

## DEVELOPMENT OF CERTIFIED REFERENCE MATERIAL FOR LEAD, ARSENIC AND MERCURY IN COSMETIC

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**Abstract:** In response to cosmetic safety issue, the accurate measurement of the heavy metals in cosmetic is particularly important. In order to guarantee the traceability and reliability of the related measurement results, the cosmetic certified reference material was developed by NIM, which consisted of the ingredients of basic cream and the appropriate amount of chemical compounds of lead, arsenic and mercury.

**Keywords:** cosmetic, CRM, cream, Pb, As, Hg

### 1. INTRODUCTION

Nowadays, the cosmetics (e.g. lightening cream or lotion, moisturising cream, anti-wrinkle cream, beauty masks etc.) 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.

It is acknowledged that heavy metal impurities in cosmetic products are unavoidable due to the ubiquitous nature of these elements, but should be removed wherever technically feasible. There has been several legislation or standard such as cosmetics directive 76/768/EEC, ISO22716:2007 etc. available now. Different countries have also established relevant domestic regulations or guidelines. For instance, in China, hygienic standard for cosmetics regulates the heavy metal contents in products. The regulated mass fractions ( $w$ ) are  $w \leq 40 \text{ mg}\cdot\text{kg}^{-1}$  for Pb,  $w \leq 10 \text{ mg}\cdot\text{kg}^{-1}$  for As,  $w \leq 1 \text{ mg}\cdot\text{kg}^{-1}$  for Hg respectively in cosmetic products. However, in order to achieve “magic” whiten or anti-aging effects and prevent the product formulations from alteration and degradation, some additives, such as heavy metals (Pb, As, Hg) and preservatives are added on purpose in some cosmetic products. As a result, more and more attention has been paid to the cosmetic safety.

In response to cosmetic safety issue, the accurate measurement of the heavy metals in cosmetic is, therefore, particularly important. NMIs from different countries should establish their chemical metrology traceability system in this area, which include both measurement methods research and certain CRMs development. It should be noted that because the matrix of many cosmetics are complex and the contents of the heavy metals are relatively low, it is a challenging task to measure the analytes with high accuracy and precision.

In this paper, the cosmetic certified reference material was developed, which consisted of the ingredients of basic

cream and the appropriate amount of chemical compounds of Pb, As and Hg.

### 2. PREPARATION OF CREAM CRM

The cream matrix sample was prepared under the guidance of professional technicians. The formula of the cream was carefully chosen to quite match with a real cosmetic. During the cream material was prepared, the appropriate amount of chemical compounds of Pb, As and Hg solutions were added into aqueous phase, and then emulsified, homogenized with violently stirring. After pre-homogeneity investigated, it was packaged into clean brown glass bottles covered with a PE/butyl rubber stopper sealed with aluminium crimp tops.

The homogeneity Pb, As and Hg in the cream sample were fully investigated by ICP-MS after microwave digestion of sample. According to the homogeneity test results, no statistically significant heterogeneity was found based on F test.

### 3. MEASUREMENT METHODS

For the certified values of the cosmetic CRMs, IDMS method was used to determine the amount contents of Pb and Hg in the cream sample.  $^{206}\text{Pb}$  and  $^{202}\text{Hg}$  CRMs were used directly as the enriched isotope spikes during the measurements. Determination of As in the cream sample was performed by means of gravimetric standard addition calibration with  $^{74}\text{Ge}$  as an internal standard analysis using ICP-MS.

### 4. STABILITY MONITOR

These measurement methods were also used to test the stability of Pb, As and Hg in the cream sample.

As it was a kind of new matrix for certified reference materials, there were potential uncertain factors for the sample due to many organic components in the materials. Therefore, we carried out three aspects investigations for the stability monitor of the cream sample over time: 1) Determination of concentrations of Pb, As and Hg; 2) Observation of the cosmetic material state; 3) Water content monitor, including determination of losing of water content, and evaluation its effect on the cream samples.