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**DETERMINATION OF LEAD, CADMIUM, CHROMIUM, AND NICKEL IN
DIFFERENT BRANDS OF LIPSTICKS**

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ABSTRACT

Atomic absorption spectrophotometer was used for the determination of heavy metals (Lead, Cadmium, Chromium and Nickel) samples of six most popular brands of lipsticks sold at local markets in Faisalabad. Before analysis lipsticks samples were digested by using acid digestion method using HNO₃ and H₂O₂. The ranges of averages for all samples analyzed were: Pb, 0.286-6.234 ppm; Cd, 0.200-0.500 ppm; Cr, 0.222-5.430 ppm and Ni, 0.600-5.947 ppm. From all colors in dark brown and shocking pink colors the metals concentration were higher, while in baby pink color the metal contents were low. So lipsticks used every day add up to significant exposure of heavy metals in body.

Keywords: Lipsticks samples, Lead, Cadmium, Chromium, Nickel, Heavy metals, Atomic Absorption Spectrophotometer

INTRODUCTION

A large number of heavy metals are present in lipsticks. Some of these are used as coloring agent. Some of these metals are added as intentionally ingredients while some added accidentally from environment.

Skin care products fall in general category of cosmetics. These are used to improve the

appearance and health of skin. Skin function as protective layer [1]. It allows some chemical substances to pass through it, while it does not allows some chemical substances to pass. Some cosmetics products are directly applied to the skin such as lipsticks. These enter into the body and cause the hazardous

effect to the internal body organs. Cosmetics are the important source of releasing heavy metals in the environment. Cosmetics represent an important source of sensitization, since they are used every day and are applied to the thinnest areas of facial skin, such as the pre-ocular areas and lips, where absorption is very high [2].

Lead in the earth crust is naturally present, its atomic number is 82, atomic weight is 207.19, its specific gravity is 11.34, it is silvery grey or bluish metal it have at atmospheric pressure boiling point is 1740°C and melting point 327.5°C [3]. From 2000 years lead poisoning has been known that have dangerous effects on human health. Main human problems that occurred due to lead toxicity are stomach pain, unconsciousness, anemia, infertility, nervous systems disorders. Its low level introduction into the body causes behavior abnormalities, learning and hearing disorders. Lead effects on the every systems of the body such as reproductive system, renal system, hepatic etc. [4]. In the brain lead in toxic amount alter the nerve transmission and slow down the calcium transport in the human body. During pregnancy lead can cross the placenta and causes the premature delivery, and low birth weight [3]. Lipstick can become contaminated with lead via the use of contaminated raw materials or via the use of

pigments that contain lead. The level of lead was less than 20 ppm in all products in a study on its presence in 88 different colours of eye shadow [5].

Cadmium is present in many cosmetics products but mostly present in lipsticks and face powders. Its color is deep yellow to orange. It is used as color pigment in many cosmetics industries [4]. Cadmium absorption through the skin is very low (0.5%). It binds to epidermal keratin thus limited absorption observed through in vitro. Oral limited value for cadmium is 0.09 µg/kg to 3 ppm is given by USP for nutritional supplements. The threshold value for dietary products exposure is below 2.5 µg/kg per body weight in a week. Cardiovascular system is also affected at the low level of cadmium exposure. Diabetes and hypertension are also associated with its exposure [6].

Chromium is an essential nutrient for human beings and animal. It plays an important role in glucose and cholesterol metabolism [7]. Its exposure occurs via food, water and inhalation etc. In limited amount it is essential nutrient; however inhaling large amount can cause stomach, kidneys and liver problems and noserednees, irritation, nosebleed, runny nose and even death. Contact of chromium compounds with skin can cause skin ulcers [8]. It is poorly absorbed, it undergo

enzymatic reduction and form intermediates. Bleaches and detergents can cause contact dermatitis among general population. Inhalation of its compounds can result cancer in workers that work in chromate industries [9]. The level of chromium should be less than 5 ppm in cosmetics. It is present as impurity in cosmetics [2].

Nickel when come in contact with skin it causes the allergy called allergic contact dermatitis. Nickel allergy syndrome is also caused by nickel [10]. In the environment, it is highly distributed. Human exposure occurs via inhalation or ingestion Common causes are the headache, insomnia, vomiting, nausea, vertigo. It is tetragenic and has potential to cause cancer. Significant amount of nickel is present in DNA (Deoxyribonucleic acid) and RNA (Ribonucleic acid). It is thought to be factor in hormones, lipids and cell membrane metabolism [6].

MATERIALS AND METHODS

Collection of Samples

The lipsticks samples of six brands were collected from different cosmetics shops from the local market of Faisalabad. The samples were of different qualities and popular brands with different price ranges. For each brands same colors were taken. Those colors were taken that were mostly used. Collections of samples were made according to their use by

the different societies of peoples. Some brands were used by the lower and middle class peoples and some were used by the upper class peoples.

Sample Preparation

Lipsticks are present in the semi solid form, so these required pretreatment before analysis. Lipsticks are organic in nature. For this purpose 1 g of lipstick samples were exactly weighted with electrical analytical balance and put into digestion flask. Lipsticks samples were digested by using wet digestion method by repeatedly addition of HNO_3 and H_2O_2 at atmospheric pressure under open system at hot plate under $100\text{ }^\circ\text{C}$ and heated until the white fumes started evolving, which showed the completion of digestion process. The resulting digestate was reduced in volume upto 1 mL. The digestate was filtered with filter paper. The volumes of sample were made up to 10 ml by the addition of doubly distilled deionized water. Samples were stored in clean labeled sample bottles until analysis [11].

RESULTS AND DISCUSSION

The distributions of heavy metals in 30 samples of 6 brands were studied. Table 1 showed values of metals for all determined metals. Lead detected by AAS in all tested brands of lipsticks in the range of 0.286-6.234 ppm. The USFDA (US Food and Drug

Administration) limit for lead as color additive in cosmetics is 20 ppm. So in all brands and colors the lead concentration was below the FDA limit. The campaign for safe cosmetics has given the 0.1 ppm lead level in candy. Safe level of lead according to EPA lead safe level is 0.5 ppm. Using these values it was concluded that in all brands lead level was higher than CSC (Campaign for Safe Cosmetics) and EPA (Environmental Protection Agency) safe limit values. In the results of this study the lead level was lower in expensive brands. In all brands and in all colors the cadmium was present in the range of 0.200-0.500 ppm. The oral limited value for the cadmium is 0.9 to 3ppm [6]. When cadmium is directly subjected it lowers the blood pressure. So its trace amount is also not safe [12]. In all lipsticks samples chromium was present in the range of 0.222-5.430 ppm. It is added as colorant in lipsticks. Its amount should be less than 5 ppm. According to EPA the safe level of chromium is 1 ppm [2]. So in brand 1 and 5 chromium concentration was maximum in baby pink colour while in brand 3 lowest was baby pink colour, while in brand 2 in dark brown in brand 3 in copper, 4 in red and in brand 6 in shocking pink colour Cr concentration was higher.

Nickel was present in the range of 0.600-5.947 ppm. Nickel concentration above 1 ppm

can cause the contact dermatitis [13]. So in brand 1 and 2 nickel concentration was highest in shocking pink and lowest was in red and pink colour. While in brand 3 the highest value was in red colour and lowest was in shocking pink colour and in brand 4, 5 and 6 in dark brown the highest concentration was present and lower level present was in shocking pink and copper colours.

Brand 1 was the cheapest brand of the lipsticks and mostly used by the lower class peoples. The lead and cadmium concentrations were higher in all the tested colors when mean value of all metals in all colors were calculated followed by the nickel in this brand. The mean value for lead was 4.53 ppm in all colors. In brand 2 which was also all metals were present in greater concentration, but the level of cadmium and lead were greater as compared to other metals.

When mean value of metals was determined for cadmium its concentration was 3.59 ppm. In brand 3 chromium concentration was higher. The mean values for Cd, Cr, Ni were 3.014 ppm, 2.92 ppm and 2.83 ppm respectively (**Figure 1**). It was mostly used by the middle class societies. In this all the metals were present in lower limited values. Only the nickel was present in greater concentration followed by the lead and

chromium. Brand 5 was mostly used by the upper class society. in this brand cadmium contents were found higher. in brand 6 all metals contents were lower.

In our results of all tested samples of red colors, in all 6 brands lead (2.89 ppm), cadmium (2.48 ppm) and nickel (2.70 ppm) levels were higher, followed by the chromium (2.03 ppm) (Figure 2). While in dark brown color, in this color all metals were present in higher concentration, when compared to other metals lead (4.02 ppm) and cadmium (3.29

ppm) levels were higher. In all shocking pink samples cadmium and nickel levels were higher and there was not too much difference between the values of lead, chromium. In all tested samples of baby pink color the chromium concentration was higher followed by the cadmium, nickel. In all brands in the copper color all metals were present below the level of 3 ppm. In this color the chromium, cadmium and lead concentration were higher when compared with the concentration of other metals.

Table 1: Concentration (ppm) of Metals in Different Brands

Brands	Lead	Cadmium	Chromium	Nickel
Brand 1	4.53±0.21	3.72±0.087	2.54±0.088	3.04±0.093
Brand 2	3.30±0.047	3.59±0.0537	3.40±0.014	3.34±0.092
Brand 3	2.22±0.058	3.04±0.089	2.92±0.088	2.83±0.052
Brand 4	48.0±1.10	1.49±0.092	2.15±0.082	3.64±0.054
Brand 5	1.10±0.054	3.56±0.054	2.87±0.049	2.02±0.089
Brand6	2.53±0.026	2.02±0.068	2.21±0.034	2.38±0.017

NOTE: The values are the Average of Triplicate Samples (n = 3) ± S.D., (p <0.05)

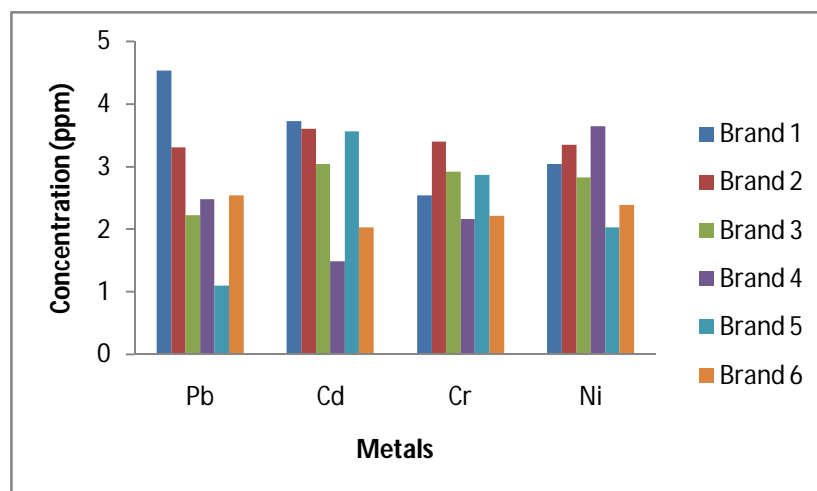


Figure 1: Concentration of Metals in Different Brands of Lipsticks

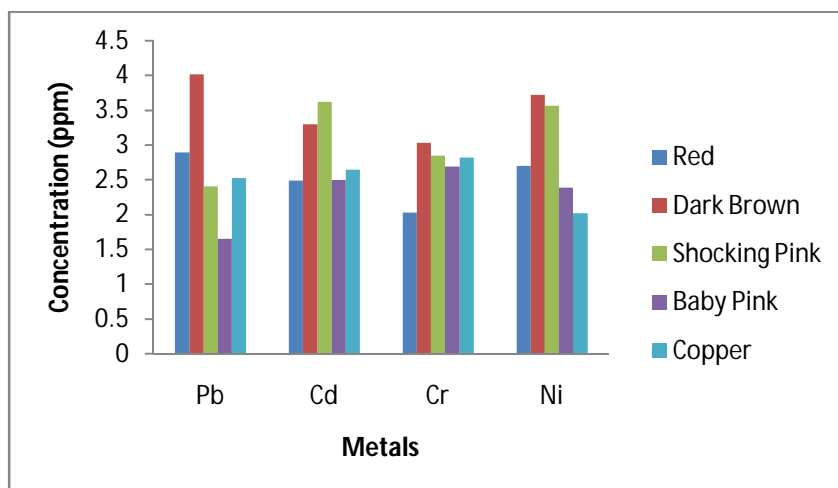


Figure 2: Mean Concentration of Different Metals in Different Colors of Lipsticks

CONCLUSION

Atomic absorption spectrophotometer was used for the determination of heavy metals (Lead, Cadmium, Chromium and Nickel) samples of six most popular brands of lipsticks sold at local markets in Faisalabad. The ranges of geometric averages for all samples analysed were: Pb, 0.286-6.234 ppm; Cd, 0.200-0.500 ppm; Cr, 0.222-5.430 ppm; and Ni, 0.600-5.947 ppm. From all colors in dark brown and shocking pink colors the metals concentration were higher, while in baby pink color the metal contents were low.

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