



**International
Standard**

ISO 6608-1

**Active and intelligent packaging —
Part 1:
General requirements and
specifications of active packaging**

Emballage actif et intelligent —

*Partie 1: Exigences et spécifications générales relatives à
l'emballage actif*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 122, *Packaging*.

A list of all parts in the ISO 6608 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

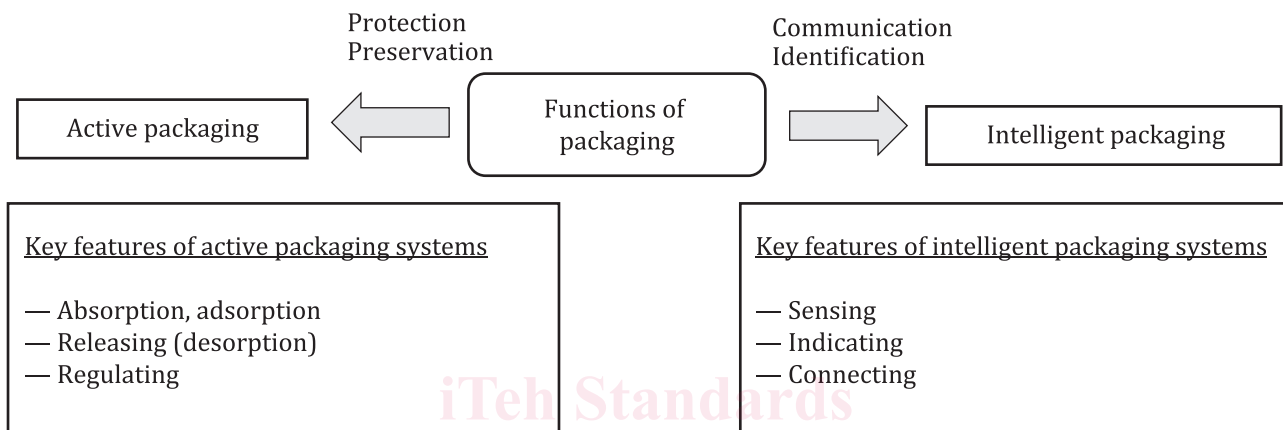
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Introduction

Active and intelligent packaging, frequently referred to as “smart” packaging, is evolving technology that can enhance preservation of contained products and communicate effectively to distributors and users. “Smart packaging” is a general term to describe a large category of packaging that leverages technology to provide enhanced functionality that goes beyond simply housing a product.

The role of active packaging and intelligent packaging is different. Active packaging is intended to sense internal or external environmental change and to respond by changing its own properties or attributes and hence the internal package environment. Intelligent packaging does not change or influence the contained products but is capable of providing information on the conditions of the packaged products. In general, the main function of active packaging is to extend the shelf life of a product while that of intelligent packaging is communication and identification.



As materials and communication technologies advance, more products and packaging involve active, intelligent packaging to enhance the product and user experience it contains. The main industrial sectors are food and beverages, but it is also applied to a variety of product packaging.

From a regulatory perspective, active and intelligent packaging is not subject to any special regulations in many countries, but there are general concerns regarding safety, especially on food contact materials. European regulation (EC) No 1935/2004, concerning a declaration of compliance and the availability of appropriate documentation, states that any active and intelligent material shall provide that the material is safe to be used in contact with food under specified conditions of contact.

Active and intelligent packaging (AIP) helps to optimize for transport and efficiency in logistics by providing interactive and accurate supply chain information. AIP is useful for improving safety and security of perishable and temper sensitive products such as vaccine and pharmaceutical industry. It helps companies in branding and marketing advantages. Ultimately, this technology helps to minimize the packaging and product waste by reducing unnecessary resources and product spoilage during distribution process. This document is intended to be used effectively in the development and use of related products in the future.

Active and intelligent packaging —

Part 1: General requirements and specifications of active packaging

1 Scope

This document specifies the definitions, functional requirements and evaluation criteria of active packaging.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 21067-1, *Packaging — Vocabulary — Part 1: General terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21067-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 **product**

first level or higher assembly that is sold in a complete end-usable configuration

[SOURCE: ISO 28219:2017, 3.8]

3.2 **product package**

packaging and its contents

[SOURCE: ISO 21067-1:2016, 2.1.3]

3.3 **packaging component**

part of packaging that can be separated by hand or by using simple physical means

[SOURCE: ISO 18601:2013, 3.11]

3.4 **packaging constituent**

part from which packaging or its components are made and which cannot be separated by hand or by using simple physical means

[SOURCE: ISO 18601:2013, 3.12]

3.5

active packaging

packaging system that actively interacts with the internal environment to extend product shelf life or improve safety or sensual properties while maintaining product quality

EXAMPLE A type of packaging that possesses barrier and protective qualities, such as oxygen scavenging, moisture scavenging, or microbial control, etc.

3.6

passive packaging

packaging with no active materials and components

3.7

active materials and components

materials and components that have the function of extending the shelf life or maintaining or improving the condition of a packaged product that is intentionally designed to contain components that release or absorb substances into the packaged product or the environment surrounding the product

3.8

sorption

physical and chemical phenomenon or process by which one substance becomes attached to another

3.9

absorption

physical or chemical phenomenon or process by which one state of matter is incorporated into another state (e.g. a liquid absorbed by a solid or a gas absorbed by a liquid)

Note 1 to entry: See [Figure 1 a](#)).

3.10

adsorption

physical or chemical phenomenon or process in which ions and molecules physically attach or bind to the surface of another phase (e.g. a reagent adsorbed on the surface of a solid catalyst)

Note 1 to entry: See [Figure 1 b](#)).

3.11

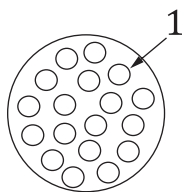
desorption

physical or chemical phenomenon or process whereby a substance is released from a packaging material

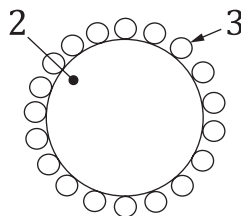
Note 1 to entry: The process is the opposite of adsorption.

Note 2 to entry: See [Figure 1 c](#)).

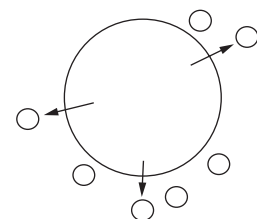
[SOURCE: ISO 16559:2022, 3.66, modified — " or through a surface" has been replaced with "a packaging material", "and adsorption" has been removed from the Note 1 to entry.]



a) Absorption



b) Adsorption



c) Desorption

Key

- 1 absorbed molecules
- 2 adsorbent
- 3 adsorbate

Figure 1 — Concept of absorption, adsorption and desorption

3.12

releasing

action to let go into environment or free movement of active materials and components

3.13

regulating

action to controlling or maintaining the rate or speed of active materials and components so that it works properly

3.14

verification

confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

Note 1 to entry: The objective evidence needed for a verification can be the result of an inspection or of other forms of determination such as performing alternative calculations or reviewing documents.

Note 2 to entry: The activities carried out for verification are sometimes called a qualification process.

Note 3 to entry: The word “verified” is used to designate the corresponding status.

3.15

certified reference material

CRM

reference material accompanied by a certificate, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body

[SOURCE: ISO/Guide 33:2015, 3.2]

3.16

modified atmosphere packaging

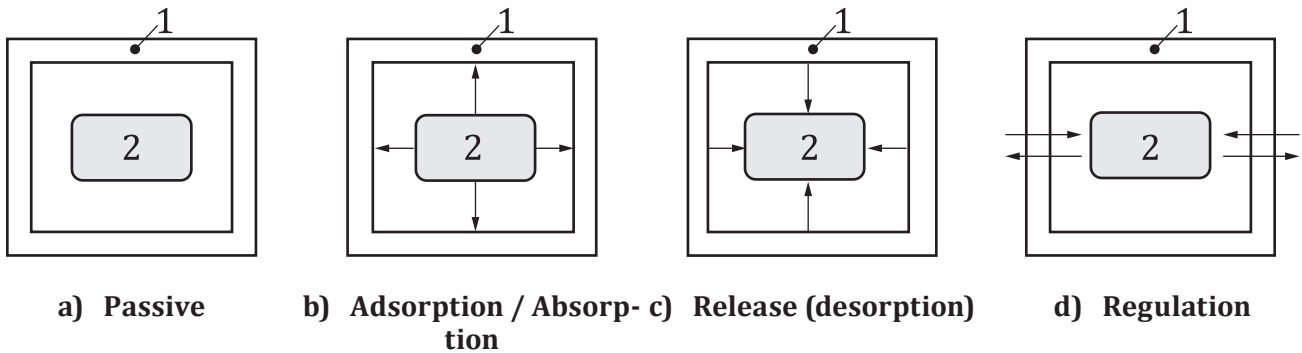
MAP

enclosure of food in a package in which the atmosphere inside the package is modified or altered to provide an optimum atmosphere for increasing shelf life and maintaining food quality

4 General

4.1 Concept of active packaging

The mechanism of the packaging system can be characterized as a) passive, b) adsorption/absorption, c) release, and d) regulation as shown in [Figure 2](#).



Key

- 1 packaging
- 2 content

NOTE Passive packaging is not a part of this document.

Figure 2 — Characteristics of packaging system

The application of active materials and components to packaging is intended to have a positive effect on the packaged product. The packaging adsorbs chemicals from the product or the environment within the packaging surrounding the product, or it releases substances into the product or the environment surrounding the product such as preservatives, antioxidants, flavourings, etc.

Active packaging typically involve packaging materials, packaging components, and/or packaging constituents that contain a variety of active substances that are incorporated into the packaging material's formulation. These substances improve the packaging material's ability to extend the shelf life of the product contained inside.

Hence, structurally, active packaging consists of two parts. One part includes the active components, while the other part concerns the carriers or passive parts that contain the active component.

NOTE In case of an ethanol releaser, the ethanol is absorbed onto a silica gel, which in turn is packaged in a paper or plastic sachet. The ethanol is defined as the active component evaluated in this process. Passive packaging materials with a simple barrier function are not covered by this document.

4.2 Classifications

There are many different types of active packaging systems such as oxygen scavengers, moisture absorbers, etc. The classification of active packaging is divided into three functions: sorption, release, and regulation. Types of active packaging systems according to the active functions are shown in [Annex A](#).

5 Evaluation

5.1 General criteria

To declare that a packaging is an active packaging, the manufacturer and/or seller shall

- a) evaluate chemical and microbiological safety;
- b) provide reliable test results to prove shelf-life extending capacity, efficacy of active systems;
- c) complete toxicological, economic and environmental evaluation;
- d) confirm compatibility with existing manufacturing processes;
- e) confirm that it does not modify organoleptic properties of foods;