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NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA

GB 1886.228-2016

**National Food Safety Standard – Food Additives –
Carbon Dioxide**

食品安全国家标准 食品添加剂 二氧化碳

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National Food Safety Standard – Food Additives – Carbon Dioxide

1 Scope

This Standard is applicable to the food additive of carbon dioxide that takes the carbon dioxide gas as the raw material produced by produced alcohol fermentation, carbonate calcination, synthetic ammonia, ethylene catalytic oxidation and coal gasification processes, and then produced through the processes of extraction, purification, drying, cooling, pressurization, etc.

2 Molecular Formula and Relative Molecular Mass

2.1 Molecular formula

CO₂

2.2 Relative molecular mass

44.01 (according to 2013 international relative atomic mass)

3 Technical Requirements

3.1 Sensory requirements

Sensory requirements shall comply with the provisions of Table 1.

Appendix A

Test Method

A.1 Warning

Some reagents used in the test methods of this standard are toxic or corrosive, and appropriate safety and protective measures should be taken during operation.

A.2 General provisions

The reagents and water used in this standard refer to analytical reagents and the Class-III water specified in GB/T 6682 when other requirements are not specified. The used solution refers to an aqueous solution when it is not specified which solvent is used for preparation.

A.3 Identification test

A.3.1 Reagents and materials

Acetic acid solution: 1+4.

A.3.2 Identification method

When carbon dioxide gas is injected into the barium hydroxide solution, a white precipitate shall be produced, which bubbles and dissolves in the acetic acid solution.

A.4 Determination of carbon dioxide (CO₂) content

A.4.1 Summary of method

Using potassium hydroxide solution to absorb carbon dioxide, the ratio of the difference between the gas volume before and after absorption and the gas volume before absorption is the carbon dioxide content.

A.4.2 Reagents and materials

Potassium hydroxide solution: 300g/L.

A.4.3 Instruments and equipment

The L-type carbon dioxide content analyser is shown in Figure A.1. The volume of the absorber (D-A-C) is 100mL±0.5mL, among which the minimum graduation value of (E) at 99mL~100mL is 0.05mL, and the error does not exceed ±0.02mL.

amount of residual gas that has not been absorbed) from E. When the content cannot be read at E, turn the analyser back; measure the residual gas diameter from the F spherical ruler; and check the "carbon dioxide content-scale comparison table" given by the L-type carbon dioxide content analyser, and get the measured carbon dioxide content.

The test results are based on the arithmetic mean of the parallel determination results; and the absolute difference between the two independent determination results obtained under repeatability conditions is no more than 0.02%.

A.5 Determination of moisture

A.5.1 Method-I - Capacitance Method

A.5.1.1 Summary of method

The polymer film or oxide coating with moisture-sensitive properties is a component of the capacitor. In a gas environment, it absorbs moisture and causes its output capacitance to change. Through data conversion, the direct relationship between the output capacitance value and the trace water content in the gas is established; and the absolute value of the water content in the gas is obtained.

A.5.1.2 Apparatus

Moisture analyser: Humidity sensitive capacitance sensor with acid resistance, gas circuit, data conversion and display system, the detection limit shall be no greater than 2 μ L/L.

A.5.1.3 Analysis procedures

A.5.1.3.1 Calibration of the instrument

The moisture analyser shall be calibrated. The calibration data shall cover at least the control points; control 200% points of the indicators, and control 50% points of the indicators.

A.5.1.3.2 Determination of gas specimens

The gas carbon dioxide with suitable pressure and flow rate is introduced into the moisture analyser through the metal or PTFE tube with a smooth inner wall; and the measurement results are determined and recorded.

A.5.1.3.3 Determination of liquid specimens

After the liquid carbon dioxide is vaporized and decompressed, it is introduced into the moisture analyser through a metal or PTFE tube with a smooth inner wall; and the measurement result is determined and recorded.

A.5.1.3.4 Calibration of readings

Use the instrument calibration result to correct the readings, and the corrected value is the moisture content value.

A.5.2 Method-II - dew point method

The calibration of the instrument and the correction of the readings are the same as those in A.5.1, and determined according to the test method given in GB/T 5832.2.

A.6 Determination of oxygen (O₂)

Use an acid fuel cell or an applicable oxygen sensor to determine in accordance with the method specified in GB/T 6285. Liquid carbon dioxide shall be sampled and determined after gasification.

A.7 Determination of carbon monoxide (CO)

Determine according to the method specified in GB/T 8984; and the liquid carbon dioxide shall be sampled and determined after gasification.

A.8 Determination of grease**A.8.1 Summary of method**

Use glacial acetic acid to dissolve the remaining grease after the carbon dioxide is evaporated. After adding water, the acetic acid solution becomes turbid; and the turbidity is analysed and quantified with the standard turbidity stage tube.

A.8.2 Reagents and materials

A.8.2.1 Glacial acetic acid.

A.8.2.2 Compressor oil (industrial oil).

A.8.3 Apparatus

A.8.3.1 Sampling scale: the weighing accuracy is no less than 2% of the sampling volume.

A.8.3.2 Analytical balance: Sensitivity of 0.0001g.

A.8.3.3 Beaker: 200mL~500mL.

A.8.4 Analysis procedures**A.8.4.1 Preparation of oil standard solution**

(CH₃CHO), ethylene oxide (CH₂CH₂O), vinyl chloride (CH₂CHCl)

A.13.1 Summary of method

Determine by gas chromatography; the components to be tested in the sample are separated by the chromatographic column; enter the detector for detection. Be qualitative based on the retention time; and be quantitative by the external standard method.

A.13.2 Apparatus

Gas chromatograph: Equipped with hydrogen flame ionization detector or equivalent detector; the detection limit of benzene is no more than $5 \times 10^{-3} \mu\text{L/L}$.

A.13.3 Reference chromatographic conditions

A.13.3.1 Chromatographic column

Chromatographic column 1: A glass or stainless-steel column with a length of 3m and an inner diameter of 3mm; packed with a polymer porous pellet (GDX-104) stationary phase with a diameter of 0.17mm~0.25mm; or a column with equivalent performance; used for the separation of organic matters.

Chromatographic column 2: A glass or stainless-steel column with a column length of 3m and an inner diameter of 3mm; packed with a diatomaceous earth support of 0.17mm~0.25mm in diameter; coated with 10% polyethylene glycol 20M stationary phase; or a column with equivalent performance; used for the separation of organic matters.

Chromatographic column 3: A glass or stainless-steel column with a length of 2m and an inner diameter of 3mm; packed with 10% (mass fraction) of SE-30 siloxane stationary liquid, coated with a 101-white carrier with a diameter of 0.17mm~0.25mm; or a chromatographic column with equivalent performance; used for the separation of trace benzene series impurities.

Refer to Appendix B for the relative retention values of corresponding components in carbon dioxide on different chromatographic columns.

A.13.3.2 Carrier gas

Nitrogen: The purity is no less than 99.999% (φ); and the total hydrocarbon content is less than $0.1 \times 10^{-6} \mu\text{L/L}$; and the flow rate is about 30mL/min.

A.13.3.3 Combustion gas

High-purity hydrogen: Complies with the provisions of GB/T 7445; with a flow rate of about 30mL/min.

dioxide shall be sampled and measured after gasification.

A.14.2 Calculation of result

The volume fraction of ammonia (NH₃), φ_7 , in $\mu\text{L/L}$, shall be calculated according to Formula (A.10):

$$\varphi_7 = \frac{(m_6 - m_7) \times 1.315}{V_4} \quad \dots\dots\dots (A.10)$$

Where:

m_6 – mass of ammonia in the specimen solution, in μg ;

m_7 – mass of ammonia in the reagent blank, in μg ;

1.315 – conversion factor between the mass and volume of ammonia;

V_4 – sampling volume converted in the standard state, in L.

The test results are based on the arithmetic mean of the parallel determination results. The absolute difference between two independent determination results obtained under repeatability conditions is no more than 10% of the arithmetic mean.

A.15 Determination of hydrogen cyanide (HCN)

Safety warning: The potassium cyanide reagent used in this method is highly toxic, and its use, storage and waste liquid treatment shall be implemented in accordance with the national regulations on dangerous goods.

A.15.1 Analysis procedures

Determine according to the method specified in GBZ/T 160.29; solid and liquid carbon dioxide shall be sampled and measured after gasification.

A.15.2 Calculation of result

The volume fraction of hydrogen cyanide (HCN), φ_8 , in $\mu\text{L/L}$, shall be calculated according to Formula (A.11):

$$\varphi_8 = \frac{(m_8 - m_9) \times 0.8287}{V_5} \quad \dots\dots\dots (A.11)$$

Where:

m_8 – mass of hydrogen cyanide in the specimen solution, in μg ;

m_9 – mass of hydrogen cyanide in the reagent blank, in μg ;

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