

## Determination of Bismuth in Cosmetics by HG-AFS

Bismuth compounds are often used in cosmetics as a replacement for lead given its toxicity. Bismuth can be measured by hydride generation atomic fluorescence spectrometer. The sample preparation consists of oxidizing Bi to  $\text{Bi}^{3+}$ , which reacted with  $\text{NaBH}_4$  yields  $\text{BiH}_3$ . The  $\text{BiH}_3$  is moved to the atomizer by the carrier gas and broken down there. The ground state of Bi can be excited by the light by the Bi-HC lamp and the fluorescence signal is measured consequently by photomultiplier tube.

### 1. Major equipment and reagents.

AI3300 atomic fluorescence spectrometer with Se lamp.

#### **NaBH<sub>4</sub> solution:**

Dissolve 10.0g  $\text{NaBH}_4$  in 500 mL (1g/L NaOH) solution.

#### **Bismuth standard solutions:**

Commercial available selenium standard solution (1000ppm), diluted to 1ppm.

#### **Thiourea solution:**

Measure 0.7g thiourea, dissolve in 100mL distilled water.

$\text{Mg}(\text{NO}_3)_2$  solution: L

Measure 500g  $\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ , add distilled to the total volume at 1000mL.

MgO;

Concentrated  $\text{HNO}_3$  (65~68%);

Concentrated HCl (36~38%);

Concentrated  $\text{HClO}_4$

Concentrated  $\text{H}_2\text{SO}_4$

High pure argon (>99.99%)

High pure distilled water.

### 2. Method

Measure 1.00g sample into a 150 mL Erlenmeyer flask, add 10mL  $\text{HNO}_3$  and 5mL  $\text{H}_2\text{O}$ . Place on hot plate and heat until no yellowish smoke comes out, cool down, add 3mL  $\text{HClO}_4$ , 5mL  $\text{H}_2\text{SO}_4$ , and heat on plate again. If the color of the mixture is brown, add more  $\text{HNO}_3$  and repeat heating step until the solution becomes clear. Cool down and add 20mL of distilled water, heat until white smoke comes out and add water again. Repeat this procedure three times and remove the remaining to the volumetric flask and add water to a final volume of 50mL.

### 3. Instrument parameters

Carrier gas	500mL/min
Shield gas	700mL/min
HCL current	100mA
PMT voltage	400V
Integration time	6 s
Pump speed	50 r/min
Reducing reagent solution	2.0% $\text{NaBH}_4$ in 0.1% NaOH

### 4. Results

This method gives:

Detection limit: 0.7ppb,

Recovery rate: 90~118%

Relative standard deviation: 2~7%

