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Fertilizers, soil conditioners and beneficial substances — Determination of ammonium citrate, disodium-EDTA soluble phosphorus and potassium by ICP-OES in inorganic fertilizers

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Principle **1**
5 Reagents **2**
6 Apparatus **3**
7 Sampling and sample preparation **4**
8 Procedure **4**
8.1 Extraction of P and K 4
8.2 Instrument conditions 4
8.3 Preparation of standards 5
8.3.1 Standards from reagent salts 5
8.3.2 Standards from commercial stock solutions 5
8.3.3 Calibration and wavelength splitting 7
8.3.4 Analysis 7
8.4 Quality control 7
8.4.1 Reference material 7
8.4.2 Duplicates 7
9 Calculations and expression of results **7**
9.1 Calculations 7
9.2 Precision 8
9.2.1 General 8
9.2.2 Repeatability, *r* 9
9.2.3 Reproducibility, *R* 9
10 Test report **10**
Annex A (informative) **Ring test background and results** **11**
Annex B (informative) **Critical factors** **24**
Bibliography **26**

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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This document was prepared by Technical Committee ISO/TC 134, *Fertilizers, soil conditioners and beneficial substances*.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Inductively coupled plasma-optical emission spectrometer (ICP-OES) instrumentation is becoming increasingly popular in fertilizer testing laboratories (see References [1], [2] and [3]). Because these instruments are automated and can determine multiple elements simultaneously, they offer significant productivity gains. Also, the method does not generate hazardous wastes. The ammonium citrate disodium etheylenediamine tetraacetic acid (EDTA) organic solvent and samples containing high phosphorus and/or potassium concentrations pose some analytical challenges for the instrumentation, which must be addressed. Due to the increasing use of this technology, this document was created.

For organic fertilizers and for liquid fertilizers containing phosphorous acid (H_3PO_3 or phosphite), an alternative method that specifically measures PO_4 is preferred since the ICP-OES measures all elemental phosphorus, which can result in a high bias for these types of fertilizer materials (see Reference [1]).

Due to the inability of the ICP-OES to differentiate between phosphorus species, under normal operating conditions, this method is primarily intended for fertilizer materials in which the source(s) of phosphorus is known. While this document can be used with minimal bias, the repeatability and reproducibility is not consistent with other standards routinely used for inspection at this time, such as EN 15959[4], EN 15477[5] or ISO 22018[6].

As a result, this document is intended for screening purposes, where a large number of fertilizer phosphorus and potassium results must be obtained as efficiently as possible.

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Fertilizers, soil conditioners and beneficial substances — Determination of ammonium citrate, disodium-EDTA soluble phosphorus and potassium by ICP-OES in inorganic fertilizers

1 Scope

This document specifies an inductively coupled plasma-optical emission spectrometer (ICP-OES) method for the determination of the ammonium citrate, disodium-etheylenediamine tetraacetic acid (EDTA) soluble phosphorus and potassium content in fertilizer extract solutions.

This document is applicable to all inorganic fertilizer products, whether compound or complex fertilizer products or blends thereof, and straight concentrated fertilizer products.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8157, *Fertilizers, soil conditioners and beneficial substances — Vocabulary*

ISO 14820-1, *Fertilizers and liming materials — Sampling and sample preparation — Part 1: Sampling*

ISO 14820-2, *Fertilizers and liming materials — Sampling and sample preparation — Part 2: Sample preparation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8157 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Principle

Phosphorus and potassium contained in inorganic fertilizers that is soluble in a heated, dilute ammonium citrate and disodium-EDTA solvent is determined. The neutral ammonium citrate is the primary solvent for phosphate, while the EDTA is mainly included to chelate calcium, magnesium and other soluble metallic cations to minimize their interaction with phosphate and eliminate the water-wash step (see Reference [7]). Also, since this solvent is a relatively weak solution, it extracts primarily the highly soluble potassium compounds and has been used for fertilizer potassium determination since 1993. It compares very favourably with other soluble potash solvents such as ammonium oxalate. The user of this document is not obligated to determine both phosphorus and potassium; however, one of the main advantages of this approach is to measure both simultaneously in a single extract in a more productive, cost-effective way.

The resulting extract solution is tested by ICP-OES to quantify the levels of phosphorus and potassium, which can be converted to their equivalent P_2O_5 and K_2O concentrations. The extract solution is

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