

ICS 13.080
CCS Z 18

HJ

**INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

HJ 889-2017

**Soil quality. Determination of cation exchange capacity(CEC).
Hexamminecobalt trichloride solution/spectrophotometric
method**

土壤 阳离子交换量的测定 三氯化六氨合钴浸提-分光光度法

(English Translation)

Issued on: December 17, 2017

Implemented on: February 1, 2018

Issued by: Ministry of Ecology and Environment

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Foreword

In order to carry out "Environmental Protection Law of the People's Republic of China", protect the environment and protect human health, standardize the cation Exchange volume measurement method), the development of this standard.

This standard specifies the determination of the amount of cation exchange of soil hexachloride trichloride cobalt extraction - spectrophotometry.

This standard is released for the first time.

This standard by the Environmental Protection Department of Environmental Monitoring Division and Science and Technology Standards Division to develop.

This standard was drafted. Yangzhou City Environmental Monitoring Center Station.

This standard verification unit. Suzhou City Environmental Monitoring Center Station, Taizhou City Environmental Monitoring Center Station, Yizheng City Environmental Monitoring Station, Yangzhou University Test Center, Suzhou City, China Testing Technology Co., Ltd. and Suzhou State Environmental Monitoring Co., Ltd..

This standard MEP approved on December 17, 2017.

This standard since February 1, 2018 implementation.

This standard is interpreted by the MEP.

1 Determination of soil cation exchange rate hexamine cobalt trichloride extraction

-Spectrophotometry

1 scope of application this standard specifies the determination of the amount of cation

exchange of soil hexachloride trichloride cobalt extraction - spectrophotometry.

This standard applies to the determination of cation exchange capacity in soil.

When the sample volume of 3.5 g, the volume of the extract was 50.0 ml, the use of 10 mm optical path cuvette, the standard determination of Yang the method detection limit of ion exchange was 0.8 cmol/kg and the lower limit of determination was 3.2 cmol/kg.

2 Normative references

This standard references the following documents or the terms. For undated references, the effective version applies to this book standard.

HJ 613 Determination of soil dry matter and moisture Gravimetric method HJ/T 166 Soil Environmental Monitoring Technical Specifications

3 Terms and definitions

Cation exchange capacity (CEC) Under the conditions specified in this standard, the total amount of various cations adsorbed by soil colloids, known as the cation exchange capacity, Expressed in cmol/kg. Since the pH value of the ammonium hexachloride cobalt soil suspension is close to the pH value of the aqueous suspension, the cation exchange capacity measured by the method is the amount of available cation exchange.

4 Method principle

Under the condition of $(20 \pm 2) ^\circ\text{C}$, ammonium hexachloride trichloride solution was used as leaching solution to extract soil, the cation in the soil Hexamine cobalt trichloride exchange down into the solution. Ammonium trichloride cobalt has a characteristic absorption at 475 nm, absorbance and Concentration is proportional to the difference between the absorbance before and after leaching liquid extract, calculate the amount of soil cation exchange.

5 Interference and elimination

When more dissolved organic matter in the sample, the organic matter also has absorption at 475 nm, affecting the amount of cation exchange Set the result. Absorbance can be measured simultaneously at 380 nm to correct for interference with soluble organic matter.

Assuming that A_1 and A_2 are absorbances measured at 475 nm and 380 nm, respectively, the sample is calibrated for absorbance (A) is. $A = 1.025A_1 - 0.205A_2$.

26 Reagents and materials

Unless otherwise specified, the analysis of the use of analytical reagents in line with national standards (experimental water conductivity of less than 0.5 $\mu\text{S}/\text{cm}$ of distilled or deionized water).

6.1 hexamine cobalt trichloride $[\text{Co}(\text{NH}_3)_6\text{Cl}_3]$. excellent grade pure.

6.2 Hexamine cobalt trichloride solution. $c[\text{Co}(\text{NH}_3)_6\text{Cl}_3] = 1.66 \text{ cmol/L}$.

Accurately weigh 4.458 g hexamine cobalt (6.1) dissolved in water, set the volume to 1000 ml, 4 °C low temperature preservation.

7 instruments and equipment

7.1 Spectrophotometer. Equipped with a 10 mm pathlength cuvette.

7.2 oscillator. oscillation frequency can be controlled at 150 ~.200 times/min.

7.3 Centrifuges. up to 4000 rpm with 100 ml round plastic centrifuge tubes (with sealing cap).

7.4 Analytical Balance. Sense of 0.001 g and 0.01 g.

7.5 nylon sieve. aperture 1.7 mm (10 mesh).

7.6 General laboratory commonly used instruments and equipment.

8 samples

8.1 Sample Collection and Storage Soil samples should be collected and stored according to HJ/T 166. Soil samples collected, you should use wood knives, wood chips or poly Ethylene sampling tools, soil samples stored in bags or plastic bags.

8.2 Sample Preparation Dry the sample over a nylon sieve (7.5) and mix well. Weigh 3.5 g of the sample after mixing, placed in 100 ml centrifuge tube , Add 50.0 ml hexamine cobalt hexachloride solution (6.2), tighten the centrifuge tube seal cover, placed on the oscillator (7.2) Shake at $(20 \pm 2)^\circ\text{C}$ for (60 ± 5) min and adjust the oscillation frequency so that the soil leachate mixture is shaken in suspension. Centrifuge at 4000 r/min for 10 min and collect the supernatant in the cuvette. The analysis was completed within 24 h.

8.3 Preparation of blank samples the experimental water was used instead of soil and the laboratory blank samples were prepared according to the same procedure as the preparation of the sample (8.2).

9 Analysis steps

9.1 The establishment of standard curve Separately, take 0.00 ml, 1.00 ml, 3.00 ml, 5.00 ml, 7.00 ml, 9.00 ml hexamine cobalt chloride solution (6.2) in six 10 ml colorimetric tubes, respectively, diluted with water to the mark, the concentration of hexamine cobalt trichloride

were 0.000 cmol/L, 0.166 cmol/L, 0.498 cmol/L, 0.830 cmol/L, 1.16 cmol/L and 1.49 cmol/L. In 10 mm cuvette in at a wavelength of 475 nm, absorbance was measured separately with water as a reference. A standard series of solutions of hexamine cobalt chloride solution 3 concentration (cmol/L) as the abscissa, with its corresponding absorbance as the ordinate, the establishment of a standard curve.

9.2 Sample Determination the same procedure as in the standard curve (9.1) was followed to determine the sample (8.2).

9.3 Blank test

The blank sample (8.3) was measured according to the same procedure as the sample measurement (9.2).

10 Results Calculation and Presentation

10.1 Calculation Results in the sample, calculate according to formula (1).

CEC =

dmwmb

VAA

xx- 3) (0 (1)

Where. CEC - soil sample cation exchange capacity, cmol/kg;

A0 - blank sample absorbance;

A - sample absorbance or absorbance correction;

V-- volume of extract, ml;

3 - [Co (NH₃)₆]³⁺;

b - standard curve slope;

m - sample size, g;

wdm - soil samples dry matter content,%.

10.2 results indicated when the test result is less than 10 cmol/kg, keep one after the decimal point. When the test result is 10 cmol/kg or more when retaining the three significant figures.

11 precision and accuracy 11.1 precision Six laboratories with cation exchange capacity of 5.5 cmol/kg, 17.8 cmol/kg, 29.4 cmol/kg of uniform sample Repeated determination of 6 times, the relative standard deviation in the laboratory were. 4.1% ~ 5.6%, 3.1% ~ 5.0%, 1.7% ~ 3.6%; The relative standard deviations of laboratory were 7.9%, 4.8%, 2.0% respectively; The repeatability limit was 0.8 cmol/kg, 2.1 cmol/kg, 2.5 cmol/kg;