

# Active & intelligent food-packaging in Japan: An overview

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COST Action ActInPak  
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Oxygen scavengers  
Antibacterial packaging  
Wax paper  
EU regulations on  
food contact material

Cellulose nanofibers  
Paper/board  
Antibacterial packaging  
Controlled release systems

Thermoresponsive bio-nano-  
materials  
Cellulose nanofibers



2010



2013



2015

*International engineering  
school of Paper science, Print  
media and Biomaterials*

*Laboratory of pulp and  
paper science and graphic  
arts*

*The University of Tokyo*

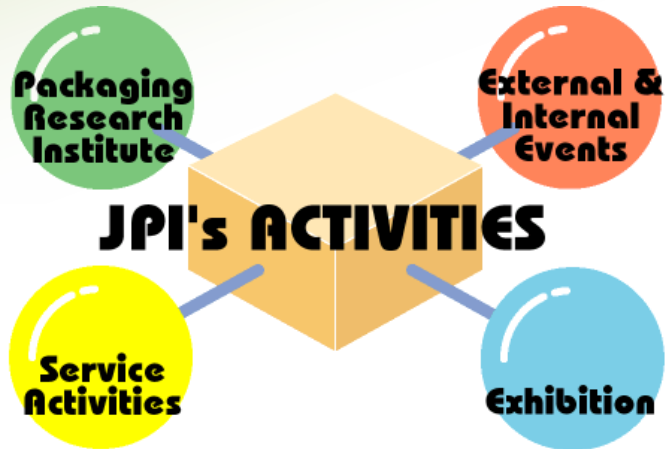
**JAPAN**



# Meeting & Interview at the Japan Packaging Institute



[www.jpi.or.jp/](http://www.jpi.or.jp/)



Promotes **knowledge and know-how** on packaging  
Helps in the **improvement of packaging technique**  
Enacts **standards and rules** about packaging from its production to its use/commercialization  
**Holds meeting, seminars, symposium**  
Has close **collaboration with packaging industries**

**Mr. Mitsuhiro Suimoto**  
President & Chief Consultant  
Registered Engineer (No. 15790,IPEJ)  
SUMIMOTO PACKAGING  
CONSULTANT OFFICE



# Active & Intelligent food-packaging in Japan

## *An overview*

**1** From Japan to Europe: When & How were the first AIP developed?

**2** Legislative background in Japan: How different is it from Europe?

**3** AIP in Japan: What is the current market situation?

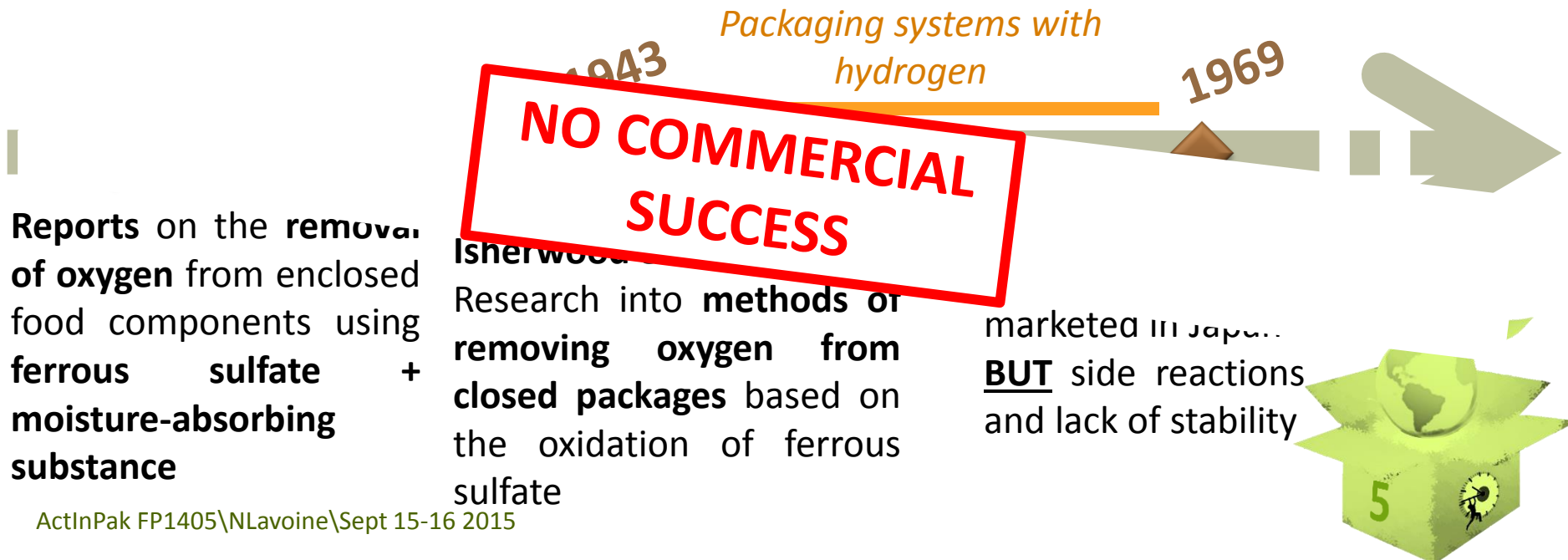


# A bit of history

Concept of **active packaging**: tested or employed **for more than 50 years**  
*e.g. incorporation of desiccant pouches within sealed packaging of products sensitive to moisture (= moisture removal)*

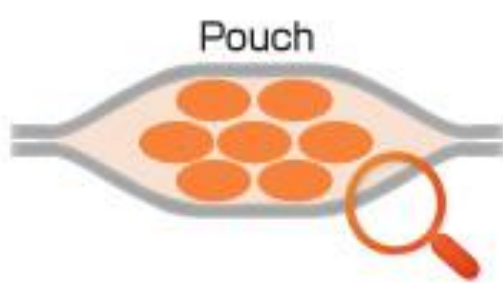
**Oxygen**: major factor in **food product degradation**, and despite the use of hermetically sealed packages, oxygen can penetrate after closure.

→ **Focus on oxygen removal**



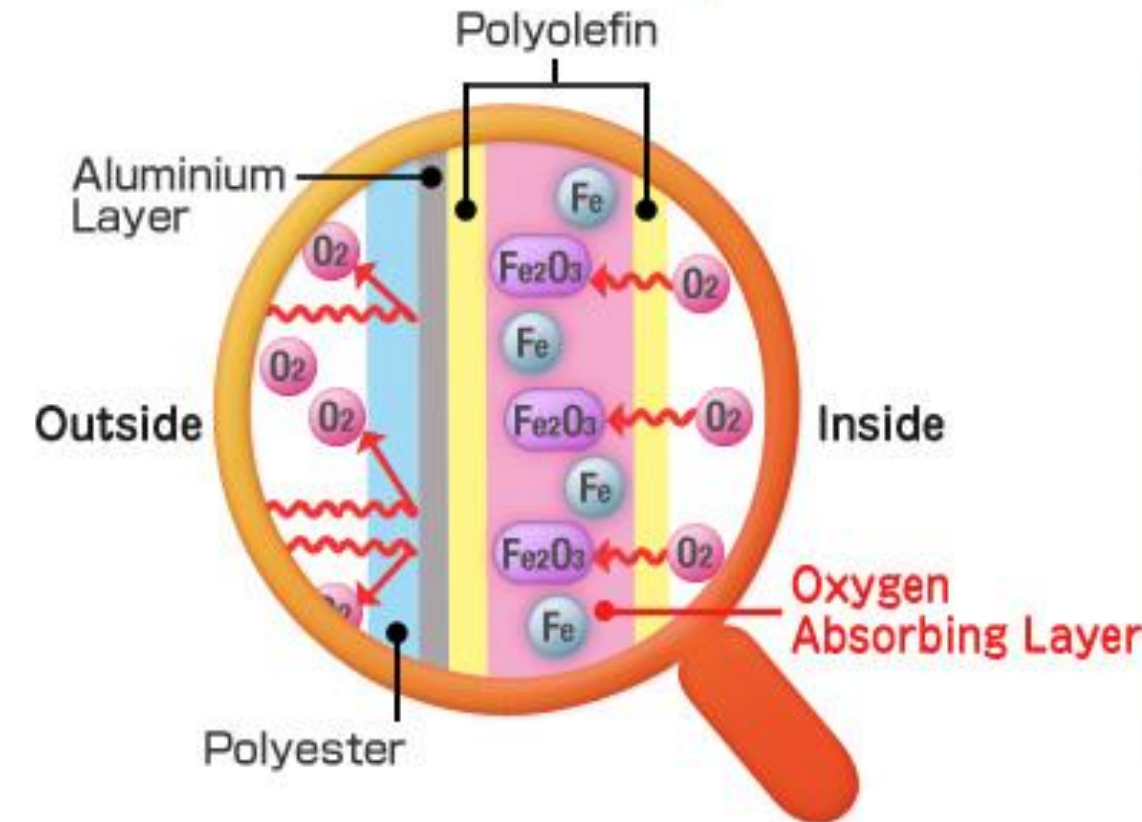
# A bit of history

1970s



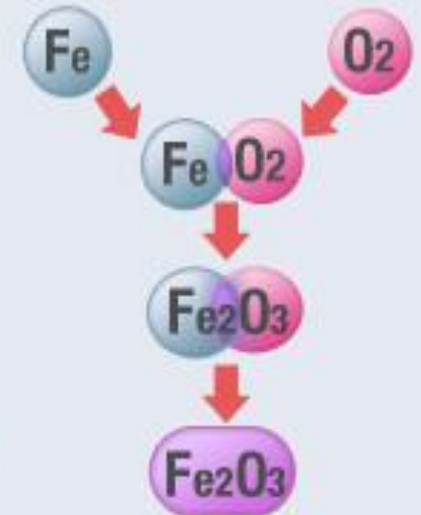
<https://www.toyo-seikan.co.jp/e/technique/filmcup/barrier/>

1980s



1990s

Oxyguard Principle



# In brief,

## **JAPAN: Pioneer in the successful commercialization of oxygen scavenger sachets**

1. The greatest **amount of development**
2. The greatest **commercial success**



In **1995**, in Japan:

~ **2 billion oxygen scavenger sachets** used/year

Led by **Mitsubishi Gas Chemical Co.**

→ **70 % of the Japanese market**

Today:

→ **50 % of the Japanese market**

= **20 billions yen/year** (about 1.5 billion €/year)

<http://ageless.mgc-a.com/AGELESS%20brochure.pdf>



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# Legislative background

## Japanese regulatory framework for food-packaging materials

### Government regulations

Regulatory authority:  
**Ministry of Health,  
Labor and Welfare**

Advisory scientific body:  
**Food Safety  
Commission (FSC)**

**Food Sanitation Law  
Specifications (1947)**

**Food Safety Basic Law  
(2003)**

**General safety standards:**  
food, food additives,  
packaging materials and  
equipment, etc.

**Risk assessments**  
(effect of food on health)  
**Risk communication**  
**Emergency response**

### Industry standards

**Japanese trade  
associations**  
*e.g. Japan Paper  
Association (1997)*

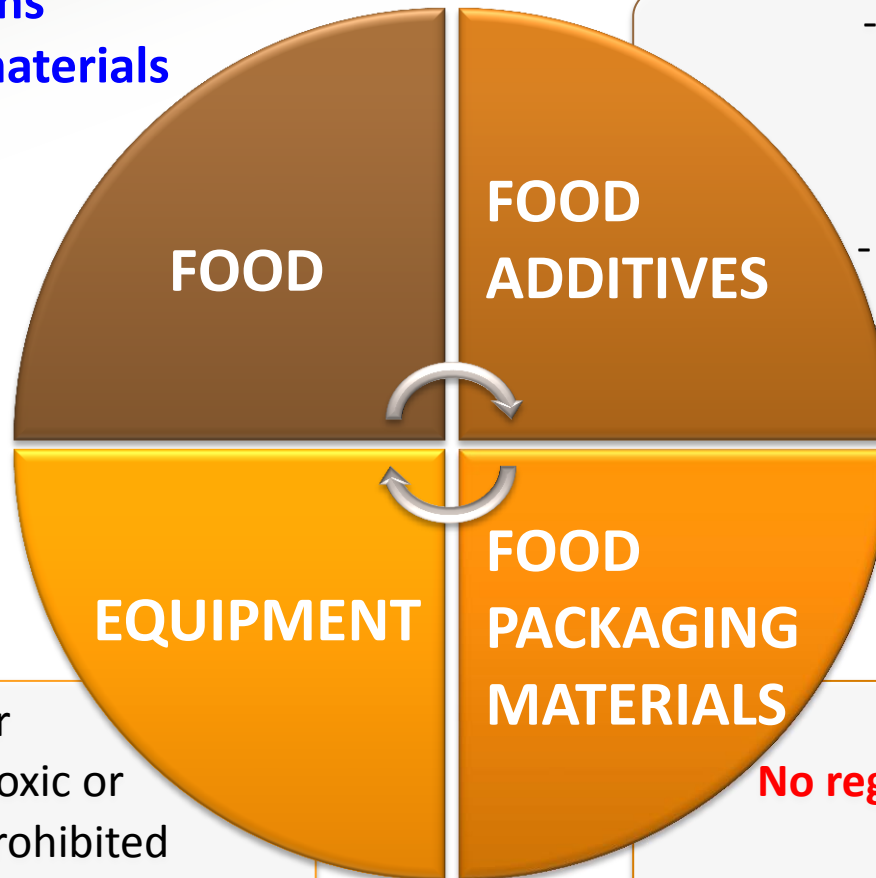
**Voluntary standards:**  
another vehicle for  
marketing food packaging  
materials

*“Voluntary Standard of  
Paper and Paperboard  
intended for use in food  
contact” (2007)*



# Legislative background

Focus on **Food Sanitation Law Specifications & Food contact materials**



- Used in or on food in the process of manufacturing
- Purpose: processing or preserving food
- Currently 345 designated food additives

- Sale of equipment or packages containing toxic or harmful substances prohibited
- Inspection of domestic food-business facilities, import notification requirements, penalties..

**Food contact materials**  
**No regulations or authoritative statement**

**No positive list**

**Premarket review or approval prior to their use not required**

**BUT...**

# Legislative background

**Specifications for food containers and packaging exist:**

- (1) General specifications for all containers and packaging
- (2) Material-specific standards (metal can, glass/ceramic, rubber articles)
- (3) Specifications applied to the end-use application

+ **Voluntary standards developed by Japanese trade associations**

## IN THE NEWS

### JAPAN MOVES TOWARDS ADOPTION OF POSITIVE LISTS FOR FOOD-CONTACT MATERIALS

Jul 15, 2015

Japan's Ministry of Health, Labour and Welfare (MHLW) held a meeting on June 22, 2015, to discuss its future regulation of food-contact materials, including the introduction of a new "Positive List" system.

By way of background, MHLW is authorized under the Food Sanitation Act to establish specifications for food containers and packaging, as well as for raw materials used to manufacture such articles. The Ministry has established testing specifications for finished packaging materials, and imposed restrictions on certain substances; however, Japan does not currently have a positive list of substances that may be used in food packaging. For this reason, various trade associations—including the Japan Hygienic Olefin and Styrene Plastics Association (JHOSPA), the Japan

*Process of getting a substance on a positive list would be open to the world -But not the priority-*



# Legislative background: EU vs. Japan

	EU	Japan
Regulatory authority		Ministry of Health, Labor and Welfare
Advisory scientific body		Food Safety Commission (FSC)
Food contact substances (any materials intended to come into contact with food)	<p>Regulations less restrictive than in EU, which promotes the commercialization of AIP</p> <p>However: <b>current marketed AIP are elaborated in order to avoid any safety or health issues</b></p> <p>Changes are expected for the next 10-20 years</p> <p>→ <b>Opportunity for foreign entities to enter the Japanese food and beverage market</b></p> <p>Reference: Magnuson et al. (2013) Review on the regulation and safety assessment of food substances in various countries and jurisdictions. <i>Food Additives &amp; Contaminants: Part A</i>, 30(7), 1147-1220</p>	<p>Food Safety Standards of polyolefin positive list” - the safe use of paper/paperboard for use in FCM</p> <p>In <b>2010: positive list announced</b> (&gt; 2,000 substances submitted by industry)</p>
	approval required when not on the positive list	

JHOSPA: Japan Hygienic Olefin and Styrene Plastics Association (1973)

JPA: Japan Paper Association (1997)



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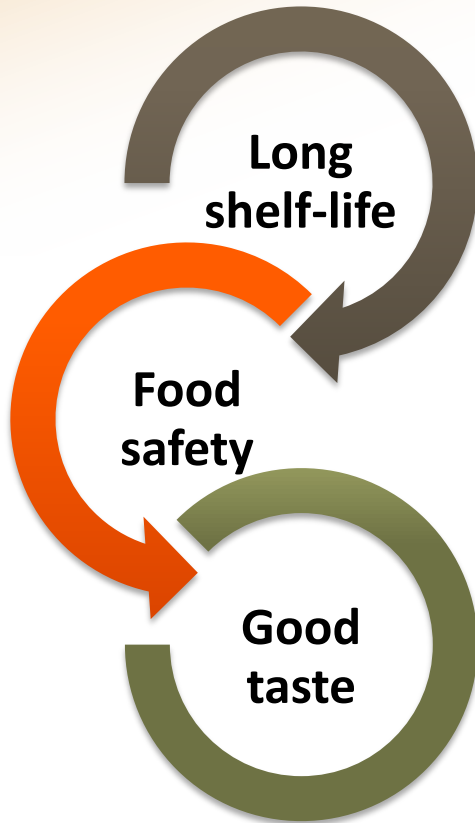
# AIP in Japan: Current market

Two main technologies available on the market:

- **Sachets**
- **Lamination – Multiple layers**

Mainly: **Plastic-based materials** (using PE, PP)  
(No data available unfortunately)

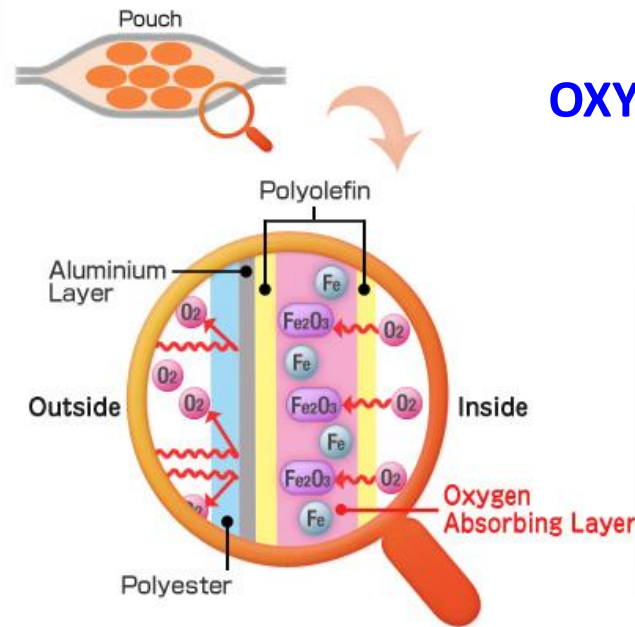
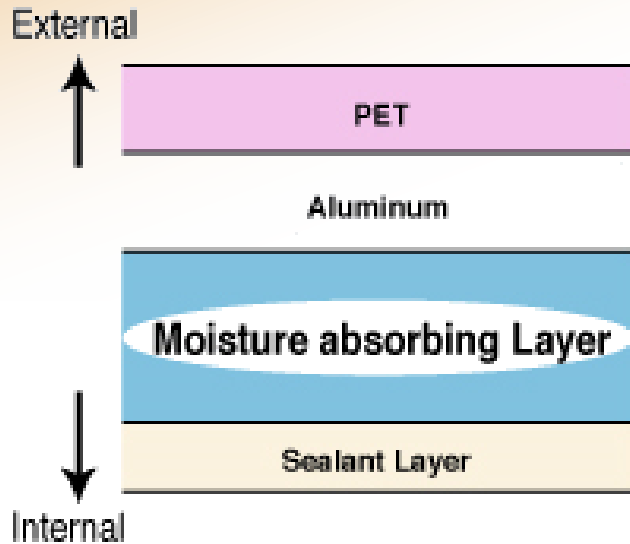
- Focus on **food safety**
- **No direct contact** of the active packaging with the food (thus, no legislative issues)
- Paper and board substrates **do not have** the required **barrier properties** to be used as AIP



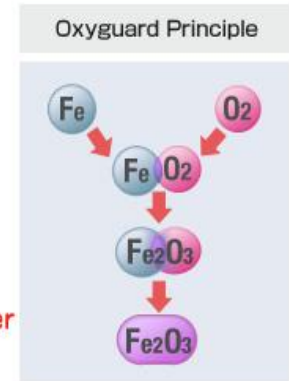
Companies	Type of packaging/action	Tradename
Mitsubishi Gas Chemical Co, Inc.	<b>Oxygen scavengers</b> (sachets)	Ageless®
OhE Chemicals Inc.	<b>Oxygen absorbers</b> (sachets)	Tamotsu®, Sanso-cut, Sequ
	<b>CO<sub>2</sub> /Ethylene</b> absorber	CRISPER
Kyodo Printing	<b>Moisture scavengers</b>	MOISTCATCH™
	<b>Humidity indicator</b> (free of heavy metals)	HUMIJUDGE™
Tokyo Seikan Co. Ltd.	<b>Oxygen scavengers</b> (pouch, multi layers)	Oxyguard
Torishige	<b>Desiccant</b> (lamine paper pulp, resin, PP)	シートドライヤー Sheet dryer
	<b>Oxygen absorbers</b> (sachets)	エバーフレッシュ Ever Fresh
Zeomic	<b>Silver-based inorganic antimicrobial agent</b> (silver ions + zeolites) - pellets or suspension	Zeomic
Mitsubishi-kagaku Foods Corporation	<b>Antibacterial + Antifungal</b> Lamine: Allyl isothiocyanate (from mustard) + PP (films, beads, label)	Wasaouro™

# Process & Technology: Overview

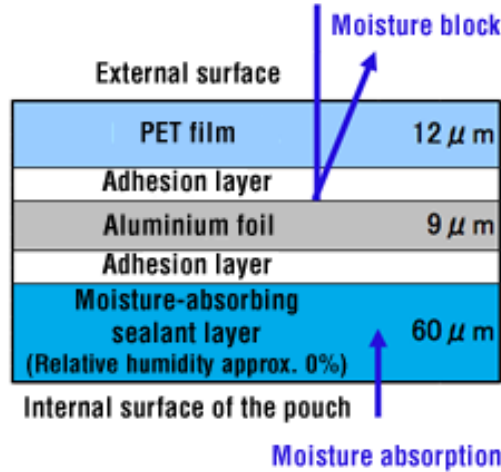
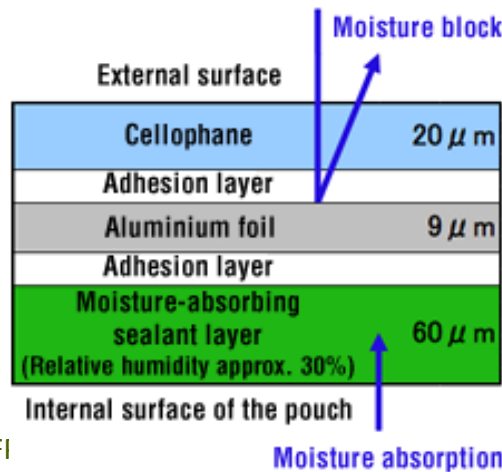
## MOISTCATCH™



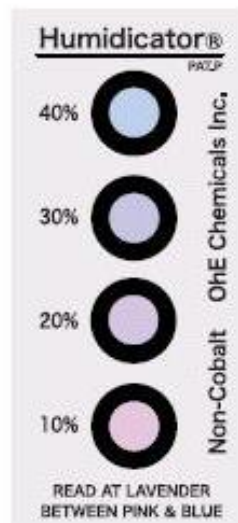
## OXYGUARD



## TOYAL DRY™



ActInPak FI





## Mustard-based sheets, labels, cellulose beads, emulsion and powder

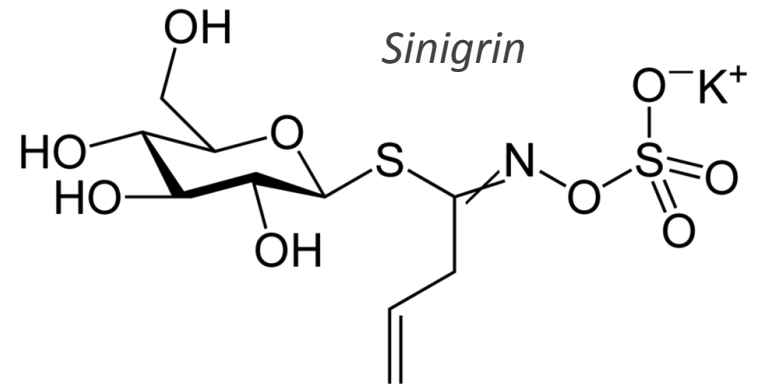
# Wasaouro™

**ACTIVE AGENT: Allyl Isothiocyanate (AIT)**, obtained by hydrolysis of sinigrin in Brassicaceae (wasabi, mustard, cabbage, etc.)

→ Used as **Volatile Oil of Mustard (VOM)**

**REGULATION:** Use of synthetic AIT is **limited to only flavor** (Food Sanitation Law - Additives)

Plant Extract containing AIT is possible to be used for **antimicrobial effect**.









	Quality	Cost	Supply Stability	Judgement
Wasabi	○	×	△	×
Horseradish	×	○	○	△
Mustard	○	○	○	○

**Mustard Extract**  
was chose as a  
optimal source



# Wasaouro™

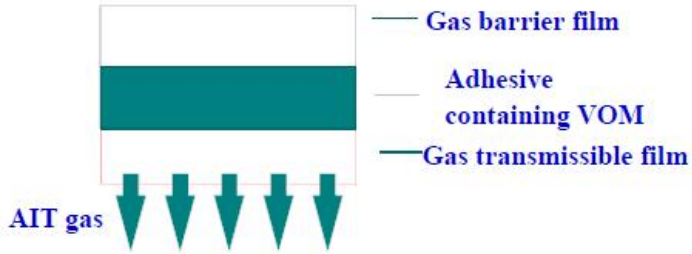
taxon	Species		MIC(ppm)			
			20	60	120	360
Fungi	<i>Alternaria alternata</i>	IFO 4026	●			
	<i>Mucor racemosus</i>	IFO 6745	●			
	<i>Penicillium citrinum</i>	ATCC 9849	●			
	<i>Aspergillus n</i>					
	<i>Cladosporium</i>					

	Kept in 25°C	Not Used						
Fungi	<b>4 days later</b>							
			<b>7 days later</b>					
					Yeast			
							<b>Fungus grow slightly</b>	
<b>Fungus grow slightly</b>								
		Gram negative bacteria						
				<b>Fungus grow slightly</b>				

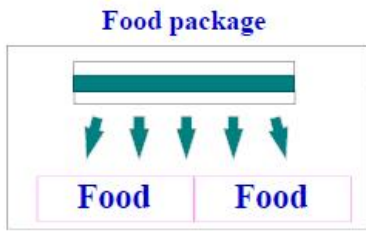
Elapsed Days	3 days	4 days	5 days	6 days	7 days
Not used	No change	Fungus grow	Fungus grow	→	→
Used	No change	→	→	→	Fungus grow

## Wasaouro™ Sheet/Film

### (1) Construction



### (2) Application



# Wasaouro™

## Product types:

### Sheet type (AIT Vapor release)

- Labels (outer, inner)
- Sheets (cut, roll)

### Food additive type (Water-soluble)

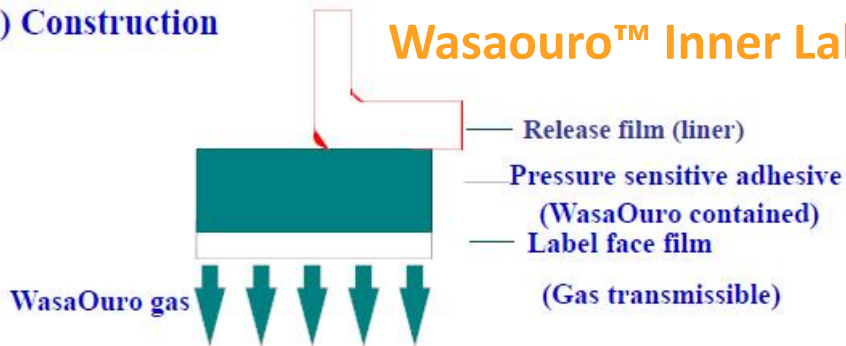
- Emulsion
- Powder

### Others (anti-insect etc.)

- Beads in sachets

### (1) Construction

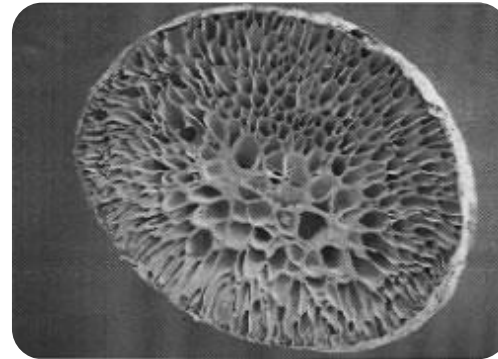
## Wasaouro™ Inner Label



### (2) Application



Sectional view of cellulose beads



19

# Active & Intelligent food-packaging in Japan

## *An overview*

### Concluding remarks



# **S** TRENGTHS

**History:**  
Early commercial introduction  
Consumers' acceptance  
Regulation and Trade Associations



**High costs of production**

**Low production volume**



# **W** EAKNESSES

**Development of the regulations: internationalization?**

**Bioplastics (Green PE, Braskem)**

**Nanotechnology**



**Regulation changes: positive list?**

**Petroleum price**



# **O** PPORTUNITIES

# **T** HREATS



# Thank you for your attention!

## Acknowledgements

Mr. Suimoto (JPI)

Pr. Akira Isogai (The University of Tokyo)

## References

JPI: [ONLINE] <http://www.jpi.or.jp/english/>

JPA: [ONLINE] <https://www.jp.a.gr.jp>

### Food regulation

**Magnuson et al 2013** *Food Additives & Contaminants: Part A* 30(7), 1147-1220

**Food Sanitation Act** (Act No 233 of February 24, 1947)

**Food Safety Basic Act** (Act No 48 of March 23, 2003)

**Food Safety Commission of Japan** (2010) *Guideline for Assessment of the Effect of Food on Human Health Regarding Food Additives*, 25 pp.

**Brody et al. 1995** *The use of oxygen scavengers and active packaging to reduce oxygen within internal package environments. Technical Report Natick/TR-95/033, Massachusetts*, 135 pp.

[ONLINE] [www.packaginglaw.com](http://www.packaginglaw.com)

[ONLINE] [www.foodpackagingforum.org](http://www.foodpackagingforum.org)

### AIP in Japan

[ONLINE] [www.toppan.co.jp](http://www.toppan.co.jp) / [www.ohe-chem.co.jp](http://www.ohe-chem.co.jp) /

[www.torishige.co.jp](http://www.torishige.co.jp) / [www.braskem.com.br](http://www.braskem.com.br) / [www.toyal.co.jp](http://www.toyal.co.jp) /

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