions focused, as they pass to the final chamber and the outcome were recorded by the detectors It uses a higher thermal energy which discrete the cations from the photons and neutral particles.
- Analyte ions are then separated & scanned using multiplier detector. The spectrometer will measure the spectrum of each ion.

 

| BRAND | LEAD (PPM) | NICKEL (PPM) | COBALT (PPM) |
|---|---|---|---|
| Biotique | 4 | 2 | 2 |
| Attitude | 6 | 4 | 3 |
| Colorbar | 8 | 5 | 3 |
| Coloressence | 15 | 4 | 5 |
| Loreal | 4 | 3 | 2 |
| Maybelline | 5 | 3 | 2 |
| Oriflame | 5 | 2 | 2 |
| Revlon | 7 | 4 | 3.8 |
| Signature | 4 | 2 | 3 |
| Faces | 4 | 2 | 2 |

**Table 2:** The concentration of lead, nickel, and cobalt in Lipstick brands.

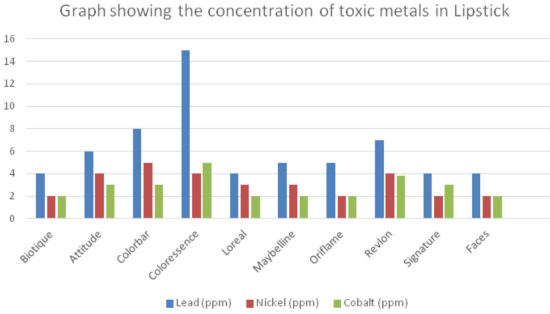


**Figure 1:** Graphical representation of lead, nickel, and cobalt in lipsticks

- The light intensity on the wavelength is measured and with the calibration calculated into a concentration.

## RESULTS

This research was performed in triplicate analysis. The number of selected lipsticks was ten which was collected from the cosmetic shops and local market. The data presented in Table 1 shows remarkably high concentration of lead in all the brands, the least being shared by 4 brands (Biotique, Loreal, Signature and Faces) estimated at 4 ppm. The maximum was observed in Coloressence at 15 ppm. However, Nickel and Cobalt also observed in all the samples with maximum in Coloressence (as shown in table no.1 and graph.1).

## DISUCSSION

The metal toxicity has been well-documented from early times in 370 BCE (Palpandi and Kesavan, 2012). The investigation to understand the process of action of heavy metals was identified by Voegtlin *et al.,* in 1923. Studies have also shown that there is a marked difference in the absorption of heavy metals in the skin based upon varied physical parameters. (Lilley *et al.,* 1988). While exposure to heavy metals may take place through various means such as diet, environment and medicines (Adal and Tarabar, 2013), the use of cosmetics have also been identified as one such source. Dermal and oral exposure to these heavy metals can occur from application of cosmetics products such as lipsticks (Sainio, et al., 2000). While the present study has reported significant amount of lead, nickel and cobalt in different brands of lipstick, other studies have also shown significant concentration of heavy metals in different cosmetic products (Al-Dayel, *et al.,* 2011).

## CONCLUSION

The study has revealed that high values of lead may be due to the presence of factitious elements in the samples as there are no proper awareness in the production and distribution of these cosmetic products. However, the chances of mixing of sub-standard elements can't be ignored. The result clearly shows that further studies need to be conducted of these toxic metals which are used in cosmetic products. Also, the good manufacturing practice must be followed by the companies. There is need for an assessment of health risk of the individuals from the exposure of cosmetics which are adulterer with heavy metals. It was concluded from the result that most of the brands of were tainted with high concentrations lead. The companies can initiate in minimizing the impurities in products by following good manufacturing practices. These includes testing of ingredients and the finished products to make sure they meet certain manufacturer specifications. The removal of heavy metals from these cosmetic

products is not possible after manufacturing, however if the raw material is carefully chosen while keeping in mind the heavy metal contents, we can surely improve the quality of these products and save our mother nature, the environment and health of humans using these products. IJFMP

**Acknowledgment:**
*The authors have made no acknowledgment in this article.*
**Conflict of Interest:**
*The authors declare that there is no commercial or financial links that could be construed as conflict of interests.*
**Source of Funding:**
*The author declares that there is no funding for this project.*

## REFERENCES

1. ***Adal, A., Tarabar, A.,*** *Heavy Metal Toxicity, 2013: http://emedicine.medscape.com/article/814960-overview.*
2. ***Al- Saleh I, Al-Enazi S, Shinwari N.*** *Assessment of lead in cosmetic products. Regulatory Toxicology and Pharmacology. 2009 54: 1005-1013*
3. ***Al-Dayel, O., Hefne, J., and Al-Ajyan, T.*** *Human exposure to heavy metals from cosmetics, Orient. J. Chem. 2011;27(1):01-11*
4. *Asian Pac. J. Trop. Biomed. 2012; 358-367.*
5. ***Ferner D. J.,*** *Toxicity and heavy metals. eMedicine Journal. 2001;2(5):1-4.*
6. ***Gondal, M.A., Seddigi, Z.S. and Nasr, M.M.*** *Spectroscopic detection of health hazardous contaminants in lipstick using Laser Induced Breakdown Spectroscopy. Journal of Hazardous Materials. 2010. 175(1–3):726- 732.*
7. *https://timesofindia.indiatimes.com/what-is-the-origin-of lipsticks/articleshow/8003518.cms (accessed on 16/08/21)*
8. ***Jun Wang, Ashley B. Kay, Jeremiah Fletcher, Margaret K. Formica and Timothy E. McAlindon*** *Is lipstick associated with the development of systemic lupus erythematosus (SLE). Clinical Rheumatology. 2008;27 (9):1183-1187.*
9. ***Lilley, S.G., Florence, T. M., Stauber, J.L.*** *The use of sweat to monitor lead absorption through the skin, Sci. Total Environ., 1988; 76(267):278.*
10. ***Nancy M Hepp , William R. Mindak, and John Cheng,*** *Determination of total lead in lipstick: Development and validation of a microwave-assisted digestion, inductively coupled plasma–mass spectrometric method, Journal of Cosmetic. Science, 2009:60, 405–414.*
11. ***Palpandi, C., Kesavan, K.*** *Heavy metal monitoring using Nerita crepidularia-mangrove mollusc from the Vellar estuary, Southeast coast of India,*
12 ***Sainio, E. L., Jolanki, R., Hakala, E., and Kanerva, L.*** *Metals and arsenic in eye shadows, Contact Dermatitis., 2000;42(1):5-10.*
13. ***Stellman, Mager J.*** *Encyclopedia of occupational health and safety. International Labor Organization: 1988. 812-814*
14. ***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 Chemistry. 2013;10(1):10-18*
15. *US FDA, United State Food Drug & Cosmetic Act on Hazardous Chemicals in Cosmetics. 2020.*
16. *Voegtlin, C., Dyer, H.A., Leonard, C.S., On the mechanism of the action of arsenic upon protoplasm, Public Health Rep., 1923; 38:1882-1912.*