



## TEST METHODS MANUAL

Laboratory Services Division  
Bureau of Soils and Water Management  
Department of Agriculture

# TM-LSD-04-18

SECTION : SOIL CHEMISTRY

Issue No.: 3

Effective date: July 1, 2022

SUBJECT : **SOIL SALINITY/ALKALINITY - CARBONATE AND BICARBONATE (TITRIMETRIC METHOD)**

Revision No.: 0

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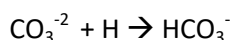
### SCOPE

This method is for the measurement of carbonate and bicarbonate on soils that contain excessive concentrations of either soluble salts or exchangeable sodium or both.

### PRINCIPLE

Soil salinity and sodicity can affect nutrient movement to plants, soil properties, and various soil chemical reactions including pH. In alkaline soils, pH usually increases with an increase in salinity due to the presence of sodium-bicarbonate carbonate. However, it is reported that increasing sodicity in soil does not necessarily yield a rise in pH. Many sodic soils are neutral in reaction, whereas some are even acid in reaction. The strongly alkaline reaction (pH around 10) of most sodic soils is caused by alkalization during which sodium carbonate and bicarbonate are formed. Under less alkaline conditions, i.e. where calcium carbonate dominates the soil mineralogy, soil pH has been shown to drop with an increase in salinity (Lai and Stewart). In calcareous soils, statistical studies suggest a strong inverse relationship between the concentration of soluble  $\text{Ca}^{2+}$  ions and pH.

When the pH value of a sample of natural water or water extract of soil is above 8.4, carbonate ion is present, normally as sodium carbonate. If the sample is titrated with standard mineral acid to a pH of 8.4, the carbonate ion is converted to bicarbonate, and the amount of acid used is a measure of the carbonate present.



### TEST PRECAUTIONS

Titration of carbonate and bicarbonate usually includes small amounts of phosphates, borates and silicates, but are generally negligible.

### EQUIPMENT

- a) Microburette, 10mL capacity
- b) Analytical Balance, precision of 0.0001 g


### LABORATORY WARE

- a) Volumetric Flask, 1000mL and 100mL
- b) Erlenmeyer Flask, 250mL
- c) Beakers
- d) Microburette, 10mL


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- e) Pipettor
- f) Pipettes, graduated

### CHEMICALS AND REAGENTS

- a) Phenolphthalein Indicator. Dissolve 0.1 gram of the powder in 100 mL of 60% ethanol (dilute 63.16 mL of 95% Ethanol to 100 mL with deionized water).
- b) Methyl Orange Indicator. Dissolve 0.01 gram of the powder in 100 mL of water. Filter if necessary.
- c) Sulfuric Acid, 0.05 M. Pipet 2.84 mL of concentrated sulfuric acid into a 1 liter volumetric Flask and dilute to the mark with distilled water.
- d) Standard Sulfuric Acid, 0.005M. Pipet 100 mL of 0.05 M Sulfuric Acid into a 1 liter volumetric flask and dilute to the mark with deionized water. Add 10 mL of 0.05 M Thiomethane (THAM) in triplicate.

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### HEALTH AND SAFETY

<https://forms.gle/RbCgCdA54prTS6oN7>

Wear proper personal protective equipment. Use laboratory coat, close shoes, gas mask or dust masks and appropriate gloves when performing chemical analysis to mitigate the harmful effects of exposure on chemicals.

For Laboratory Use: always check the SDS and COA for each delivered chemical as to confirm if it is compliant with the specifications provided.

Observe careful and proper handling of chemicals when using inorganic salts, strong alkali bases, strong acids and oxidizing agents. Potential direct body contact (e.g. ingestion, inhalation) may cause severe irritation and inflammation to the skin, eyes, respiratory and digestive tracts. Severe exposure to these corrosive substances may cause serious health damage or death.

Thank you!

Avoid mixing incompatible chemicals to reduce risks of fire and explosion inside the laboratory. Keep locked up and away from incompatibles such as moisture.

### PROCEDURE

#### Standardization of 0.005 M Sulfuric Acid with THAM

1. Weigh 0.060 grams of NIST traceable Tris(hydroxymethyl) aminomethane (THAM) in triplicate and transfer to a 250 mL Erlenmeyer flask.
2. Add 40 mL of deionized water and stopper the flasks.
3. Swirl gently until the reagent dissolves.

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