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Animal and vegetable fats and oils — Determination of mass per unit volume ("litre weight") in air

Corps gras d'origine animale et végétale — Détermination de la masse volumique dans l'air

Reference number
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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 6883 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Animal and vegetable fats and oils — Determination of mass per unit volume ("litre weight") in air

1 Scope and field of application

This International Standard specifies a method for the determination of mass per unit volume ("litre weight") in air of animal and vegetable fats and oils in order to convert volume to mass or mass to volume.

It is not applicable to fats which deposit crystals at the temperature of determination.

2 References

ISO 661, *Animal and vegetable fats and oils — Preparation of test sample.*

ISO 3507, *Pyknometers.*

ISO 5555, *Animal and vegetable fats and oils — Sampling.*

3 Definition

For the purpose of this International Standard, the following definition applies.

mass per unit volume ["litre weight"] of a fat or oil : Ratio of the mass of a fat or oil to its volume, at a given temperature.

It is expressed in grams per millilitre or kilograms per litre.

4 Principle

Measurement of the mass, at the required temperature, of a volume of liquid fat or oil in a pyknometer which has been calibrated at the same temperature.

The determination is made directly on samples which are liquid at ambient temperature or after complete melting for other samples, preferably at 40, 50, or 60 °C. If necessary a higher temperature may be used.

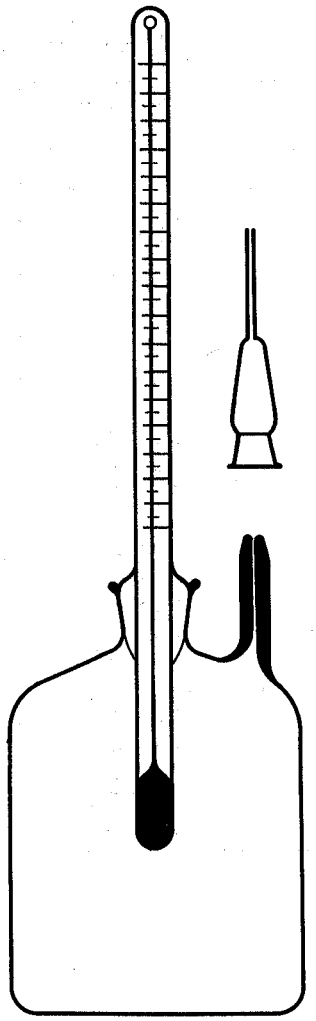
5 Apparatus

5.1 Pyknometer with thermometer, of capacity 50 ml, fitted with a calibrated thermometer graduated in divisions of 0,1 °C and with a side-arm and cap (see the figure).

The pyknometer should preferably be made of borosilicate glass, but if this is not available then one made of soda glass may be used.

NOTE — The cap is only required when the determination is carried out at a temperature below ambient. The top of the cap is perforated and leads into an expansion tube.

Alternatively, the type 3 (Gay-Lussac) pyknometer specified in ISO 3507 may be used; however, the use of a pyknometer with thermometer is preferred.



Figure

Calibrate the pyknometer at least annually at the temperature of determination as follows.

Weigh, to the nearest 0,1 mg, the empty pyknometer with the thermometer or stopper.

Fill the pyknometer with recently distilled water or water of equivalent purity, free from air, at the approximate temperature of calibration and replace the thermometer or stopper, taking care not to include air bubbles. Place the filled pyknometer in the water-bath or oven (5.2) at a temperature which does not vary by more than 1 °C from the temperature required for the determination until the contents have reached a stable temperature (which takes about 1 h). Allow the water to overflow and wipe the surplus from the top of the outlet. Record the temperature, θ_0, of the pyknometer to the nearest 0,1 °C. Remove the pyknometer from the water-bath, wiping it carefully with fluff-free material, or from the oven. Allow its temperature to reach ambient. Weigh the full pyknometer.

The volume, V_θ, in millilitres, of the pyknometer is equal to

$$V_\theta = \frac{m_1 - m_0}{\varrho_{H_2O,\theta}} [1 + \alpha (\theta - \theta_0)]$$

where

m_0 is the mass, in grams, of the empty pyknometer;

m_1 is the mass, in grams, of the pyknometer filled with water;

α is the mean coefficient of cubic expansion of glass (equal to 0,000 010 K^{-1} for borosilicate glass, or 0,000 025 K^{-1} for soda glass);

θ is the temperature, in degrees Celsius, used in the determination (see clause 4);

θ_0 is the temperature, in degrees Celsius, at which the pyknometer was calibrated;

$\varrho_{H_2O,\theta}$ is the density, expressed in grams per millilitre, of water in air at θ °C (see the table).

Table — Density of water in air at temperatures from 15 to 65 °C

Temperature θ	Density of water $\varrho_{H_2O,\theta}$	Temperature θ	Density of water $\varrho_{H_2O,\theta}$	Temperature θ	Density of water $\varrho_{H_2O,\theta}$
°C	g/ml	°C	g/ml	°C	g/ml
15	0,998 05	35	0,992 98	55	0,984 65
16	0,997 89	36	0,992 64	56	0,984 16
17	0,997 72	37	0,992 28	57	0,983 67
18	0,997 54	38	0,991 92	58	0,983 17
19	0,997 35	39	0,991 55	59	0,982 67
20	0,997 15	40	0,991 17	60	0,982 17
21	0,996 94	41	0,990 79	61	0,981 65
22	0,996 72	42	0,990 39	62	0,981 13
23	0,996 49	43	0,989 99	63	0,980 60
24	0,996 24	44	0,989 58	64	0,980 06
25	0,995 99	45	0,989 17	65	0,979 52
26	0,995 73	46	0,988 74		
27	0,995 46	47	0,988 32		
28	0,995 18	48	0,987 88		
29	0,994 90	49	0,987 44		
30	0,994 60	50	0,986 99		
31	0,994 29	51	0,986 54		
32	0,993 98	52	0,986 07		
33	0,993 65	53	0,985 61		
34	0,993 32	54	0,985 13		

5.2 Water-bath or **oven**, capable of being maintained at the temperature chosen for the determination (see clause 4).

6 Sampling

See ISO 5555.

7 Procedure

7.1 Preparation of the test sample

Prepare the test sample in accordance with ISO 661 but do not filter it.

7.2 Determination

7.2.1 Fats which are liquid at ambient temperature

Weigh, to the nearest 0,1 mg, the empty pyknometer with the thermometer or stopper (5.1).

Fill the pyknometer with the test sample (7.1) and replace the thermometer or stopper, taking care not to include air bubbles. Place the filled pyknometer in the water-bath or oven (5.2) maintained at the temperature, $\theta_0 \pm 1$ °C, required for the determination until the contents reach this temperature. Allow the sample to overflow and wipe the surplus from the top of the outlet. Record the temperature, θ, of the pyknometer to the nearest 0,1 °C.

Remove the pyknometer from the water-bath, wiping it carefully with fluff-free material, or from the oven. Allow its temperature to reach ambient. Weigh the full pyknometer.

7.2.2 Fats which are solid at ambient temperature

Melt the test sample at a temperature approximately 10 °C above its melting point. Follow the procedure given in 7.2.1, allowing the full pyknometer to cool before weighing.

7.3 Number of determinations

Carry out two determinations on the same test sample.

8 Expression of results

8.1 Method of calculation and formula

The mass per unit volume, ϱ_θ, expressed in grams per millilitre or kilograms per litre, of the fat or oil at θ °C is equal to

$$\frac{m_2 - m_0}{V_\theta}$$

where

m_0 is the mass, in grams, of the empty pyknometer;

m_2 is the mass, in grams, of the pyknometer filled with fat or oil;

V_θ is the volume, in millilitres, of the pyknometer at temperature θ (see 5.1).

Take as the result the arithmetic mean of the two determinations, if the conditions of repeatability are fulfilled (8.3), and express it to four decimal places.

8.2 Temperature correction

If the volume of the fat or oil is measured at a temperature θ within 1 °C of the temperature θ_0, relate the result to the temperature θ_0 using the following equations :

$$\varrho_{\theta_0} = \varrho_\theta + 0{,}000\,68 \times (\theta - \theta_0) \qquad \text{if } \theta > \theta_0$$

$$\varrho_{\theta_0} = \varrho_\theta - 0{,}000\,68 \times (\theta_0 - \theta) \qquad \text{if } \theta < \theta_0$$

The correction coefficient 0,000 68 is an approximate mean coefficient of fats or oils, but if the actual coefficient of the sample is known, it is recommended that this be used in the interest of greater accuracy.

NOTE — The formulae used for the correction can also be used to convert the mass per unit volume determined at one temperature to that at another temperature provided that the temperature difference is not more than 5 °C and the sample is liquid at both temperatures.

8.3 Repeatability

The difference between the results of the two determinations, carried out simultaneously or in quick succession by the same analyst under the same conditions using the same test sample, shall not exceed two units of the fourth decimal place.

9 Test report

The test report shall show the method used, the measurement temperature and the results obtained. It shall also mention any operating details not specified in this International Standard, or regarded as optional, together with details of any incidents likely to have influenced the results.

The test report shall include all the information necessary for the complete identification of the sample.