
**Soil quality — Determination of effective
cation exchange capacity (CEC) and
exchangeable cations using a
hexammincobalt trichloride solution**

*Qualité du sol — Détermination de la capacité d'échange cationique
(CEC) effective et des cations échangeables à l'aide d'une solution de
trichlorure de cobaltihexammine*



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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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Soil quality — Determination of effective cation exchange capacity (CEC) and exchangeable cations using a hexamminecobalt trichloride solution

1 Scope

This International Standard specifies a method for the determination of the cation exchange capacity (CEC) and the content of exchangeable cations (Al^{3+} , Ca^{2+} , Fe^{2+} , K^+ , Mg^{2+} , Mn^{2+} , Na^+) in soils using a hexamminecobalt trichloride solution as extractant.

NOTE As the pH of a soil suspension in the hexamminecobalt trichloride solution is close to the pH of the suspension in water, this method is considered to give the effective CEC, i.e. the CEC at the soil pH.

This International Standard is applicable to all types of air-dried soil samples which have been prepared in accordance with ISO 11464.

References and results of the comparison with other methods (barium chloride, ammonium acetate) are given in Annex A.

2 Normative references

The following referenced documents are indispensable for the application 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 11464, *Soil quality — Pretreatment of samples for physico-chemical analysis*

3 Principle

Cations retained by a soil sample are exchanged with the hexamminecobalt ions of an aqueous solution, with shaking for $60 \text{ min} \pm 5 \text{ min}$ at a temperature of $20 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$. The CEC is obtained by difference between the initial quantity of hexamminecobalt in solution and the quantity remaining in the extract after the exchange reaction. The measurement of hexamminecobalt concentration in the extract can be performed by direct spectrophotometric measurement, or by the determination of total ammonium nitrogen or total cobalt concentrations.

The quantities of exchanged cations are determined on the same extract using spectrometric methods, such as inductively coupled plasma atomic emission spectrometry (ICP-AES).

NOTE 1 Exchangeable acidity can also be measured in the hexamminecobalt extract.

NOTE 2 When exchangeable cations are held in micropores into which ammonium ions but not hexamminecobalt ions can enter, the CEC and exchangeable cation values determined with this method may be smaller than those determined by the ammonium acetate method. This has been observed in some soils containing allophane and imogolite, for example soils developed on volcanic rocks.