Bull. Environ. Contam. Toxicol. (1998) 60:507-510

Bulletin of Environmental Contamination and Toxicology

Red Lipstick: A Source of Barium to Humans and the Environment

S. C. Rastogi, G. Pritzl

Ministry of Environment and Energy, National Environmental Research Institute, Post Office Box 358, DK-4000 Roskilde, Denmark

Received: 27 October 1997/Accepted: 16 January 1998

General population is exposed to barium (Ba) present in the environment: drinking water, food and air. Depending upon the geographical site, intake of Ba is estimated to be 300-1700 µg/person/day (IPCS 1990). Subpopulations living under condition of high Ba exposure may have a risk of adverse health effects (IPCS 1990). It has been reported that the lethal dose of Ba in untreated cases is 3-4 g (66 mg/kg body weight) and the threshold for a toxic dose is 0.2-0.25 g (Reeves 1986).

Ba compounds are used in the production of various types of consumer products (IPCS 1990). Among the consumer products, lipsticks may be a significant source of Ba-intake because these products contain relatively high amounts of colorants and the commonly used lipsticks (red-shades) may contain Ba-colorants permitted by the Cosmetic Directive of the European Union (EEC 1976): 12 of the 16 permitted Ba-colorants are red and the other 4 permitted Ba-colorants (yellow/orange/blue) may also be used in producing various red-shades (Table 1). To assess the intake of Ba through these products, we have investigated soluble Ba content of 47 popular red-lipsticks and related products. The lipsticks were also analysed to identify the colorants which may be the source of Ba from these products.

MATERIALS AND METHODS

Forty-eight products were subjected to the analysis for soluble Ba content and colorants: 42 lipsticks, 2 lipglosses, 3 lipliners and 1 lipbalm. Besides one skin-color lipstick, all producks were red of various shades. The products represented 26 cosmetic manufacturers from Germany, Denmark, France, England, Belgium, Italy, Irland, Austria, Switzerland, Sweden and USA.

The method of Rastogi and Pritzl (1996) was used to determine the soluble Ba content of the lipsticks. In brief, the samples weredefatted by dichloromethane employing soxhlet extraction. The migration of soluble Ba from the defatted samples into 0.07 M HCl was performed as described before (Ratogi and Pritzl 1996). Ba was analysed by inductively coupled plasma-mass spectrometry (ICP-MS) using intensity of mass 138 for Ba. The concentration

Correspondence to: S. C. Rastogi

of Ba was corrected for the content of La and Ce according to following equation:

$$I_{Ba\ (corrected)} = I_{Ba\ 138} - 0.0008908 \times I_{La\ 139} - 0.000285 \times I_{Ce\ 140}$$

A gradient HPLC-method with photodiode array detection was used for the identification of organic colorants in the lipsticks (Rastogi et al. 1997). The colorants in the sample extracts were identified on the basis of their HPLC retention time as well as their UV-visible spectra (275 nm - 760 nm).

RESULTS AND DISCUSSION

The detction limit of Ba was approximately 0.1 ppb and the relative standard deviation of Ba determination was within 3.3%. The HPLC analysis has been used only for the qualitative analysis of the colorants in the samples. The detection limits of various colorants in the samples were approximately 0.001% (10 ppm).

Soluble Ba content in 28% of the investigated products was <250 ppm, 28% of the products contained 250 - 500 ppm soluble Ba, 8% of the products revealed, 500-1000 ppm soluble Ba content, and the soluble Ba content in 11% of the products was >1000 ppm, maximum 2104 ppm.

C.I. 15850 was present in 93% of the samples. Other frequently present colors in the investigated samples were C.I. 15985, C.I. 15880:1, C.I. 19140/19140:1, C.I. 45380 and C.I. 45405 and C.I. 45410:1. No organic colorant was detected in the skin-color lipstick.

In general, pink and violet samples contained minimum soluble Ba. Relatively low soluble Ba content were found in 3 samples which did not contain C.I. 15850: 8 ppm, 56 ppm and 62 ppm respectively in three lipsticks. Furthermore, the soluble Ba content of two of the C.I. 15850 positive lipsticks was also relatively low: 47 ppm and 79 ppm respectively in a pink and a violet lipstick. These two products may either contain low amounts of Ba-C.I. 15850 or they may contain Ca-C.I. 15850. It was not possible to differentiate between Ba-C.I. 15850 from the Ca-C.I. 15850 in the present investigation. The results of the present study may thus indicate an association between low content of soluble Ba and the absence of Ba-C.I. 15850 in lipsticks and related products. In other words, relatively high concentration of soluble Ba in lipsticks may be associated with the presence of Ba-C.I. 15850 in these products.

The investigated lip-products were found to contain soluble Ba in the range 8 ppm - 2104 ppm. For the calculation of an average Ba-intake, 1000 ppm soluble Ba/lip-product may therefore be reasonable to consider. According to European Commissions notes of guidance for safety evaluation of cosmetic ingredients (EC 1996), the amount of lipstick ingested per person per day is 60 mg. Thus, a lipstick user may intake on an average 60 µg soluble Ba per

Table 1. The colorants permitted to be used as Ba-lakes / pigments / salts in cosmetic products.

Colors, Color Index (C.I.) No.	**Application area**
10316,12085,15510,15630, 15850,15865,15985,16255, 17200,19140,27290,42051, 45370,45380,45410,45430	All cosmetics with following exceptions: C.I. 10316 and C.I.15510 are not permitted in products to be used around eyes. C.I. 27290 is permitted only for the products for a short contact with the skin.

day. This amount of soluble Ba intake through the use of lipsticks appears to be quite significant, especially when that is an unknown source.

The amount of lipstick which is not ingested is washed off / wiped off and disposed into the environment. Considering that 50% of the lipstick used by a person is released into the environment, the amount of Ba relesead into the enviroment through this source will be equal to that ingested by the person, i.e. 60 µg. The amount of Ba release to the environmenmt through the use of lipsticks thus appears to be relatively low: 60 g Ba / day for a population having one million lipstick users. On the other hand, the amount of release of colorants into the environment by the use of lipsticks may be quite significant. It is known that lipsticks may contain up to 10% (w / w) colorants. The release of 60 mg lipstick / person to the environment by one million persons will thus amount to 60 kg / day, or 6 kg colorant / day. The most of the colorants identified in the lipsticks in the present study are azo-dyes. Azo-dyes have been considered to be harmful to both human and the environment (Brown and DeVito 1993).

Acknowledgments. Mrs. Gitte H. Jensen provided skillful technical assistance.

REFERENCES

Brown MA and DeVito SC (1993) Predicting azo dye toxicity. Critical Revs Environ Sci Technol 23: 249-324.

EC (1996) Notes of guidance for testing of cosmetic ingredients for their safety evaluation. Doc. No. XXIV / 1878 / 96, Scientific Committee on Cosmetology, European Commission - DGXXIV Consumer Policy Service, Brussels.

EEC (1976) Council Directive 76 / 768 / EC of 27 July on the approximation of the laws of Member States relating to cosmetic products. Official Journal of European Communities, No. L262, p.169. Latest ammendment: 94 / 35 / EC.

IPCS (1990) Environmental health criteria No. 107: Barium. International Programme on Chemical Safety, WHO, Geneva, Switzerland.

Rastogi SC and Pritzl G (1996) Migration of some toxic metals from crayons and water colors. Bull Environ Contam Toxicol 56: 527-533.

Rastogi SC, Barwick VJ and Carter SV (1997) Identification of organic colourants in cosmetics by HPLC-diode array detection. Chromatographia 45: 215-228.

Reeves AL (1986) Barium. In: Handbook on the toxicology of metals - Volume II - Specific metals (Friberg L, Nordberg G.F. and Velimir B., eds) Elsevier Science Publishers, Amsterdam. pp 84-93.