INTERNATIONAL STANDARD

ISO 8871-2

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Elastomeric parts for parenterals and for devices for pharmaceutical use —

Part 2: Identification and characterization

Éléments en élastomère pour administration parentérale et dispositifs à usage pharmaceutique —

Partie 2: Identification et caractérisation

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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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8871-2 was prepared by Technical Committee ISO/TC 76, *Transfusion, infusion and injection equipment for medical and pharmaceutical use*.

Together with the other parts (see below), this part of ISO 8871 cancels and replaces ISO 8871:1990, which has been technically revised.

ISO 8871 consists of the following parts, under the general title *Elastomeric parts for parenterals and for devices for pharmaceutical use*:

— *Part 1: Extractables in aqueous autoclavates*

— *Part 2: Identification and characterization*

— *Part 3: Determination of released-particle count*

— *Part 4: Biological requirements and test methods*

— *Part 5: Functional requirements and testing*

Introduction

The elastomeric parts specified in the various parts of this International Standard are produced from a material which is usually called “rubber”. However, rubber is not a unique entity, since the composition of rubber materials may vary considerably. The base elastomer and the type of vulcanization have a major influence on the principle characteristics of an individual rubber material, as do additives such as fillers, softeners and pigments. These may have a significant effect on the overall properties. The effectiveness, purity, stability and safe handling of a drug preparation may be affected adversely during manufacture, storage and administration if the rubber part used has not been properly selected and validated (approved).

Elastomeric parts for parenterals and for devices for pharmaceutical use —

Part 2: Identification and characterization

1 Scope

This part of ISO 8871 specifies evaluation procedures applicable to elastomeric parts used for drug containers and medical devices in order to guarantee the product identity between the samples evaluated in the (suitability test) acceptance process and the current supplies. The physical and chemical test procedures specified in this part of ISO 8871 permit the determination of the typical characteristics of rubber materials, and may serve as a basis for agreements between manufacturer and user regarding the product consistency in subsequent supplies. An appropriate set of tests is selected, depending upon the type of rubber and its application.

This part of ISO 8871 does not specify other requirements for rubber materials. These are laid down in the relevant product standards.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 48:1994, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 247:1990, *Rubber — Determination of ash*

ISO 2781:1988, *Rubber, vulcanized — Determination of density*

ISO 8871-1:2003, *Elastomeric parts for parenterals and for devices for pharmaceutical use — Part 1: Extractables in aqueous autoclavates*

3 Tests

3.1 General

Rubber is a complex material and not generally definable. The only property which all elastomeric materials have in common is a special type of resilience or elasticity. When a strip of rubber is stretched, it will extend by up to many times its original length without breaking. On release of the stretching force, it snaps back to its original size and shape virtually unaltered. Similarly, one can squeeze it, twist it or distort it in any direction comparatively easily, and it will spring back again to its original shape unchanged.

Owing to its three-dimensional network, achieved by chemical cross-linking of the polymer chains during vulcanization, rubber is practically insoluble in solvents such as tetrahydrofuran, although considerable reversible swelling may occur; this characteristic differentiates rubber from pseudo-elastic materials, such as poly(vinyl chloride) and certain thermoplastic elastomers.

In view of the complexity of rubber, the identity of a given elastomeric material cannot be verified just by applying a single physical or chemical test, and a set of tests is needed for reliable identification.

The manufacturer shall guarantee that all elastomeric parts of current supplies have been produced from the same formulation and that they exhibit the same characteristics as the samples which have been given to the user first and the suitability of which has been proved.

3.2 Hardness

Hardness shall be determined in accordance with ISO 48.

3.3 Density

Density shall be determined in accordance with the procedure described in ISO 2781:1988, method A.

3.4 Ash

The inorganic residue after combustion shall be determined as described in ISO 247:1990, method A.

3.5 Infra-red spectrum

The infra-red spectrum shall be obtained on a pyrolysate as described in Annex A. It shall be compared with a reference spectrum.

3.6 Compression set

The compression set indicates the degree of permanent deformation remaining after compression at a constant deformation and defined temperature for a defined time. The compression set shall be determined in accordance with Annex B.

3.7 Swelling

Elastomeric materials are subject to varying degrees of swelling when exposed to organic solvents; the degree of volume and/or mass increase is primarily influenced by the type of elastomer. Swelling requires special care when the rubber components are in contact with emulsions or oily vehicles.

The relevant procedure is specified in Annex C.

3.8 Development of a fingerprint by gas chromatography

The elastomeric materials under examination are extracted in a solvent, which does not dissolve but might swell the rubber. The extract is injected into a gas chromatograph. The chromatogram obtained exhibits a typical profile and can be used as a fingerprint for identification purposes. Furthermore, GC-coupling techniques, e.g. GC-MS, may provide additional information about the composition of the extract.

The relevant procedure is specified in Annex D.

3.9 Detection of volatile substances by gas chromatography

Elastomeric materials may release volatile substances. These may originate from one of the following categories of material:

— oligomers or process aids present in the base polymer;

— stabilizers or antioxidants;

— softeners.

The relevant procedure is specified in Annex E.

3.10 Determination of residual moisture

During treatments typical for the pharmaceutical industry, elastomeric parts can absorb moisture in considerable quantities. During storage of the drug unit, the trapped moisture may be released and absorbed by the drug product, thus reducing the effectiveness of the drug (critical case: lyophilized drugs). The nature of the absorption and desorption processes is affected by the composition of the rubber, the type of treatment (e.g. steam autoclaving) and the efficiency of any subsequent drying process.

The relevant procedure is specified in Annex F.

3.11 Determination of fingerprint by thermogravimetric analysis (TGA)

Elastomeric parts are composed of components which can be classified relative to their performance under thermal treatment, as follows:

— base polymers;

— inorganic fillers;

— substances volatile at elevated temperatures;

— carbon black.

The relevant procedure is specified in Annex G.

3.12 Determination of extractables in aqueous autoclavates

Elastomeric materials may release substances of undetermined nature in water. For the general assessment of the chemical cleanliness of closures, the determination of overall parameters such as oxidizable materials and electrical conductivity can be used.

The relevant test procedures are specified in ISO 8871-1.

4 Preparation of samples for testing

4.1 Treatment before testing

Since the various test procedures may require different pretreatments, such treatment is specified in each annex.

It is generally assumed that samples of rubber parts will be provided in a clean state in accordance with the state of the art. In order to avoid recontamination, they shall be contained in protective packaging. Any particular treatment or method of packaging to be carried out by the manufacturer shall be subject to agreement between the manufacturer and the customer.

4.2 Number of samples needed for the tests

Due to the large number of tests in this part of ISO 8871 and their complexity, usually not all of the tests are performed in each investigation. For this reason, the number of samples needed shall be agreed on between the manufacturer and the test laboratory. Each annex specifies the number of samples which are necessary to perform that specific test.

5 Reagents and materials

5.1 Use only reagents of recognized analytical grade and purified water prepared by distillation or by other suitable means. The conductivity of the water used shall not exceed 3,0 µS/cm.

NOTE Purified water as specified by various national pharmacopoeias corresponds to grade 1 or 2 of ISO 3696.

5.2 All glass equipment shall be made from borosilicate glass.

Annex A
(informative)

Identification of elastomeric material by pyrolysis IR

A.1 General

When rubber parts are exposed to dry heat with restricted access to oxygen, the elastomeric matrix is thermally disintegrated and the rubber is converted into polymer fragments which appear in the form of vapour or oils of various viscosities.

These oily products are used to produce an IR spectrum which can serve to identify the original rubber material.

A.2 Reagents and materials

A.2.1 Dry, filtered acetone, to clean the KBr discs.

A.2.2 Indicator paper.

A.2.3 Copper wire.

A.2.4 Acetone.

A.2.5 Trichloromethane.

A.2.6 Sodium sulfate, anhydrous.

A.3 Apparatus

A.3.1 IR spectrometer, to produce IR spectra in the range from 400 cm^{-1} to 4 000 cm^{-1} and from 0 % to 100 % transmission.

A.3.2 Potassium bromide (KBr) discs, including spacers and clamps.

A.3.3 Desiccator.

A.3.4 Bunsen burner.

A.3.5 Test tubes, for the pyrolysis process.

A.3.6 Soxhlet extraction apparatus (optional).

A.4 Sample preparation

Cut about 3 g of a rubber part into pieces of about 3 mm × 3 mm.

Optionally, extract the rubber pellets thus produced with acetone in a Soxhlet extractor under reflux for 8 h.