SIST

SLOVENSKI STANDARD
SIST EN 14233:2003

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Materiali in predmeti v stiku z ģivili - Polimerni materiali - Ugotavljanje temperature polimernih materialov in predmetov na stiku ģivila in polimernega materiala pri segrevanju v mikrovalovni in in konvencionalni peļ ici z namenom izbire primerne temperature

Materials and articles in contact with foodstuffs - Plastics - Determination of temperature of plastics materials and articles at the plastics/food interface during microwave and conventional oven heating in order to select the appropriate temperature for migration testing

Werkstoffe und Gegenstände in Kontakt mit Lebensmitteln - Kunststoffe - Temperatur an der Kunststoff-Lebensmittel-Schnittstelle - Bestimmung der Temperatur von Werkstoffen und Gegenständen aus Kunststoff an der Kunststoff-Lebensmittel-Schnittstelle während der Erwärmung im Mikrowellengerät oder im herkömmlichen Ofen zur Auswahl der geeigneten Temperatur für die Migrationsprüfung

Matériaux et objets en contact avec les denrées alimentaires - Matieres plastiques - Détermination de la température des matieres plastiques et objets a l'interface matieres plastiques/denrées alimentaires lors du chauffage en four classique ou a micro-ondes afin de sélectionner la température appropriée pour les essais de migration

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EUROPEAN STANDARD

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English version

Materials and articles in contact with foodstuffs - Plastics - Determination of temperature of plastics materials and articles at the plastics/food interface during microwave and conventional oven heating in order to select the appropriate temperature for migration testing

Matériaux et objets en contact avec les denrées alimentaires - Matières plastiques - Température à l'interface matières plastiques/denrées alimentaires - Détermination de la température des matières plastiques et objets à l'interface matières plastiques/denrées alimentaires lors du chauffage en four classique ou à micro-ondes afin de sélectionner la température appropriée pour les essais de migration

Werkstoffe und Gegenstände in Kontakt mit Lebensmitteln - Kunststoffe - Bestimmung der Temperatur von Werkstoffen und Gegenständen aus Kunststoff an der Kunsfstoff-Lebensmittel-Schnittstelle während der Erwärmung im Mikrowellengerät oder im herlömmlichen Ofen zur Auswahl der geeigneten Temperatur für die Migrationsprüfung

This European Standard was approved by CEN on 25 July 2002.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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Contents

Foreword

This document EN 14233 has been prepared by Technical Committee CEN/TC 194 "Utensils in contact with food", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2003, and conflicting national standards shall be withdrawn at the latest by April 2003.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

In this standard the annex A is normative and annex B is informative.

This standard should be read in conjunction with EN 1186-1 and ENV 13130-1.

WARNING Food heated in microwave ovens can bubble and splatter. Caution should be taken when handling hot foods. Metal thermocouples should not be used in microwave ovens unless special precautions are taken.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Migration tests for plastics materials and articles are to be carried out, selecting times and temperatures, which correspond to the worst foreseeable conditions of contact for the materials or articles being studied. For materials and articles intended for use in microwave ovens, migration testing is carried out using a conventional oven and appropriate time and temperature conditions selected from Table 3 of EN 1186-1:2002.

In order to be able to select the appropriate temperature for migration testing, it is necessary to know the temperature which occurs at the food-packaging interface under the worst foreseeable conditions of use of the material.

For plastics materials and articles used in microwave ovens for the microwave cooking or heating of mainly aqueous foods, it is generally recognized that the temperature at the food-packaging interface does not exceed 100 °C. For more complex food matrices, including those of a high fat and/or sugar content, temperatures generated during microwave heating and cooking cannot be predicted readily. Thus it can be necessary to measure temperatures at the food-packaging interface during the cooking or heating of such foods.

For cooking or heating in conventional ovens, the temperature at the food/packaging interface is dependant upon the temperature of the oven, the thermal conductivity of the plastics material or article, the nature of the food and the heating time. Temperatures at the food-packaging interface cannot be predicted readily. Thus it can be necessary to measure temperatures at the food-packaging interface during heating and cooking in conventional ovens.

The methods described here can be used to measure the temperature of plastics materials and articles at the food-plastic interface during microwave and conventional oven heating and thereby enable selection of the appropriate temperature for migration testing.

Migration testing can be carried out by selection of contact conditions generally recognized as more severe without the need of pre-application of this standard.

NOTE The basic rules necessary for testing the overall migration of the constituents of plastics materials and articles intended to come into contact with foodstuffs are laid down in Council Directive 82/711/EEC [1] and its subsequent amendments, [2] and [3].

1 Scope

This European Standard specifies methods to measure the temperature reached by plastics materials and articles in contact with foodstuffs during microwave heating and conventional oven heating in order to select the appropriate temperature for migration testing.

It is applicable to all plastics materials and articles for which the food(s) with which they can come into contact under worst foreseeable conditions of use is/are known. This includes pre-packaged foods such as ready meals which will be heated in the packaging, and for foods which need some pre-preparation but which include the cooking container in the pack, e.g. cake mixes. The method is also suitable for plastics materials and articles to be used for preparing foods in the home or for use in commercial food preparation where the article is supplied as a stand-alone item, i.e. not containing or not including food at the point of sale.

NOTE Although the method has been developed for plastics materials and articles, it is also applicable to other packaging materials including paper and board, rubber and elastomers, ceramics, glass etc. Temperature measurements using conventional oven heating are suitable for metal materials but these items should generally not be heated in microwave ovens due to possible problems with arcing.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

ENV 1186–1:1994, *Materials and articles in contact with foodstuffs - Guide to the selection of conditions and test methods for overall migration*.

3 Principle

Plastics materials and articles containing foods of the type which they can come into contact with under worst foreseeable conditions of use, are heated in a microwave oven or in a conventional oven (heated by gas or by electricity). For the determination of temperature during microwave heating, the temperature of the plastic is measured at the interface with the food using a fibre-optic thermometer. Thermocouples are used to measure the temperature at the interface during heating in a conventional oven. A fibre-optic thermometer can also be used to measure temperatures in a conventional oven. The temperatures measured are used to select an appropriate temperature for migration testing from Table 3 of EN 1186-1:2002. The appropriate time for migration testing is also selected from the table taking into account the time of heating in normal and foreseeable conditions of use.

4 Reagents

Distilled water or water of equivalent quality.

5 Apparatus

5.1 Polythene beaker, with a diameter of 140 mm ± 20 mm and a minimum capacity of 1 000 ml.

5.2 Expanded polystyrene foam pad to fit under plastic container (5.1) and at least 8 mm thick.

5.3 Calibrated thermocouple or thermometer capable of measuring over the range -10 °C to 30 °C to a limit deviation of ± 0,1 °C.

5.4 Plastic tube or rod for stirring.

5.5 Thermostatically controlled incubator capable of maintaining a set temperature of 10 °C ± 0,5 °C.

5.6 Calibrated fibre-optic thermometer capable of measuring over a range of -20 °C to 200 °C.

5.7 Calibrated type 'K' thermocouple capable of measuring over a range of –20 °C to 230 °C.

5.8 Data logger or temperature converter compatible with type 'K' thermocouples.

5.9 Microwave oven, with output in the range of 600 W to 1 000 W.

5.10 Oven, capable of maintaining ± 5 °C of the required set temperature averaged over a 30 min heating period, after the oven has reached the set temperature.

NOTE In the case of ready meals the set temperature is that typically given in the on-pack instructions. For materials and articles intended for the preparation of food in the home, the set temperature should be taken from appropriate recipes.

6 Samples

The number of test samples required is dependent on the number of probes of the fibre-optic thermometer or the number of thermocouples. For fibre-optic thermometers with one probe a minimum of twelve test materials or articles are required. For thermometers with 12 probes, a minimum of three test materials or articles are required. For measurements in conventional ovens using a single thermocouple or fibre optic probe, a minimum of eight test materials or articles are required. For systems where 8 thermocouples or probes can be employed simultaneously, a minimum of two test materials or articles are required.

NOTE Test materials or articles should contain food of the same, or similar, nature and of the same or similar mass, as will be heated in the material or article under worst foreseeable conditions of use.

Materials or articles, containing food, which are to be heated from frozen are stored at -20 °C. Those containing food which is to be heated from a chilled state are stored at 5 °C and for not longer than 3 days.

7 Procedure

7.1 Determination of temperatures during microwave heating

7.1.1 Determination of power output of microwave oven

The power output of the microwave oven (5.9) to be used for the temperature tests is determined by measuring the time taken to raise the temperature of 1 000 g of water by 10 °C ± 2 °C.

For turntable ovens, disable the turntable. This can be done by removing the glass tray or by removing the rotating mechanism. Place the polystyrene pad (5.2) at the geometric centre of the base of the oven (non-turntable type) or at the centre of the disabled turntable mechanism. Bring distilled water to a constant temperature of 10 °C ± 0,5 °C using an incubator (5.5). Transfer 1 000 g ± 5 g distilled water (4.1) to the polyethylene container (5.1). Stir using the plastic tube or rod (5.4) and measure the temperature of the water using a suitable calibrated device, e.g. a thermometer or a thermocouple (5.3). Place the container with water on the centre of the polystyrene pad and microwave on full power until the temperature of the water has risen by 10 °C ± 2 °C. Quickly stir the water and measure the temperature. Determine the change in temperature of the water. Repeat the test twice more.

NOTE Some pre-experimentation can be necessary to determine the time required to raise the water temperature by 10 °C ± 2 °C. An approximate guide is between 50 s and 80 s.

If foods will be heated under a setting other than full power under worst foreseeable conditions of use, then the power output of the test oven at these power settings should be determined. The above procedure should be followed but using the appropriate power setting.

Calculate the power output of the microwave oven using the following equation:

$$W_m = m_w \cdot 4{,}187 \cdot \frac{\Delta T}{t} \qquad (1)$$

where

W_m is the microwave power output in watts;

m_w is the mass of water heated in grams;

ΔT is the mean of actual temperature rise in degrees Celsius, which has to be in the range 10 °C ± 2 °C;

t is the time taken to achieve rise, in seconds;

4,187 is the specific heat of water.

7.1.2 Temperature measurement

7.1.2.1 Calculation of heating time

The total energy input to the sample for the temperature measurement shall the same as that which would occur under worst foreseeable conditions of use. Heating times are typically given for standard wattage ovens. It can be necessary to adjust the heating time to allow for differences between the standard wattage oven and the power output of the microwave oven used for temperature measurement.

This is done as follows:

$$t_t = \frac{t_r \cdot W_s}{W_m} \qquad (2)$$

where

t_t is the heating time for temperature measurement, in minutes;

t_r is the heating time, in minutes, under worst foreseeable conditions of use for an oven of standard wattage e.g. from microwave heating instructions on a pre-packaged food item;

W_s is the standard wattage oven, in watts, for which t_r is given or implied;

W_m is the oven wattage determined in 7.1.1, in watts.

7.1.2.2 Determining temperature

Plastics materials or articles shall be tested containing food of the same or of a similar type with which they can come into contact in worst foreseeable conditions of use.

Place the plastic material or article to be tested containing food at the geometric centre of the base of the oven