INTERNATIONAL STANDARD

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Meat and meat products — Measurement of pH — Reference method

Viande et produits à base de viande — Mesurage du pH — Méthode de référence

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 2917 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*, Subcommittee SC 6, *Meat and meat products*.

This second edition cancels and replaces the first edition (ISO 2917:1974), which has been technically revised.

Meat and meat products — Measurement of pH — Reference method

1 Scope

This International Standard specifies the reference method for measuring the pH of all kinds of meat and meat products, including poultry.

The method is applicable to products which may be homogenized and also to non-destructive measurements on carcass meat, quarters and muscles.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, this publication do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative documents referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3696, *Water for analytical laboratory use — Specification and test methods*.

3 Term and definition

For the purposes of this International Standard, the following term and definition apply.

3.1
pH of meat and meat products
result of measurements performed in accordance with the procedure specified in this International Standard

4 Principle

The potential difference is measured between a glass electrode and a reference electrode, which are placed in a sample or a sample extract of the meat or meat product.

5 Reagents

Use only reagents of recognized analytical grade, unless otherwise specified.

5.1 Water, complying with at least grade 3 in accordance with ISO 3696.

The water used for preparing the buffer solutions should in addition be freshly boiled or scrubbed with carbon-dioxide-free nitrogen to remove carbon dioxide.

5.2 Buffer solutions, for calibrating the pH-meter.

The following buffer solutions may be used:

a) commercially available ready-to-use buffer solutions with a guaranteed pH value, accurate to at least 0,01 pH units;

b) buffer solutions prepared from commercially available dry mixtures;

c) self-prepared buffer solutions as described in 5.2.1 to 5.2.3.

5.2.1 Buffer solution, pH = 4,00 at 20 °C.

Dry potassium hydrogen phthalate at 110 °C to 130 °C until constant mass. Cool to ambient temperature in a desiccator.

Dissolve 10,21 g of the dried potassium hydrogen phthalate in about 800 ml of water in a 1 000 ml one-mark volumetric flask. Dilute to the mark with water and mix.

The pH of this solution is 4,00 at 0 °C and at 10 °C, and 4,01 at 30 °C.

5.2.2 Buffer solution, pH = 6,88 at 20 °C.

Dry potassium dihydrogen phosphate (KH_2PO_4, anhydrous) and disodium hydrogen phosphate (Na_2HPO_4, anhydrous) at 110 °C to 130 °C until constant mass. Cool to ambient temperature in a desiccator.

Dissolve 3,40 g of the dried KH_2PO_4 and 3,55 g of the dried Na_2HPO_4 in about 800 ml of water in a 1 000 ml one-mark volumetric flask. Dilute to the mark with water and mix.

The pH of this solution is 6,98 at 0 °C, 6,92 at 10 °C, and 6,85 at 30 °C.

The solution can be stored in a refrigerator for up to 3 months.

5.2.3 Buffer solution, pH = 5,45 at 20 °C.

Dissolve 7,01 g of citric acid monohydrate ($C_6H_8O_7 \cdot H_2O$) in about 500 ml of water in a 1 000 ml one-mark volumetric flask. Add 375 ml of sodium hydroxide solution (5.3), dilute to the mark with water and mix.

5.3 Sodium hydroxide solution, c(NaOH) = 1,0 mol/l.

Dissolve 40 g of sodium hydroxide in water and dilute to 1 000 ml.

5.4 Potassium chloride solution, c(KCl) = 0,1 mol/l.

Dissolve 7,5 g of potassium chloride in water in a 1 000 ml one-mark volumetric flask. Dilute to the mark with water and mix.

If muscle meat in prerigor condition is to be measured, glycolysis is stopped by adding 925 mg iodoacetic acid per litre of solution. Adjust the pH of the solution with sodium hydroxide solution (5.3) to 7,0.

5.5 Cleaning liquids.

5.5.1 Diethyl ether, saturated with water.

5.5.2 Ethanol (C_2H_5OH), 95 % volume fraction.

6 Apparatus

Usual laboratory apparatus and, in particular, the following.

6.1 Mechanical or **electrical equipment,** capable of homogenizing the laboratory sample.

This includes a high-speed rotational cutter, or a mincer fitted with a plate with apertures not exceeding 4,0 mm in diameter.

6.2 pH-meter, with digital or analog display, accurate to the nearest 0,01 pH unit.

If a temperature-correction system is not provided, the scale shall apply to measurements at 20 °C. The device shall be sufficiently protected from induction currents, due to external electric charges or currents, during the measurements.

6.3 Combined electrode, in which the glass indicator electrode and the Ag/AgCl or $Hg/HgCl_2$ reference electrode are joined in one shaft.

The glass electrode may be spherical, conical, cylindrical or needle-shaped.

NOTE A separate glass and reference electrode with an easily restorable liquid junction may also be used, in order to cope with problems caused by greasy samples.

6.4 Shaft homogenizer, capable of operating at a rotational frequency of 20 000 min^{-1}.

6.5 Magnetic stirrer.

7 Sampling

Sampling is not part of the method specified in this International Standard. A recommended sampling method is given in ISO 3100-1 [1].

It is important that the laboratory receive a sample which is truly representative and has not been damaged or changed during transport or storage.

Proceed from a representative sample of at least 200 g.

8 Preparation of test sample

8.1 Non-destructive measurements

Select a representative point of the sample for measurement of the pH. Proceed in accordance with clause 9.

8.2 Destructive measurements

Homogenize the laboratory sample with the appropriate equipment (6.1). Take care that the temperature of the sample material does not rise above 25 °C. If a mincer is used, pass the sample at least twice through the equipment.

Fill a suitable airtight container with the prepared sample. Close the container and store in such a way that deterioration and change in composition are prevented. Analyse the sample as soon as practicable, but always within 24 h after homogenization.

9 Procedure

NOTE If it is required to check whether the repeatability limit is met (11.2), carry out two single determinations in accordance with 9.2 to 9.4.

9.1 Calibration of the pH-meter

Calibrate the pH-meter (6.2), using two buffer solutions with pH values spanning the expected sample pH value, at the temperature of measurement, while stirring with the magnetic stirrer (6.5).

If the pH-meter does not include a temperature-correction system, the temperature of the buffer solution shall be within the range (20 ± 2) °C.

For homogenized products, proceed in accordance with 9.2.

For non-destructive measurements, proceed in accordance with 9.4.

9.2 Test portion

Homogenize a certain mass of the prepared test sample (see 8.2) in 10 times as much potassium chloride solution (5.4) by means of the shaft homogenizer (6.4).

See also 5.4.

9.3 Measurement on sample extract

Introduce the electrodes into the sample extract and set the temperature-correction system of the pH-meter (6.2) to the temperature of the extract. If there is no temperature-correction system, the temperature of the sample extract shall be within the range (20 ± 2) °C.

While stirring with the magnetic stirrer (6.5), measure the pH using the procedure appropriate to the pH-meter used. When a constant value has been reached, read the pH directly from the instrument, to the nearest 0,01 pH unit.

Proceed in accordance with 9.5.

9.4 Measurement on sample

Pierce a hole in the sample with a knife or a sharp pin and insert the electrode without risk of breakage.

Set the temperature-correction system of the pH-meter (6.2) to the temperature of the sample. If there is no temperature-correction system, the temperature of the sample shall be within the range (20 ± 2) °C.

Measure the pH using the procedure appropriate to the pH-meter used. When a constant value has been reached, read the pH directly from the instrument, to the nearest 0,01 pH unit.

For measurement on fresh meat, which is generally kept at temperatures between 0 °C and 5 °C, it is necessary to use a pH-meter with a temperature-correction system.

Repeat the measurement at the same point of incision.

If it is considered useful to know the differences between the pH measured at several points in the sample, repeat the measurements at different points. The number of measuring points shall be a function of the nature and size of the sample.

9.5 Cleaning the electrodes

Clean the electrodes by wiping them with pieces of cotton wool wetted with diethyl ether (5.5.1) and ethanol (5.5.2) successively. Finally, wash them with water (5.1) and store them as described in the manufacturer's instructions.

10 Expression of results

10.1 Non-destructive measurements

Take as the result the arithmetic mean of the two pH values obtained at the same point. Report the mean pH value for each point to the nearest 0,05 pH unit.

When measurements have been made at different locations in the sample, make a sketch and indicate the points of measurement with their respective average pH values.

10.2 Homogenized products

Report the result to the nearest 0,05 pH unit.

11 Precision

11.1 Interlaboratory tests

The precision of the method was established by interlaboratory tests carried out in accordance with ISO 5725 [2].

11.2 Repeatability

The absolute difference between two independent single test results, obtained using the same method on identical test material in the same laboratory by the same operator using the same equipment within a short interval of time, will in not more than 5 % of cases exceed 0,04 pH units.

The repeatability standard deviation (s_r) will be about 0,014 pH units.

11.3 Reproducibility

The absolute difference between two single test results, obtained using the same method on identical test material in different laboratories by different operators using different equipment, will in not more than 5 % of cases exceed 0,12 pH units.

The reproducibility standard deviation (s_R) will be about 0,042 pH units.

12 Test report

The test report shall specify:

— all information necessary for the complete identification of the sample;

— the sampling method used, if known;

— the test method used, indicating whether destructive or non-destructive measurements were applied;

— all operating details not specified in this International Standard, or regarded as optional, together with details of any incidents which may have influenced the test result(s);

— the test result obtained, or the two test results obtained if the repeatability has been checked.

Bibliography

[1] ISO 3100-1, *Meat and meat products — Sampling and preparation of test samples — Part 1: Sampling*.

[2] ISO 5725:1986, *Precision of test methods — Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests*.

[3] ISO 5725-1:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definition.*

[4] ISO 5725-2:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*.

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