

SCHEDULE 2

METHODS OF ANALYSIS

PART II

14.

DETERMINATION OF MANGANESE

SCOPE AND FIELD OF APPLICATION

1. This method is applicable to all fertilisers.

PRINCIPLE

2. The sample is ashed and dissolved in dilute hydrochloric acid or, if it contains no organic substances, it is dissolved directly in dilute hydrochloric acid. The solution is diluted and the manganese content of the extract is determined by atomic absorption spectrophotometry.

REAGENTS

3.—(3.1) Hydrochloric acid ($d=1.18\text{ g/ml}$).

(3.2) Hydrochloric acid, 6 N solution.

(3.3) Hydrochloric acid, 0.5 N solution.

(3.4.1) Manganese solution (1) (stock):

weigh to the nearest 0.001 g, 1 g pure manganese, dissolve in 25 ml 6 N hydrochloric acid solution (3.2) and dilute to 1 litre with water. 1 ml of this solution = 1,000 μ of manganese (Mn).

(3.4.2) Manganese solution (dilute):

dilute 10 ml of stock solution (3.4.1) to 1 litre with water. 1 ml of this solution = 10 μ of manganese.

(3.5) Lanthanum chloride solution:

dissolve 12 g lanthanum oxide in 150 ml water, add 100 ml 6 N hydrochloric acid solution (3.2) and dilute to 1 litre with water.

APPARATUS

4.—(4.1) Atomic absorption spectrophotometer with a manganese lamp (279.5 nm).

PREPARATION OF SAMPLE

5. See Method 1.

PROCEDURE

Preparation of the solution for analysis

(1) Commercially available standard manganese solution may be used.

Status: This is the original version (as it was originally made). This item of legislation is currently only available in its original format.

Preparation of the solution for analysis

In the absence of organic matter

- (6.1.1) Weigh to the nearest 0.001 g, 5 g of the prepared sample, place it in a 400 ml beaker, add carefully 5 ml hydrochloric acid (3.1) (there may be a vigorous reaction due to carbon dioxide formation). Add more hydrochloric acid, if necessary. When effervescence has stopped, evaporate to dryness on a steam bath, stirring occasionally with a glass rod. Add 15 ml 6 N hydrochloric acid solution (3.2) and 120 ml water. Stir with the glass rod, which should be left in the beaker, and cover the beaker with a watch glass. Boil the solution gently until dissolution appears complete and then filter through a filter paper(2) into a 250 ml graduated flask. Wash the beaker and filter with 5 ml of hot 6 N hydrochloric acid solution (3.2) and twice with boiling water. Cool and make up to the mark with water. (The hydrochloric acid concentration of this solution should be about 0.5 N.)

In the presence of organic matter

- (6.1.2) Weigh to the nearest 0.001 g, 5 g of the prepared sample into a silica or platinum crucible and place the crucible into a cold muffle furnace. Close the furnace and gradually raise the temperature to 450-475°C over about 90 minutes. Maintain this temperature for at least 16 hours and then open the furnace and allow the crucible to cool. Moisten the ash with water and transfer it into a 250 ml beaker. Wash the crucible with about 5 ml hydrochloric acid (3.1) and add the latter slowly and carefully to the beaker (there may be a vigorous reaction due to carbon dioxide formation). If necessary, add more hydrochloric acid (3.1) with stirring, until all effervescence has stopped. Evaporate the solution to dryness, occasionally stirring with a glass rod. Add 15 ml of 6 N hydrochloric acid solution (3.2) and 120 ml water. Stir with the glass rod, which should be left in the beaker, and cover with a watch glass. Boil the solution gently until dissolution appears complete and filter through a filter paper(2) into a 250 ml graduated flask. Wash the beaker and filter with 5 ml of hot 6 N hydrochloric acid solution (3.2) and twice with boiling water. Cool and make up to the mark with water. (The hydrochloric acid concentration of this solution should be about 0.5 N.)

Blank solution

- (6.2) Prepare a blank solution from which only the sample has been omitted and allow for this in the calculation of the final results.

Determination

Preparation of sample and blank test solutions

- (6.3.1) Dilute the sample solutions (6.1.1 or 6.1.2) and the blank test solution (6.2), with 0.5 N hydrochloric acid solution (3.3) to a concentration within the optimal measuring range of the spectrophotometer. The final solution must contain 10% (V/V) of the lanthanum chloride solution (3.5).

Preparation of the calibration solutions

- (6.3.2) By diluting the standard solution (3.4.2) with 0.5 N hydrochloric acid solution (3.3) prepare at least 5 standard solutions of increasing concentration corresponding to the optimal measuring range of the spectrophotometer. The final solutions must contain 10% (V/V) of the lanthanum chloride solution (3.5).

(2) Whatman 541 or equivalent.

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Measurement

(6.4) Set up the spectrophotometer (4.1), at a wave length of 279.5 nm using an oxidising air-acetylene flame. Spray successively, in triplicate, the standard solutions (6.3.2), the sample solution and the blank test solution (6.3.1), washing the instrument through with distilled water between each spraying. Plot the calibration curve using the mean absorbances as the ordinates and the corresponding concentrations of manganese $\mu\text{g/ml}$ as the abscissae. Determine the concentration of manganese in the final sample and blank solutions by reference to the calibration curve.

EXPRESSION OF RESULTS

7. Calculate the manganese content of the sample taking into account the weight of the test sample and the dilutions carried out in the course of the analysis. Express the result either as a percentage or as mg/kg .