

# Concentrations and exposure risks of toxic elements in facial cosmetics

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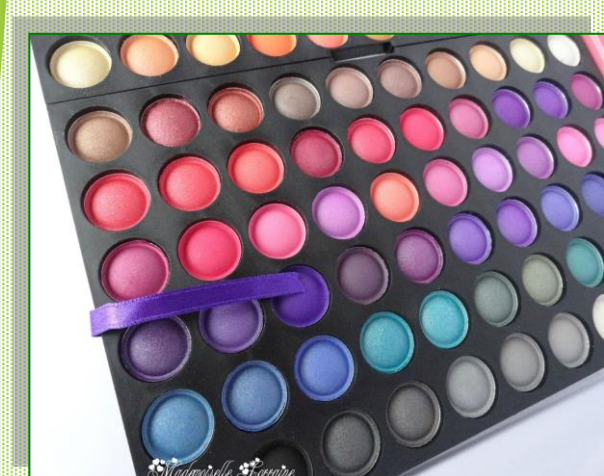
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INCNTIM



ICSI



Samples:  
eye shadows,  
lipsticks



Nowadays, the cosmetics are regarded as a means of improving the skin and beautifying the complexion is well established. They are commonly used of practically all walks of life, being commonly used by millions of consumers daily. The global market for beauty products has shown an average increase of about 5% per year.

These products are directly applied to human skin and mainly produce local exposure to certain ingredients. The analysis of cosmetics constitutes a challenge mainly due to the large variety of ingredients and formulations, leading to vast matrix complexity and variability. The concentrations of heavy and toxic metals were determined in some cosmetics from the Romanian market.

The European Union developed a list of more than 1000 compounds that are banned for use in cosmetics manufacturing.

Elements chosen for examination are commonly considered to be toxic, although there are others that might be considered hazardous.

## RESULTS

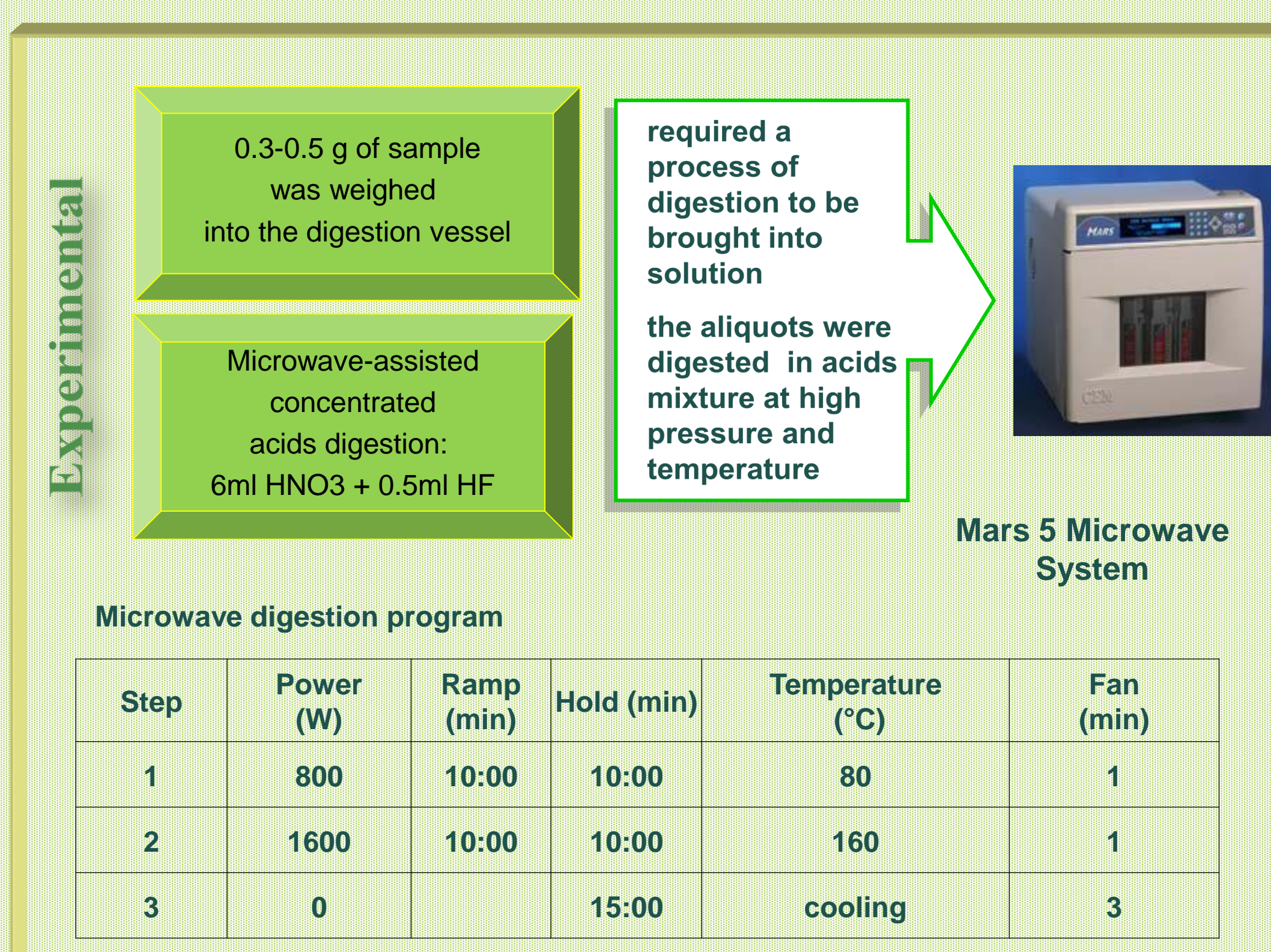
Fourteen cosmetic products were characterized (nine lipstick samples and four make-up samples), collected from the Romanian market, in terms of the content of heavy metals (Cr, Co, Ni, Cu) and toxic metals (As, Pb, Hg, Cd), using inductively coupled plasma mass spectrometry (ICP-MS) as the technique of analysis.

Using these data, the dose of systemic SED exposure was determined, compared with the tolerable limits. SED for Cd ranged from  $2,525 \times 10^{-8}$  -  $2,470 \times 10^{-6}$   $\mu\text{g}/\text{kg}/\text{day}$  (with an average of  $4,571 \times 10^{-7}$ )  $\mu\text{g}/\text{kg}/\text{day}$  for lipsticks and  $0.0001$ - $0.0003$   $\mu\text{g}/\text{kg}/\text{day}$  (with an average of  $0.0002$   $\mu\text{g}/\text{kg}/\text{day}$ ) for make-up.

It should be mentioned that one of the blush samples showed an increased value for SED (156,668), but within the range of 50-500 for PTDI. Otherwise, all SED values were well below tolerable limits, so the cosmetics studied did not pose a health hazard.

## CONCLUSIONS

- Cosmetics are one of the most important sources of releasing heavy metals in the environment. The possibility of skin allergy / contact dermatitis may increase due to the presence of heavy metals in cosmetics. Since the heavy metal's toxicity has been exemplified the problem of environment pollution, it is necessary to know about the all-possible sources. In this context, we have tested the different cosmetic products for the presence of metals, in special toxic metals.
- The concentrations of toxic metals were measured in some commonly used cosmetic products from Romania market with a view to providing information on the risk of exposure to metals from the use of these products. Interpreting how reported metal concentrations in cosmetics may be related to potential health risk can be challenging and it is usually not very easy to determine the contribution of cosmetics to the body burden of metals. Cosmetics safety should be assessed not only by the presence of hazardous contents but also by comparing estimated exposures with health-based standards.
- The risk characterization was performed by calculating the systemic exposure dosage (SED). The results showed that the heavy metals exposure through the usage of studied cosmetic products is below their respective provisional tolerable daily intake (PTDI) or recommended daily intake (RDI) values. The heavy metals levels in the investigated cosmetics present no potential risk to the users' health.



Multi-element analysis by ICP-MS ELAN DRC-e

Cr  
Cd  
Pb  
As  
Hg  
Ni  
Co  
Cu



Table 1. SED results for cosmetic products ( $\mu\text{g}/\text{kg bw} / \text{day}$ )

	Cr	Co	Ni	As	Cd	Hg	Pb	Cu
Lip. 1	$9.853 \times 10^{-6}$	$1.148 \times 10^{-5}$	$1.933 \times 10^{-5}$	$1.050 \times 10^{-6}$	$1.304 \times 10^{-7}$	$4.882 \times 10^{-7}$	$9.786 \times 10^{-6}$	$6.722 \times 10^{-6}$
Lip. 2	$1.211 \times 10^{-5}$	$7.782 \times 10^{-6}$	$1.379 \times 10^{-5}$	$1.250 \times 10^{-6}$	$3.199 \times 10^{-7}$	$7.744 \times 10^{-7}$	$1.875 \times 10^{-5}$	$1.642 \times 10^{-5}$
Lip. 3	$1.720 \times 10^{-5}$	$1.433 \times 10^{-5}$	$2.071 \times 10^{-5}$	$8.797 \times 10^{-7}$	$3.156 \times 10^{-7}$	$2.946 \times 10^{-8}$	$5.370 \times 10^{-6}$	$7.463 \times 10^{-5}$
Lip. 4	$1.029 \times 10^{-5}$	$6.145 \times 10^{-7}$	$3.859 \times 10^{-6}$	$3.283 \times 10^{-7}$	$6.313 \times 10^{-8}$	$1.262 \times 10^{-8}$	$1.940 \times 10^{-6}$	$2.550 \times 10^{-5}$
Lip. 5	$1.728 \times 10^{-5}$	$1.300 \times 10^{-6}$	$8.881 \times 10^{-6}$	$7.029 \times 10^{-7}$	$2.315 \times 10^{-7}$	$3.872 \times 10^{-7}$	$8.334 \times 10^{-6}$	$2.719 \times 10^{-5}$
Lip. 6	$4.812 \times 10^{-5}$	$8.30 \times 10^{-6}$	$3.872 \times 10^{-5}$	$7.745 \times 10^{-7}$	$1.894 \times 10^{-7}$	$2.062 \times 10^{-7}$	$8.027 \times 10^{-6}$	$7.450 \times 10^{-6}$
Lip. 7	$1.049 \times 10^{-5}$	$6.987 \times 10^{-6}$	$1.552 \times 10^{-5}$	$1.245 \times 10^{-6}$	$6.229 \times 10^{-7}$	$8.418 \times 10^{-7}$	$5.977 \times 10^{-6}$	0.016
Lip. 8	$1.129 \times 10^{-5}$	$6.650 \times 10^{-7}$	$1.064 \times 10^{-5}$	$5.261 \times 10^{-7}$	$2.020 \times 10^{-7}$	$3.914 \times 10^{-7}$	$5.846 \times 10^{-6}$	$4.661 \times 10^{-5}$
Lip. 9	$1.897 \times 10^{-5}$	$1.889 \times 10^{-6}$	$2.815 \times 10^{-6}$	$1.767 \times 10^{-7}$	$2.525 \times 10^{-8}$	$7.155 \times 10^{-8}$	$3.085 \times 10^{-6}$	$8.123 \times 10^{-6}$
Lip.10	0.0006	$7.934 \times 10^{-6}$	$3.327 \times 10^{-5}$	$1.956 \times 10^{-5}$	$2.470 \times 10^{-6}$	$1.600 \times 10^{-5}$	0.011	0.0001
Min.	$9.853 \times 10^{-6}$	$6.145 \times 10^{-7}$	$2.815 \times 10^{-6}$	$1.767 \times 10^{-7}$	$2.525 \times 10^{-8}$	$1.262 \times 10^{-8}$	$1.940 \times 10^{-6}$	$6.722 \times 10^{-6}$
Max.	0.0006	$1.433 \times 10^{-5}$	$3.872 \times 10^{-5}$	$1.956 \times 10^{-5}$	$2.470 \times 10^{-6}$	$1.600 \times 10^{-5}$	0.011	0.016
Media	$7.830 \times 10^{-5}$	$6.129 \times 10^{-6}$	$1.675 \times 10^{-5}$	$2.649 \times 10^{-6}$	$4.571 \times 10^{-7}$	$1.921 \times 10^{-6}$	0.0011	0.0016
Y1	3.058	0.026	0.035	0.0013	0.0003	0.0009	0.017	0.028
Y2	0.013	0.002	0.003	0.0013	0.0002	0.0011	0.025	0.047
Y3	0.024	0.001	0.004	0.0007	0.0002	0	0.090	0.104
Y4	0.024	0.015	0.067	0.0030	0.0001	0.0006	0.0095	156.668
Min.	0.013	0.0018	0.003	0.0007	0.0001	0	0.0095	0.028
Max.	3.058	0.026	0.067	0.0030	0.0003	0.0011	0.090	156.668
media	0.780	0.011	0.027	0.0016	0.0002	0.0004	0.035	39.212