



**MINES AND GEOSCIENCES BUREAU**  
 Cordillera Administrative Region  
 80 Diego Silang Street, Baguio City 2600

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**PROCEDURE IN THE ANALYSIS OF  
 CALCIUM OXIDE (CaO) AND MAGNESIUM (MgO)**

**Document History**

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## PROCEDURE IN THE ANALYSIS OF CALCIUM OXIDE (CaO) AND MAGNESIUM (MgO)

### 1.0 PURPOSE

This procedure details the complete analysis of lime and magnesium composition from solid and water samples.

### 2.0 SCOPE

This procedure is pertinent to solid and water sample/s as per submitted by clients for the analysis of lime (CaO) and magnesium (CaO)

### 3.0 ASSOCIATED DOCUMENTS

- 3.1 Procedure on Receiving of Sample
- 3.2 Procedure on Sampling
- 3.3 Procedure on Preparation of Standards and Reagents
- 3.4 Work Instruction Manual
- 3.5 Manual on Standard Analytical Procedures of the Mines and GeoSciences Bureau Laboratory (Revised Edition; Diliman Quezon City; 2001)

### 4.0 DEFINITION OF TERMS

- 4.1 **Lime** – a caustic highly infusible solid that consists of calcium oxide (CaO) often together with magnesium oxide (MgO)
- 4.2 **Magnesium** - Magnesium is a chemical element with symbol Mg and atomic number 12. It is a shiny gray solid which bears a close physical resemblance to the other five elements in the second column (group 2, or alkaline earth metals) of the periodic table: all group 2 elements have the same electron configuration in the outer electron shell and a similar crystal structure. Magnesium occurs naturally only in combination with other elements, where it invariably has a +2 oxidation state. The metal is now obtained mainly by electrolysis of magnesium salts obtained from brine, and is used primarily as a component in aluminium-magnesium alloys,

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sometimes called magnalium or magnelium. Magnesium is less dense than aluminium, and the alloy is prized for its combination of lightness and strength

- 4.3 **Analysis** - a detailed examination of complex material in order to identify its nature or to determine its elemental composition
- 4.4 **Titration** - Titration, also known as titrimetry, is a common laboratory method of quantitative chemical analysis that is used to determine the unknown concentration of an identified analyte.
- 4.5 **Titrant or titrator is** prepared as a standard solution of known concentration and volume of titrant reacts with a solution of analyte to determine concentration of the unknown composition of the sample.
- 4.6 **Eriochrome Black T (EBT)** is a complexometric indicator that is used in complexometric titrations, e.g. in the water hardness determination process
- 4.7 **Calcein** - used traditionally as a complexometric indicator for titration of calcium ions with EDTA, and for fluorometric determination of calcium.
- 4.8 **Volume** – measurement of amount of liquid. Usually expressed in milliliter and liter.
- 4.9 **Molarity** - amount concentration or substance concentration, is a measure of the concentration of a solute in a solution, or of any chemical species, in terms of amount of substance in a given volume.
- 4.10 **EDTA (EthyleneDiamineTetraacetic Acid)** - is a chemical used for both industrial and medical purposes. It is an aminopolycarboxylic acid and a colorless, water-soluble solid. Its conjugate base is disodium EDTA.

### **5.0 RESPONSIBILITIES**

#### **5.1 Laboratory Technician I/Laboratory Aide**

- 5.1.1 Prepares sample/s for analysis
- 5.1.2 Receives sample/s
- 5.1.3 Releases Report of Analysis

#### **5.2 Chemist III**

- 5.2.1 Receives/ sample/s
- 5.2.3 Analyzes sample/s
- 5.2.4 Computes results of analysis



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5.2.5 Releases Report of Analysis

### **5.3 Chemist IV**

5.3.1 Receives sample/s

5.3.2 Assigns sample/s for preparation for analysis/ses

5.3.2 Analyzes sample/s

5.3.3 Computes result/s

5.3.4 Signs Final Report of Analysis

5.3.5 Releases Report of Analysis

### **5.4 Mining Claims Examiner II**

5.4.1 Receives sample/s

5.4.2 Records essential details of Incoming Sample/s on a Logbook

5.4.3 Analyzes sample/s

5.4.4 Encodes Reports of Analysis/ses

5.4.5 Releases Report of Analysis

### **5.5 Division Chief**

5.5.1 Affixes sign on Report of Analysis from the Laboratory

## **6.0 PROCEDURE OF ANALYSIS**

6.1 Procedure on Receiving of Sample

6.2 Procedure on Sampling

6.3 Chemist III/Chemist IV/Mineral Analyst does the analysis as follows:

6.2.1 Weighs 0.50 gram powdered sample in a 250-ml beaker and cover with watch glass.

6.2.2 Moistens sample with distilled water.

6.2.3 Digests/Decomposes with Hydrochloric acid (HCl). Cool

\* **Note:** If sample is a processed lime (i.e. quicklime), add 10 ml 1:1 Hydrochloric Acid (HCl) and evaporate to syrupy consistency. If sample is an ore (i.e. Limestone), add concentrated Hydrochloric Acid (HCl) and evaporate to dryness.



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6.2.4 Digests/Decomposes again with Hydrochloric Acid (HCl) according to sample description. Cool.

6.2.5 Adds distilled water up to 100 ml mark. Boil.

6.2.6 Filters through Whatman #40 filter paper receiving filtrate in a 250ml volumetric flask.

6.2.7 Washes the beaker, watch glass, and residue with hot water. Cool. Dilute to mark.

6.2.8 Takes a portion of 10 ml sample solution in 250-ml beaker in duplicate.

6.2.9 Adds distilled water up to 100 ml mark.

6.2.10. Adjusts the pH of the solution

6.2.10.1 for Calcium analysis: between 12-13 using 25% Potassium Hydroxide (KOH) solution.

6.2.10.2 for Magnesium analysis: pH 13 using NH<sub>4</sub>OH

6.2.11 Adds a pinch of the indicator

6.2.11.1 for Calcium analysis: add a pinch of Calcein indicator.

6.2.11.2 for Magnesium analysis: add a pinch of EBT

6.12 Titrates with standard EDTA solution until color change occur:

6.2.12.1 for Calcium analysis: from light neon green to light pink color solution

6.2.12.2 for Magnesium analysis: from lavender/pinkish tinge to bluish black color solution

6.13 Computes for

6.13.1 % Lime content as Calcium Oxide (CaO)

$$\% \text{ CaO} = \frac{(\text{Volume EDTA}) (\text{MEDTA})(56.08)}{\text{mgs of sample}} \times 100$$

6.13.2 % Magnesium content as Magnesium Oxide (MgO)



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$$\% \text{ MgO} = \frac{(\text{Volume EDTA}) (\text{MEDTA})(40.31) \times 100}{\text{mgs of sample}}$$

### **7.0 RECORDS**

- 7.1 Assessment of Fees
- 7.2 Request for Analysis
- 7.3 Test Result Worksheet
- 7.4 Report of Analysis
- 7.5 Logbook
  - 7.5.1 Logbook on Details of Incoming Samples (Private and Official)
  - 7.5.2 Logbook of Incoming Samples (for Receiving Samples)
  - 7.5.3 Logbook on Instruments/Apparatus Status Used During Analysis
  - 7.5.4 Logbook on Volumetric Determination of Samples