International Journal of Environment, Agriculture and Biotechnology, 5(2)
Available: https://ijeab.com/

Heavy Metals in Some Lipstick products marketed in Makurdi Metropolis, Benue State Nigeria

Oklo, A. D.; Enenche, D. E.; Mary - Ann Msoo Aondoakaa

Benue State University Makurdi, Benue State

Abstract*— *Cosmetics still retain their attractive use and brilliant effects, however public concern about their toxicity has become a topic of debate. Trace amounts of toxic heavy metals can be either intentionally added to cosmetics or present as impurities in the raw materials. The present study reports the content of five heavy metals (Cd, Cu, Ni, Pb, and Zn) in six brands of lipstick products sold at various markets in Makurdi metropolis of Benue State, Nigeria using atomic absorption spectroscopy (AAS). Pb in the samples ranged from<0.01 – 3.92. mg/g, Zn ranged from 2.23 – 3.01 mg/g, Ni ranged from 0.12 – 0.23 mg/g and Cd ranged from <0.01 – 1.35 mg/g. all metals except Cd and Pb were above the safe limits for metals in products. Prolonged use of these products containing these metals therefore, may pose a threat to human health and could damage the environment. The results lead to the conclusion that constant control of metallic content in lipsticks and other facial cosmetics should be seriously considered.

***Keywords*— Lipstick products, Heavy Metals, AAS.**

I. INTRODUCTION

Cosmetics are substances intended to be used in contact with various external parts of the human body by means of rubbing, sprinkling or spraying on the desired part for the purpose of cleansing, beautification, altering appearance, correcting body odours and keeping the body in good condition (Lee et al., 2008). One of the most used cosmetics are lipsticks. Lipsticks are cosmetics containing oil, pigments, waxes and emollients that apply colour, texture and protection to the lips. They often come in varieties of colours. Lipsticks have water or gel base and may contain alcohol to help the product remain sticky. They temporarily saturate the lips with a dye and are usually designed to be water proof with many colours, shades and types of lipsticks available. As with most other types of makeup, lipsticks are typically but not exclusively used by women. Their use dates back to medieval time (Kumar *et al*., 2012).

Many lipsticks have been reported to contain heavy metals such as lead, arsenic, cobalt (Adepoju-Bello *et al.*, 2012) either as ingredients or impurities. Although the chemical constituents of cosmetics can sometimes be seen to raise eyebrows, some chemicals are widely seen and beneficial. Titanium dioxide TiO_2 found in sun screens and zinc oxides have inflammatory properties (Barakat, 2011). Mineral make-ups with these ingredients can have a calming effect on the skin which is particularly important for those with inflammatory problems such as rosacea. Zinc oxide is also anti-microbial, so mineral make-ups containing it can be beneficial for people with acne. However, the presence of other chemicals can spell danger to the consumers. Studies on animals show that if consumed in high amounts, it affects the kidney, stomach and liver. Mercury on the other hand is a neurotoxin and prolonged use of its products leads to inflammation of the liver, kidney and urinary tract. Lead can be very harmful even at low concentrations causing learning disabilities, behavioural issues, decreased muscle growth, brain damage among others(Ramakant *et al*., 2014).

In general, the use of some heavy metals in cosmetics has been controversial due to the biological accumulation of those metals and their toxicity in the human body (Patel, 2016).At low concentrations, heavy metals have been reported to have negative effects on consumers with acceptable limits of heavy metals varying according to the sub-population of interest (Ramakant *et al*., 2014). Most of

ISSN: 2456-1878
https://dx.doi.org/10.22161/ijeab.52.8

these metals are not intentionally used as ingredients during the production of these cosmetics. They are simply impurities in the products and are not required to be listed on the labels. Manufacturers are however supposed to take care of these impurities but more often than not, these guidelines are so laid-back very few manufacturers remove these heavy metals from their final products. The metals of primary toxicology concern in cosmetics products include lead, mercury, cadmium and antimony. Dermal exposure is expected to be the most significant route for cosmetics since majority of cosmetics are applied via the skin. Oral exposure can also occur for cosmetics used in and around the mouth (Ramakant *et al*., 2014).

Lead, cadmium, mercury, chromium, nickel, and copper are the most common heavy metals detected in cosmetic products, including shampoo, lipstick, cream, eye shadow and powder (Volpe *et al*., 2012). The ingredients and colorants, along with inadequate purification of raw materials, contribute to the presence of these impurities in cosmetics (Al-Saleh *et al*., 2009). Cosmetics appear on the list of products manufactured in various parts of the world for which recall notices have been issued in the US. Thus, in Caribbean countries, an import alert was declared for skin-whitening cream after Hg level in the product measure 8% (Grosser *et al*., 2011).

In recent times, cosmetic application has become a way of life as many women and even men want beauty enhancement aids. However, only a handful are concerned if they contain toxic chemicals and potentially harmful ingredients (Adepoju-Bello *et al.*, 2012). Even with the regulation of many cosmetic products, there are still health concerns regarding the presence of such chemicals in them. Since cosmetic use is rapidly increasing worldwide and various heavy metals are usually found in then, health hazards are posed to their consumers as they are vulnerable due to lack of awareness. This work was therefore aimed to evaluate the content of some heavy metals which include lead, zinc, copper, cadmium and nickel present in some lipsticks sold in local markets within Makurdi, Benue State, Nigeria.

II. STUDY AREA

This study was carried out in Makurdi Local Government area of Benue State, situated at 7.74^0 North Latitude, 8.51^0 East longitude and 104 meters elevation above sea level with a population of about 292,645 inhabitants.

Sample collection

Samples of lipsticks were randomly sampled from retailers from four markets including High level, Wurukum, Wadata and Northbank markets.At each market,three samples were obtained and coded before been taken to the laboratory for further analysis.

SAMPLE CODE	LIPSTICK BRAND	COLOUR	LOCAL MARKET
A	Romantic Shiny	Purple	Wurukum
B	Beauty Lady Rose	Light Brown	Wurukum
C	Black Opal	Pink	Wadata
D	Lovely Absolute	Red	Northbank
E	Miss Rose	Pitch	High Level
F	Cisou	Oxblood	Wadata

Sample Digestion and Analysis

Sample digestion for the determination of lead, zinc, copper, cadmium and Nickel was done as described by Sonawane *et al.* (2013).]. Exactly 1.0g of each sample was weighed into a conical flask and 10 mL mixture of concentrated acid HNO_3: $HCLO_4$ (3:1) added. This was then heated for 3 hours on a hot plate at 90^0C before 5.0 mL of acid mixture was added and the solution heated again for 2 hours to complete the digestion. The samples were cooled and made up to 25.0 mL in volumetric flask. The solution was finally filtered through Whatman no. 41 filter paper, and the clear solution was used for metal quantification using AAS (model: Buck Model 210 VGP)

III. RESULTS AND DISCUSSION

The concentrations of various metals in the sampled lipsticks from Makurdi metropolis in Benue State is given in Figures 1,2,3,4 and 5.

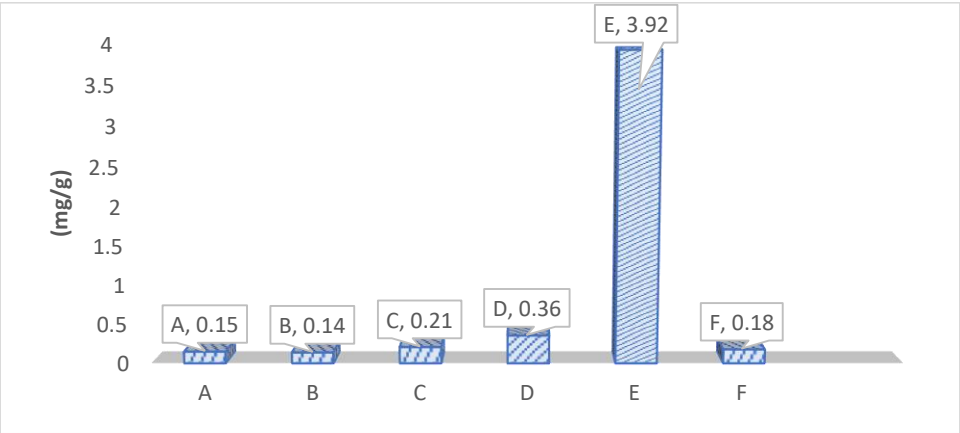

Fig.1: Cu concentration in various lipstick samples

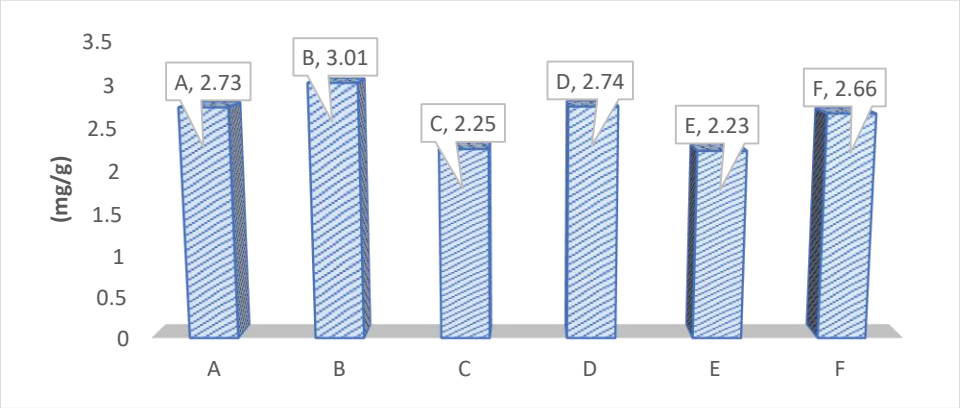

Fig.2: Zn concentration in various lipstick samples

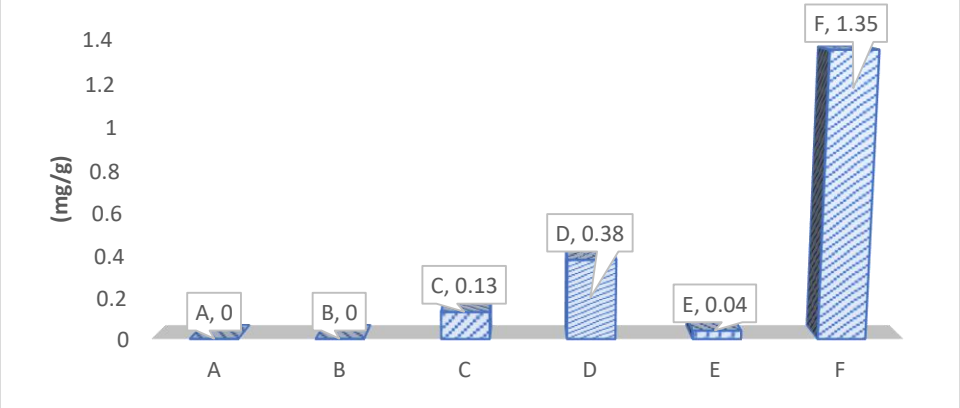

Fig.3: Cd concentration in various lipstick samples

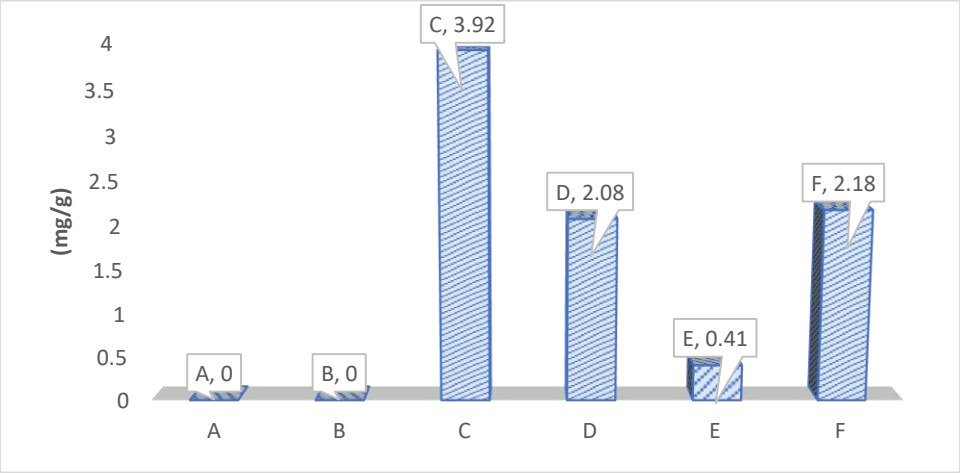

Fig.4: Pb concentration in various lipstick samples

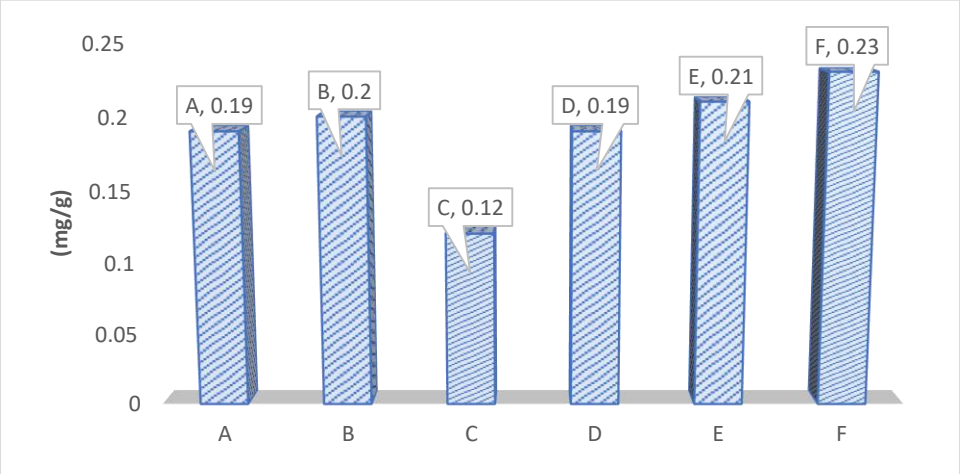

Fig.5: Ni concentration in various lipstick samples

The concentration of Pb in the samples ranged between <0.01 – 3.92. mg/g. Two of the samples were not detected with lead. This conforms with the European union act which prohibits the preserve of lead in lipsticks/cosmetics. The values of the samples that were detected with Pb were less than permissible value 20 mg/g.The concentration of Zinc ranged between 2.23 – 3.01 mg/g with a standard deviation of 0.22684 and copper 0.13 – 3.92mg/g and its values were less than 50 mg/g which is the standard for Cu in cosmetics. Zinc is efficient in smaller quantities but even at that, bioaccumulation can pose potential heaths damages.Ni concentration in the six samples ranged between 0.12 – 0.23 mg/g. The values of the detected samples were less than 5 mg/g which is the standard limits.Cadmium in some samples was not detected. Its concentration ranged between <0.01 – 1.35 mg/g. The European Union and Health Canada also prohibits the presence of cadmium in cosmetics. The samples detected with Cd were less than 15 mg/g.

This study showed that the concentration of Cu which ranged between 0.14 – 3.92 fell under the permissible limits. Zinc ranged between 2.23 – 3.01 mg/g was within, Cd and Pb fell below the permissible limit and ranged between 0.00 – 1.35 mg/g and 0.00 – 3.92 mg/g respectively; while Ni ranged between 0.12 – 0.23 mg/g was within permissible limits. The concentrations of these heavy metals for all the samples fell within their permissible limits.The maximumvalue for Ni (0.23 mg/g) was found to be higher than that reported inmost previous studies (Al-Saleh et al., 2009; Barakat, 2011). The highest concentration of Pb (3.92 mg/g) wasfound to be higher than the reported values (Al-Saleh*et al*., 2009; Saeed *et al*., 2010; Barakat, 2011). The maximum valueof Zn (3.01

mg/g), which as an oxide has properties similar to TiO_2, was found tobe lower than many reports in the literature.

The results of the analysis showed the presence of copper, zinc nickel in 90% of the samples. The concentration of heavy metals in the lipstick samples indicate that the control measures for these elements must be maintained in other for the lipsticks to be safe for use. The differences in concentration of the various metals would be due to the variations in materials used to get each colour of lipstick. Also, the lipsticks may be graded into high class and low class, which determines the quality of the materials used for each production. Zainy (2017) reported that higher class oflipsticks (more expensive, higher quality) is safer than the lower class (less expensive,lower quality), and is consistent with earlier research for lead and cadmiumlevels in various cosmetic brands.

These heavy metals in lipsticksare impurities and bind with proteins incells, leading to cell death and multiple diseases (Shanker, 2008). The slow liberation of these metals into thebody means that they may cause damage after accumulating over time in variousorgans. Other studies have also reported heavy metal concentrations invarious cosmetic products (Adepoju-Bello *et al.*, 2012).

IV. CONCLUSION

The application of atomic absorption spectroscopy (AAS) technique allowed the quantification of heavy metals in lipsticks. In some samples, lead and cadmium were present at level prohibited by European regulation. It should be emphasized that although Pb and Cd were not detected in some samples due to the detection limit of the analytical procedure, this does not mean that these metals were completely absent.

However, from the results one can deduce that a lower amount of Pb, Ni and Cdis more beneficial for consumers, especially for those with hypersensitivity to contact allergies. Consequently, extensive uses of such products should be avoided. Thus, there is need for further assessment of risk to human health from exposure to cosmetics that are contaminated with heavy metals. Careful selection of the raw materials used in producing them with regard to heavy metal content can improve the safety of cosmetics and their impact on the environment.

Conflict of interest: There is no conflict of interest

REFERENCES

[1] Adepoju-Bello, A.A., Oguntibeju, O.O., Adebisi, R.A., Okpala, N. and Coker, H.A.(2012) Evaluation of the Concentration of Toxic Metals in Cosmetic Products in Nigeria. African Journal of Biotechnology, 11, 16360-16364.
[2] Al-Saleh, I., Al-Enazi, S. and Shinwari, N. (2009) Assessment of Lead in Cosmetic
[3] Barakat, M. (2011) New Trends in Removing Heavy Metals from Industrial Wastewater.Arabian Journal of Chemistry, 4, 361-377.https://doi.org/10.1016/j.arabjc.2010.07.019
[4] Kumar, S., Singh, J., Das, S. and Garg, M. (2012). "AAS Estimation of heavy metlas and Trae Elements in Indian Herbal cosmetic Preparations". *Research Journal of Cosmetic Science*. Pp46 – 48.
[5] Lee, S., Jeong, H. and Inseop, C. (2008). "Simultaneous determination of heavy metals in Cosmetic products". *Journal of Cosmetic Science pp. 441 – 447.*
[6] Patel, P. (2016) Toxic Cosmetics: Lead in Lipstick. Bioclinic Naturals.
[7] Products. Regulatory Toxicology and Pharmacology, 54, 105-113.https://doi.org/10.1016/j.yrtph.2009.02.005
[8] Ramakant, S., Saxena, M.S. and Sapna, J. (2014). "Heavy Metals in Cosmetics. Centre for Science and Environment" p. 3-13.
[9] Saeed, M., Muhammad, N. and Khan, H. (2010) Analysis of Toxic Heavy Metals inBranded Pakistani Herbal Products. Journal of the Chemical Society of Pakistan, 32,471-475.
[10] Shanker, A.K. (2008) Mode of Action and Toxicity of Trace Elements. In: Prasad,M.N.V., Ed., Trace Elements as Contaminants and Nutrients : Consequences inEcosystems and Human Health, Chapter 21, John Wiley & Sons, Inc., Hoboken.https://doi.org/10.1002/9780470370124.ch21
[11] Sonawane, N. S., Sawant, C. P. & Patil, R. V. (2013). Soil Quality and Heavy Metal Contamination in Agricultural Soil in and around Toronmal (Triable Region) Of Maharashtra. *Archives of Applied Science Research*, 5(2), 294-298.
[12] Zainy, F.M.A.(2017) Heavy Metals in Lipstick ProductsMarketed in Saudi Arabia. Journal of Cosmetics, Dermatological Sciences and Applications, 7, 336-348.https://doi.org/10.4236/jcdsa.2017.74030