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Assessment of heavy metals in some traditional cosmetics sold in local market of Raipur

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Abstract

The study was aimed to determine the levels of some toxic heavy metals (Pb, Cd, and Zn) in different traditional cosmetic products sold at local markets of Raipur. The samples were acid digested and elements were analyzed using Atomic Absorption Spectrometer. Each analyzed element was found below the recommended limits of the WHO (1998) only with the exception one kohl sample (sample no SK1) that showed 38.0 mg/kg lead. While most of the samples of henna (sample no SH1-0.47, SH3-0.35, SH4-0.11 and SH5-0.18mg/kg), sindoor (sample no SS2-1.47 and SS4-0.39mg/kg), and kohl (sample no SK1-38.0 and SK3-0.89mg/kg) showed more values of lead than the recommended limits by EU. It is however feared that the continuous use of contaminated cosmetics could result in an increase in some metal levels in the human body beyond acceptable limits and hence cause certain health complications.

Key words: Traditional cosmetics, toxic metals, permissible limit, health effects

Introduction

Cosmetics have been used as a part of routine body careby all classes of people throughout the world. They areclassified as any item intended to be rubbed, poured,sprinkled or sprayed on, or introduced into or otherwiseapplied to the human body or any part of the body forcleansing, beautifying, promoting attractiveness, or alteringthe appearance, and include any item intended foruse as a component of cosmetics (Drug and Cosmetic Act 1940). Metallic elements in any cosmetic are considered systemic toxicants that are known to induce multiple organdamage such as damage to blood composition, lungs, kidneys, liver and other vital organs, evenat lower levels of exposure (Bradl*et al*., 2002).

Henna, sindoor and kohl are typical examples of traditional cosmetics in India. Henna (*Lawsonia inermis*) is a flowering plant and the sole species of the Lawsonia genus. Kohl is a powder traditionally made by grinding galena and other ingredients to darken the eyelids or as mascara for the eyelashes (Healy *et al*., 1984). Sindoor is a traditional vermilion red or orange-red coloured cosmetic powder from Indian subcontinent, usually worn by married women along the part of their hair (Tharu*et al*., 1993). The objective of the present study was to examine the selected metal content of henna, sindoor and kohl samples commonly sold in local markets.

Material and Methods

Collection of Samples: Samples of traditional commercial cosmetic products were collected from the various retail shops of Raipur city. In this study, a total of 14 samples (3 samples of kohl, 5 samples of henna, and 6 samples of sindoor) were collected.

Sample preparation: Henna, Kohl and Sindoor were analyzed for lead, cadmium and zinc. Dried and grinded samples were weighed 1.0 gm each and digested in 10 ml mixture of concentrated acid HNO_3:$HClO_4$ (3:1) for 2-3 hours on a hot plate at 90ºC until brown fumes disappear and a clear solution was obtained. If colour persists, mixture was cooled to room temperature; 3.0 ml of acid mixture was added and heated again for 2-3 hours to complete the digestion. The digested samples were cooled and diluted to 50 ml with deionised water. The final solution was then filtered through Whatman filter paper and solution was used for metal quantification.

Preparation of standard solution: A working solution of 100 ppm was prepared from the stock solution and three standards for each element were made from the working solution. The instrument was calibrated using working standards of Pb, Zn and Cd.

Sample Analysis for lead, cadmium and zinc determination**:** The absorbance of the solutions was obtained using AAS at 228.8, 283.3 and 213.9 nm for cadmium, lead and zinc respectively. The calibration graph was plotted and the samples were analyzed for the selected elements concentration.

Result and Discussion

The total concentrations of 3 toxic elements in 14 samples of traditional cosmetics are presented in Table 1. The concentration of each element was estimated on the dry weight basis. Each analyzed element was found below the recommended limits of the WHO (1998) only with the exception of one kohl sample (sample no SK1) that showed 38.0 mg/kg lead. While most of the samples of henna (sample no SH1-0.47, SH3-0.35, SH4-0.11 and SH5-0.18mg/kg), sindoor (sample no SS2-1.47 and SS4-0.39mg/kg), and kohl (sample no SK1-38.0 and SK3-0.89mg/kg) showed more values of lead than the recommended limits by EU and Germany.

In this study the content of lead in the henna, sindoor and kohl samples was also lower than 10μg/g with exception of one kohl sample. Al-Saleh *et al*, (2009) showed that the lead levels in 15 different colours of 8 brands of eye shadows were in the range of 0.42–58.7mg/kg. Sainio *et al* (2000) also reported that the lead content in 25 brands of eye shadows was upto16.8mg/kg. The concentration of lead in the kohl in the present study was also lower than the above mentioned studies.

Table 1: International standards showing the maximum heavy metal content (ppm) in cosmetics

Available International Standards	Lead	Cadmium
EU* (EU, 2006)	0.1	0.05
WHO (FAO/WHO, 2001, 2002)	10	3.0
Canada (Chan, 2012)	10	3.0
Germany (Whitehouse, 2017)	0.5	0.1
US FDA (FDA, 2018)	10	1.0

*in foodstuffs (oral intake) (Nir *et al*., 1992)

Table 2: Concentration (mg/kg) of metals in cosmetic samples

SN	Sample Code	Lead	Cadmium	Zinc
1.	SH1	0.47	0.057	BDL
2.	SH2	BDL	0.024	BDL
3.	SH3	0.35	0.032	0.49
4.	SH4	0.11	BDL	0.74
5.	SH5	0.18	0.016	0.67
6.	SS1	0.09	0.025	BDL
7.	SS2	1.47	0.009	1.28
8.	SS3	0.09	0.034	0.44
9.	SS4	0.39	0.009	0.17
10.	SS5	0.07	0.002	0.06
11.	SS6	BDL	0.043	0.29
12.	SK1	38.0	0.065	4.17
13.	SK2	BDL	0.017	0.43
14.	SK3	0.89	BDL	0.21

*SH- Sample Henna, *SS- Sample Sindoor, *SK- Sample Kohl, BDL* below detection limit

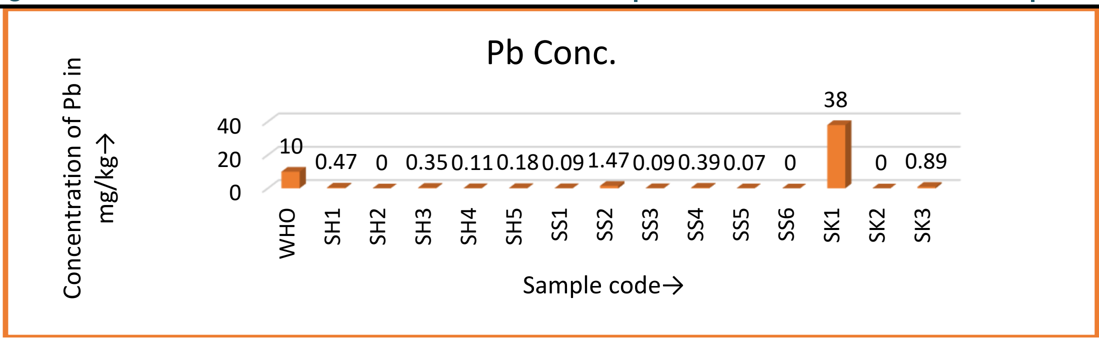

Fig. 1: Comparison of detected elements Pb with WHO standards

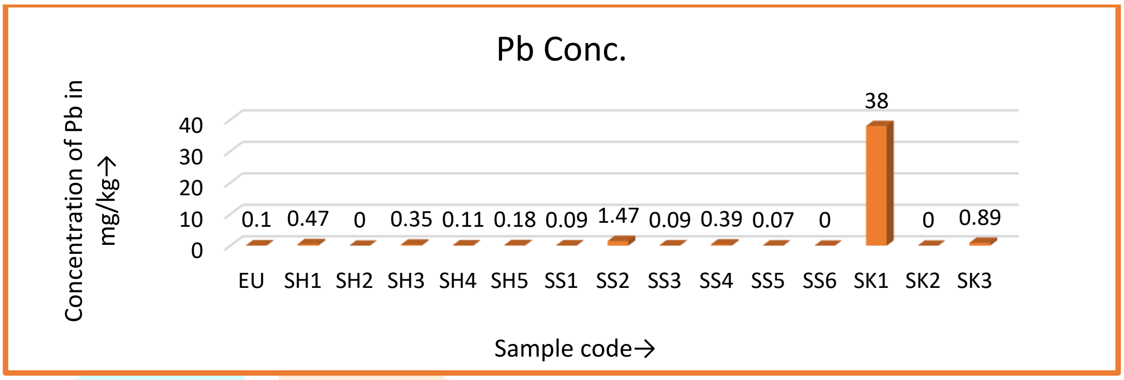

Fig.2: Comparison of detected element Pb with EU standards

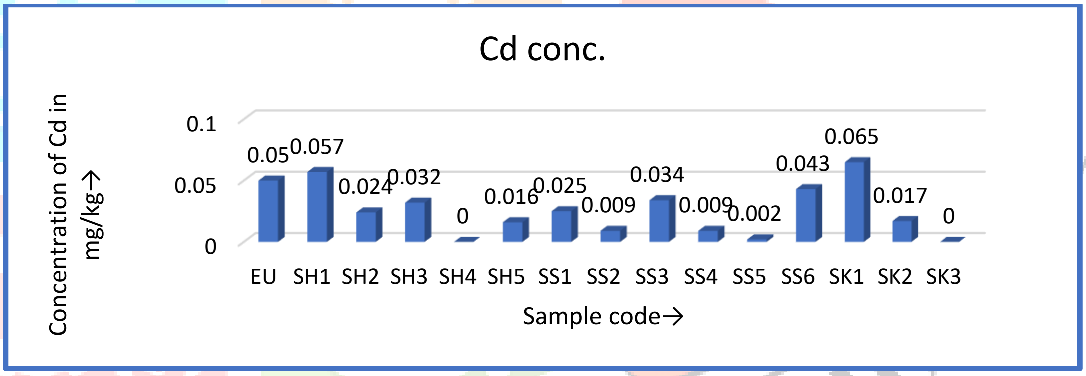

Fig.3: Comparison of detected element Cd with EU standards

Health Canada has recommended that the maximum cadmium concentration is 3μg/g in cosmetics. Therefore, a trace amount of cadmium is not safe (Health Canada, 2011). The results of this study (Table 2) showed that the amount of cadmium in most of the cosmetics sample was lower than recommended limits by WHO (3mg/kg) but some samples (SH1-0.057 and SK1-0.065 mg/kg) showed more values of cadmium than the standard of EU (0.05 mg/kg) (Madany *et al.*, 1992). The detected levels of lead and cadmium in cosmetics which are greater than the safe permissible limits of lead (0.015mg/l) and cadmium (0.005mg/L) in water and food may be of public health importance (USA, 2001., Arsenault *et al.*, 2003, Funtua *et al.*, 1997).

Lead was the most predominant element in analyzed samples, followed by zinc and cadmium. Its concentration was much higher than all the other investigated metals. This finding was also similar as reportedby Ullah et al (2013) for different brands of cosmetics purchased from a local market in Pakistan. All the analyzed cosmetic products contained more Zn than Cd with exception of sample SK1 and this is similar to the study of Tsankov *et al* (1982).

Consumers can not determine which products contain metals by reading the labels. It is the manufacturer's responsibility to ensure that the finished product contains as few impurities as possible so that it does not exceed the limits. Manufacturers should test the used raw ingredients before using them in making the final products to be able to track the origin of such contaminants (Suwaidi *et al.*, 2010, Ajayi *et al.*, 2002). Regulatory Agencies in developing nations should request information on heavy metal test results for a cosmetic product if a risk is suspected (Funtua *et al.*, 1997).

Conclusion

All the metals analyzed were detected in the samples. Lead showed the highest concentration and cadmium has the least. Zinc has been found in small amount compared to the concentration of lead. It is however feared that the continuous use of contaminated cosmetics could result in an increase in some metal levels in the human body beyond acceptable limits and hence cause certain health complications. Such findings call for instant mandatory regular testing programs to check metals' concentration in cosmetic products which may cause health risks to users. Further efforts are needed to enlighten the users and the general public on the dangers of using unknown misbranded products that are supplied in large quantities to many markets in the world.

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