THAI PACKAGING CENTRE ,THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH

Co-Organize : KURARAY (THAILAND) CO.,LTD.

Seminar on

"High gas barrier resin & film for your better life and environment"

Thursday 12 June 2014, Meeting Room 211 - 212, BITEC, Bangkok, Thailand

Programme

09.15 – 09.45	Registration
9.45 – 10.30	**- Gas barrier resin "EVOH" for food and agriculture application**
	- Market trend with gas barrier packaging and the contribution to better life and environment
	* Mr.Masahiro Kitamura Technical Manager, Kuraray Asia Pacific Pte.Ltd.
10.30 – 10.45	Coffee Break
10.45 – 11.30	**- Introduction of high barrier "organic/inorganic hybrid composite coated" film for retortable and microwavable food packaging**
	- Market trend of retort food packaging
	* Mr. Koichi Hiraoka Asia & Pacific Sales of Kurarister and EVAL Film Kuraray Asia Pacific Pte.Ltd.
11.30 – 11.45	Question and Answers

For your inquiry, please contact below.

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Mr. Prasit Piriyaparkarn or Ms. Saithip Rungratsameepat

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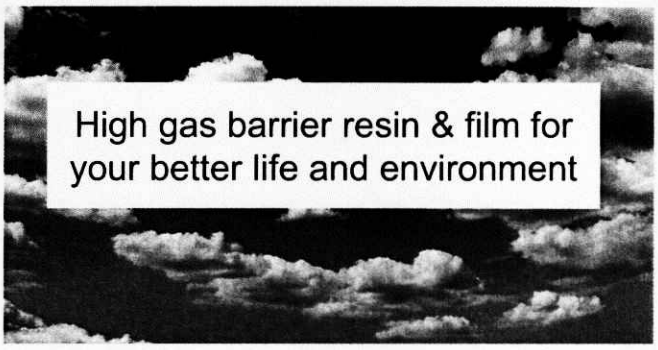

Kuraray Asia Pacific Pte. Ltd.
Masahiro Kitamura

EVAL

kuraray

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Who is Kuraray?

Kuraray Co. Ltd., founded 1926 in Kurashiki, Japan

The world's largest producer of Vinyl Acetate Monomer derivatives

kuraray

- World's largest producer of PVOH (POVAL™) and **EVOH (EVAL™)** as well as many other specialty polymers, fibres and films
- Leader in barrier technology and development
- Head office in Tokyo, Japan. Global sites: 43 sites in 17 countries

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Contents

- Kuraray introduction
- Introduction of Gas barrier resin "EVOH" and the application
- Market trend with gas barrier packaging and the contribution to better life and environment
- EVOH contribution to agriculture

(4)

EVAL division activities

Products and facilities

EVAL

EVOH barrier resins and films

- Resin and film production (81,000 T/year)
- Technical Centres in Japan, USA and Belgium
- Sales teams in Japan, China, Singapore, India, Brazil, USA and Belgium

KURARISTER

Transparent retortable barrier films

- Produced in Japan
- Sales teams in Japan, China, Singapore, India, Brazil, USA and Belgium

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Factors in food deterioration

1. Biological factor
   Bacteria growth, enzyme reaction, etc...
   ⇒ need oxygen barrier function
2. Chemical factor
   Oxidation of fat, lipid, vitamin, etc...
   ⇒ need oxygen barrier function
3. Physical factor
   Moisture adsorption / permeation, flavor loss, etc...
   ⇒ need moisture / flavor barrier function

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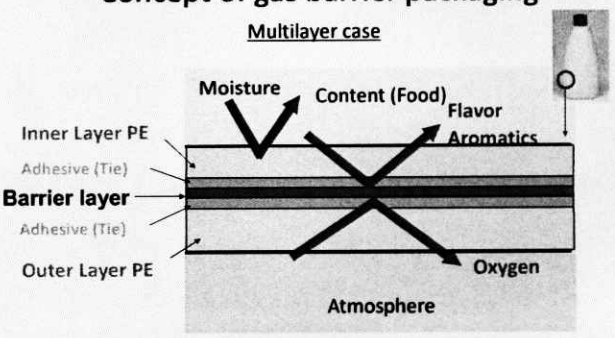
Concept of gas barrier packaging

Multilayer case



Multilayer packaging contribute to keep food quality and extend shelf life !

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OTR = Oxigent Transmison Rate

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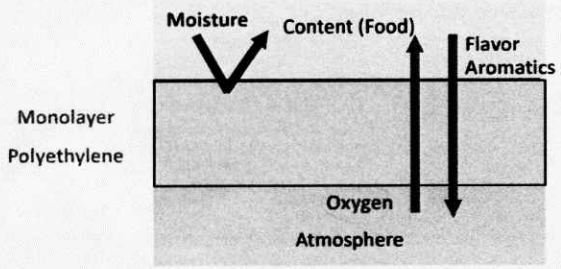
Concept of gas barrier packaging

Monolayer PE case



(1) Loss of flavor/Aromas (2) Oxidation of content

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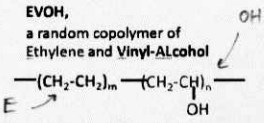
Benefit of EVOH

EVOH,
a random copolymer of
Ethylene and Vinyl-ALcohol

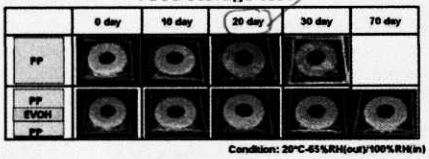


- Oxygen / Flavor barrier
- Chemical / Oil barrier
- Transparency
- Processability

Oxygen Barrier Comparison

MATERIAL	OTR @ 20degC65%RH (cc,20μm/m²,day,atm)
EVOH	0.2-3.2
PVDC	3.0~18
PAN	16
Oriented PET	50
Oriented NYLON	40
LDPE	8250
HDPE	3000
Oriented PP	3000
PS	7000

Food storage test



Extends shelf life and reduce the waste of food.

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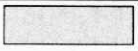
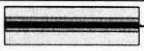
EVOH provides excellent oxygen barrier

	LDPE Monolayer	Multilayer with EVOH
Structure		 EVOH
(μm)	LDPE 100	LDPE/ tie/ EVOH*/ tie /LDPE 42.5/ 5 / 5 / 5 / 42.5 * Ethylene content = 32mol%*
OTR (cc/m2,day,atm)	1650	1.6

ที่ 1000 μm

Condition: 20°C-65%RH

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Functions of multilayer Packaging

✓ Pouch for dry foods
OPP//EVOH//LLDPE or CPP

Outside
- OPP — Moisture barrier / stiffness
- EVOH — Oxygen barrier
- LLDPE or CPP — Moisture barrier, Heat seal ability

Inside

Pouch for liquid sauce/soup
BOPA/EVOH/LLDPE

Outside
- BOPA — Pinhole resistance
- EVOH — Oxygen barrier
- LLDPE — Heat seal ability

Inside

(2)

Application of EVOH

- EVOH resin is easily converted into film, cup, bottle and tube.
- Monolayer EVOH film for lamination is also available.

(3)

Functions of multilayer Packaging

Cup for fruit jerry

Lid: BOPA//EVOH//CPP (lamination)
Cup: PP/EVOH/PP Co-ex

Outside
- BOPA — Pinhole resistance
- EVOH — Oxygen barrier
- CPP (easy peal) — Heat resistance, Moisture barrier, Heat seal ability (Easy peal ability)

Inside

Heat sealed

Inside
- PP — Rigidity, Heat resistance
- EVOH — Oxygen barrier
- PP — Rigidity, Heat resistance

Outside

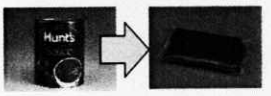
Global food packaging trend

- Key words
  - Convenient for consumer
    - Lighter weight, easy handling, microwavable
  - Safety
    - No contamination (metal detectable)
    - Concern for chemicals (e.g. Bisphenol, BHT, phthalate, etc..)
  - Environmental friendly
    - Easy to recycle (AL replacement)
    - LCA study, Reduce energy/CO_2 gas emission during total process (production-distribution-recycle)
  - Attractive packaging (Replacement of traditional packaging)
- Market Trend
  - **Longer shelf life to reduce the waste of food**
  - **Glass, Can and AL replacement by plastic barrier packages**
  - **Ready to eat meal (pouch or rigid)**
  - **Food safety**

Benefit of EVOH - Ketchup/sauces -

- ✓ **Lower weight than tin can and glass**
- ✓ **Convenience (easy open)**
- ✓ **Safety (transparency, metal detectable)**
- ✓ **Less preservative due to high O2 barrier**

  ⇒ **Better brand image**



Storage period (days)	PP/EVOH/PP pouch	PET/PP pouch ✓	PP monolayer pouch
0		pH = 3.77	
58			
121 ✓	pH = 3.74	pH = 3.68	pH = 3.40

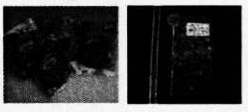
Storage condition: 40degC

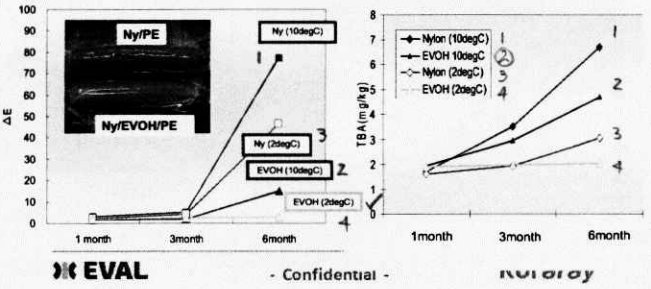
Benefit of EVOH - Ham/sausage -

- ✓ **Maintain the quality**

  ⇒ **Extend shelf life and reduce the waste**
- ✓ **Enable less preservative than conventional Nylon packaging**

  ⇒ **Better brand image**





Advantages of plastic package against metal /glass

<Safety>
1. Transparent
2. Metal detector ability
3. Safe to open
4. Unbreakable

<Convenience>
1. Lighter weight
2. Easy handling
3. Easy open, Re-closable
4. Microwavable ready meal
5. Easy to dispose

<Attractive packaging>
1. Free designing
2. Innovative product image

<Environmental>
1. Lighter weight and reduce energy/CO_2
2. Recyclable

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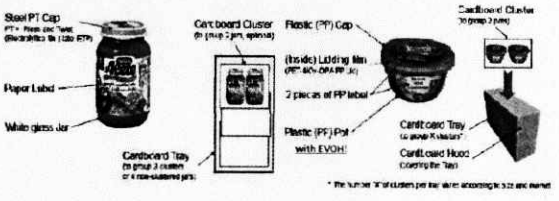
Market Trends in Europe

Glass vs Plastics: a case study by Nestle

Glass Jar components **Plastic Pot components**



Retorting ⇒ Aseptic form-fill-seal

Source:

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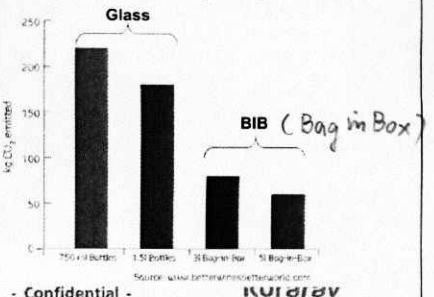
Market trend (Glass Replacement by BIB)

✓ **Reduced ecological footprint: boxed wines contribute fewer carbon emissions to the atmosphere than traditional glass bottles during making and shipping process.**

PE/tie/EVOH/tie/PE

Carbon dioxide emission per 100 gallons wine



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Market Trends in Europe

Glass vs Plastics: a case study by Nestle

Conclusions (made by some external experts):

Plastic advantage (up to 50%) due to:

- **Production: 3 times less energy, air pollution and warming gasses needed.**
- **Reduced packaging weights leading to reduced impacts of transportation.**
- **Replacement of retorting process with asceptic form fill seal**

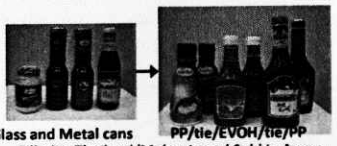
Bag-in-box in Europe

tie =

Glass and Metal can replacement

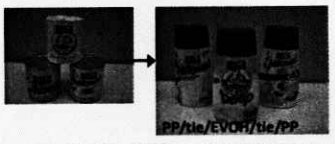
Ketchup, seasonings, condensed milk bottle

- ✓ Lighter weight than glass/cans
- ✓ Transparent
- ✓ Metal detector available
- ✓ Convenient
  - Easy/safe to open
  - Squeezable
- ✓ Drop resistance (vs glass)



Glass and Metal cans Filled in Thailand/Malaysia and Sold in Asean

PP/tie/EVOH/tie/PP



PP/tie/EVOH/tie/PP

India and AUS for domestics

Typical shelf life = 1-1.5 year at room temperature

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Glass replacement (Others)

Vegetables (catering)

Structure: PP/tie/EVOH/tie/PP

Sold in EU

Sold in AUS

Peanut butter Sold in USA

Jam Sold in Germany

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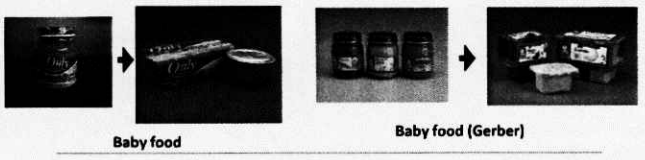
Glass replacement

Dipping sauce, baby food

- ✓ Lighter weight than glass
- ✓ Transparent
- ✓ Metal detector available
- ✓ Convenient
- ✓ Safety (Drop resistance)
- ✓ No contamination of glass fine while opening

Structure: PP/tie/EVOH/tie/PP

Cheese & salsa dipping sauce



Baby food

Baby food (Gerber)

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Market trend (Metal Can Replacement)

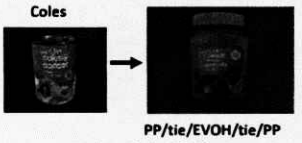
Fruit in Syrup

- ✓ Lighter weight
- ✓ Transparent
- ✓ Metal detector available
- ✓ Convenient
  - Easy/safe to open
  - Single serve (cup)
  - Reclosable (bottle)

Del Monte

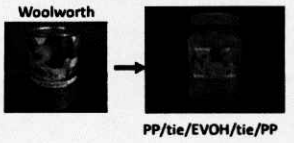
PP/tie/EVOH/tie/PP

Coles



PP/tie/EVOH/tie/PP

Woolworth



PP/tie/EVOH/tie/PP

Typical shelf life = 1 year at room temperature

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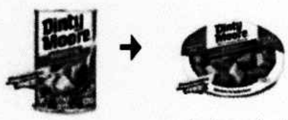
Market trend (Metal Can Replacement)

Microwavable ready meal

- ✓ Lighter weight
- ✓ Transparent
- ✓ Metal detector available
- ✓ Convenient
  - Easy/safe to open
  - Microwavable
  - Single serve
- ✓ Retortable



Typical shelf life = 1-1.5 year at room temperature

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Market trend (Metal Can / AL pouch Replacement)

Aluminium

Tuna (pet food)

Typical shelf life = 1.5 - 2 year at room temperature

Plastic packaging is going to be a trend....

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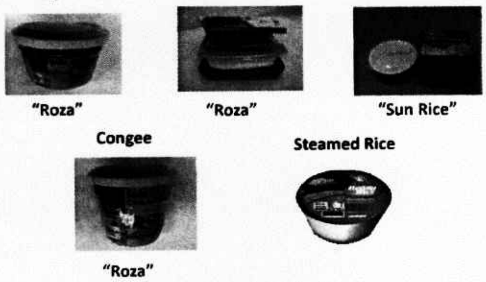
Ready meal sample with EVOH in Thailand



Structure: PP/tie/EVOH/tie/PP

EVOH is already getting common in Thailand !

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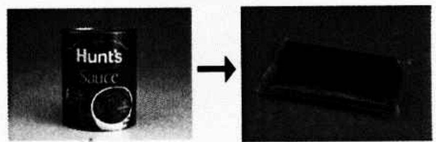
Market trend (Metal Can Replacement), others

Institutional Pouch



Lighter weight

Grind coffee

Lighter weight
Easy handling
Re-closable
Aroma barrier

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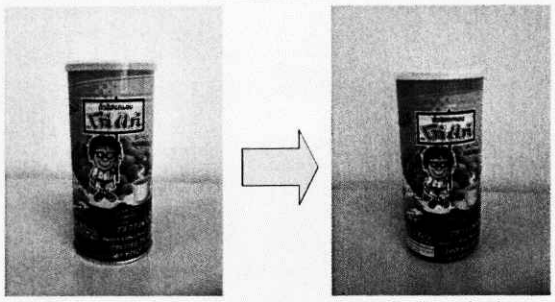
Market trend (Metal Can Replacement), others

Thai Snack



PP/tie/EVOH/tie/PP

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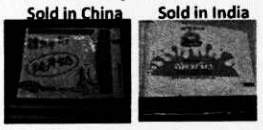
Benefit of EVOH - UHT milk pouch -

- ✓ Lower cost than aseptic carton (AL/paper) 33% or less than carton
- ✓ Reduced weight (around 25%)
- ✓ Stable barrier (flexibility)
- ✓ No refrigerator, 3-6 months shelf life
- ✓ Easy recycling

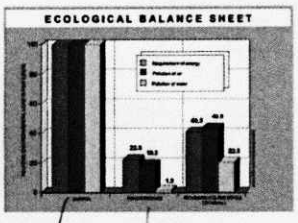
Sold in China Sold in India



Typical structure: PE/tie/EVOH/tie/PE

Benefit to consumer

Mendoza, Argentina, February 2007

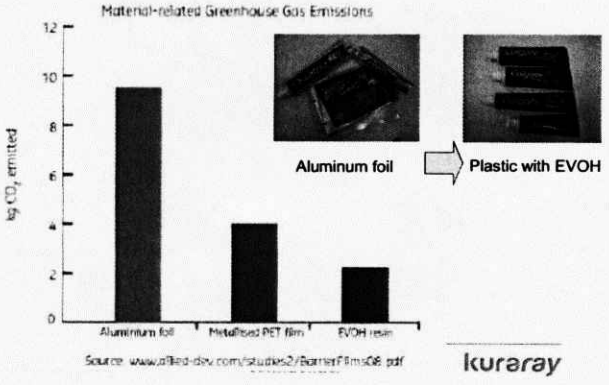


The high barrier pouch is sustainable

EVAL - Cc

carton plastic pouch

AL replacement
- Recycling material carbon foot print with EVOH -



Source: www.allied-pkg.com/studies2/BarrierFilms08.pdf

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Metallised PE

EVOH for food safety

Prevent the migration of
"Mineral Oils Hydrocarbons" from recycled carton

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1

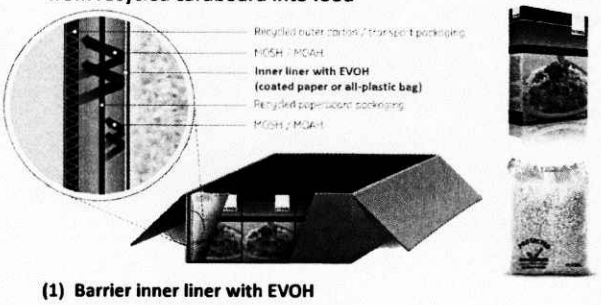
Food safety
- Migration of Mineral oil in recycled cardboard -

- Recycled cardboard can contain large amounts of residual ink, notably from newspapers
- Printing inks are usually complex mixes of hydrocarbons (mineral oil)
- Hydrocarbons can easily migrate out of recycled board.
- The average concentration of MOSH in unprinted recycled paperboard from Switzerland and Germany is **338 mg/kg** carton.
- Mineral oils contained in recycled paperboard, approximately:
  - 75-90% MOSH (Mineral Oil Saturated Hydrocarbon)
  - 10-25% MOAH (Mineral Oil Aromatic Hydrocarbon)
- At the end of shelf life, typically 60-80% of the MOSH has migrated into the packaged food.

3

Proving EVOH barrier to MOSH/MOAH

Prevent migration of mineral oil (MOSH, MOAH) from recycled cardboard into food



(1) Barrier inner liner with EVOH

(2) EVOH lamination onto cartonboard

(3)

2

Identifying the problem

Investigation by the Food Safety Authority of the Canton of Zürich:

102 different dry foods in paperboard packaging (Italy and Switzerland)

119 different dry foods in paperboard packaging (Germany)

- Concentrations of mineral oils measured in the packaged food were often 10 times higher than the ADI (allowed daily intake) limit.
- In several cases the measured amounts were more than 100 times the allowed limit.

Regulatory responses

Germany

- On 2nd May, 2011, German authorities proposed legal limits to the amount of mineral oil migration from paper (including recycled paper) for food contact applications:
  - **<0.60 mg MOSH** (C10-25)/ 1 kg food
  - **<0.15 mg MOAH** (C10-25)/ 1 kg food

EFSA (European Food Safety Authority)

- June 2012: Exposure to MOH via packaging and some foods, may pose a human health hazard, said EFSA, as it called for an overhaul of ADI levels and suggested a raft of new measures to assess and monitor the risks from the sunstances.

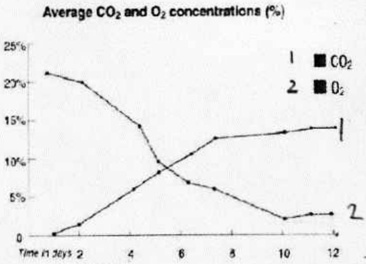
EVOH for agriculture application

1. Hermetic bag for grains/seeds
2. Fumigation film
3. Silage film

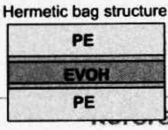
Air

Agricultural application - Hermetic Bag -

- Post harvest problem: Moisture, molds, insects
- Living organism's respiration makes high CO2 and low O2 atmosphere
- Prevent the growth of bacteria/insect by Modified Atmosphere Packaging
  → Maintain quality of crops and high germination rate of seeds



Hermetic bag structure



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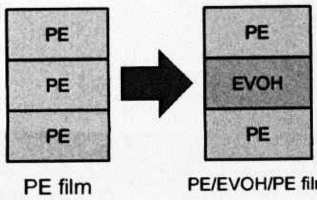
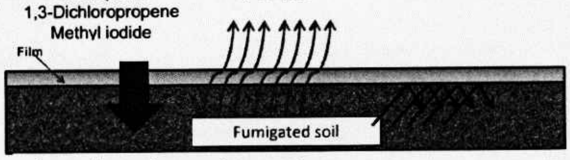
Modified Air Condition = CO2
ทำให้เชื้อรา เชื้อแบคทีเรียไม่โต

Agricultural application - Fumigation film -

Fumigant
Methyl bromide
Chloropicrin
1,3-Dichloropropene
Methyl iodide

ยาฆ่า แบคทีเรีย ในดิน





- Lower impact on environment
- Increase the fumigation efficiency
- Higher yield and/or lower fumigant cost

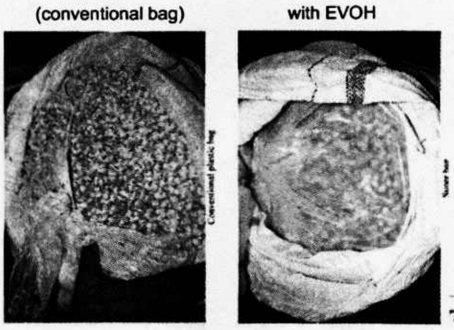
EVOH have high Fumigant Barrier

LDPE ต้องใช้ 400 lb/ac
EVOH ต้องใช้ 100 lb/ac } ลดต้นทุน

Storage test result - Corn seeds in Myanmar -

After 5 months storage

Monolayer LDPE bag (conventional bag)	Multilayer bag with EVOH



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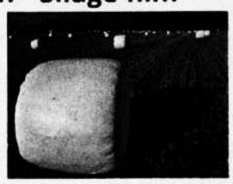
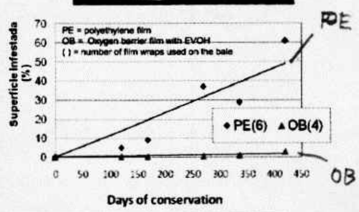
- แมลงลดลง
- Germination ดีขึ้น
- Milling ได้สูงขึ้น

ใช้มากใน EU/US

Agricultural application - Silage film -

- ✓ Prevent mold growth of forage and grains
- ✓ Reduce intrusion of rodents and other pests
- ✓ Preserve the nutritional value of feed
  → Increase the commercial value of silage





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Summary

- EVOH has superior gas barrier property, which enables to maintain food quality, prolong the shelf life.
- Plastic packaging with EVOH has many advantages against traditional packaging such as metal/glass/AL foil and contributes to environment and human life in terms of ;
  - Less weight of packaging
  - Energy saving during production and transportation
  - Reduced the waste of food
  - Food safety
  - Better quality and yield of grains/seeds/feeds
- Kuraray is a leading company of barrier technology, and developing new barrier material/application by our specialized technology.

ขอบคุณ ครับ

Thank you !

For your inquiry, please contact below.

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Prasit Piriyaparkarn or Saithip Rungratsameepat

④

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Market trend of retort food packaging

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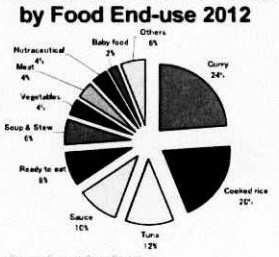
Global Retort Pouch Demand by Food End-use 2012



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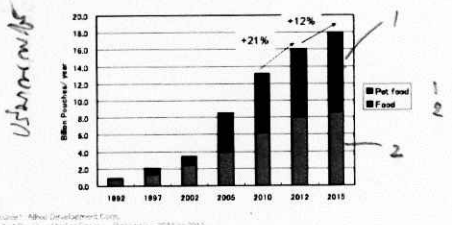
Global Retort Pouch Demand



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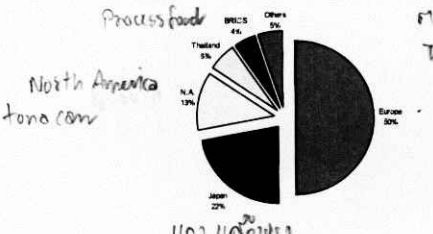
Retort Pouch Demand by Region 2012



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AAGA :-

aluminium retort pouch

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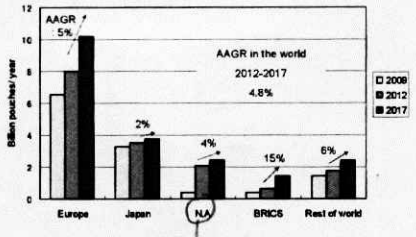
Retort Pouch trend by Region



เพราะเป็นมิตรกับ Environmental

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Industrial Level Benefit of Retort Pouch

- Reduced retort times
- Reduced storage space
- Reduced transportation costs

- Shelf appeal
  - Product visibility for quality check
- Safety
  - Metal detection

- The customer is buying !

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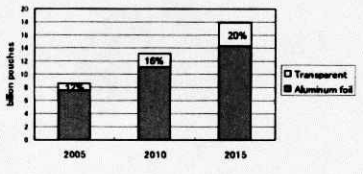
Transparent vs. Aluminum foil



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Consumer Level Benefit of Retort Pouch

- Improved quality, taste, texture
- Shelf appeal, high impact images
- Modern / innovative product image ดูทันสมัย
- Convenience
  - Suitable for microwave oven
  - Opening / handling
  - Light weight
  - Single size portions
  - Shelf stable at ambient temperatures
- Product visibility

organic ám inorganic

KURARISTER™

High-barrier, transparent film for retort packaging

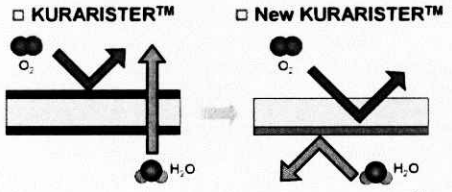
Kuraray Co., Ltd.
Film Sales Department

www.kurarister.com

KURARISTER™

Development of New KURARISTER™

- Provide high moisture barrier
- Single side coateding



KURARISTER™

Content

- Introduction of KURARISTER™ CF
- Barrier Performance
- Physical Property
- Processability

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Barrier Property

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KURARISTER™ CF Barrier Performance

Item	Before/after retort (Condition)	Retort condition	KURARISTER™ CF	Inorganic coated PET
Oxygen Transmission Rate (cc/m².day.atm)	Before retort	-	0.4	0.3
	After retort	120°C, 30min,	0.4	0.5
		130°C, 30mn,	0.4	-
Water Vapor Transmission Rate (g/m².day)	Before retort		0.2	0.8
	After retort	120°C, 30min,	0.2	2.0
		130°C, 30min,	0.2	-

*Laminate: KURARISTER™ CF or inorganic coateded film // 15μm BOPA // 50μm CPP
*Measurement condition: (OTR): 20°C, 85%RH (out)-100%RH (in)
(WVTR): 40°C, 90%RH

Laminated: or inorganic coated film // 15 μm BOPA // 50μ CPP

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Measurement Methods

OTR after Gelbo flex

Retort ➡ Gelbo flex ➡ OTR

*Test condition: 23°C, 50%RH

OTR after Folding

Pass the folded film between the rolls and measure OTR of the folded part.

Retort ➡

Measure OTR of the folded part.

*Test condition: 23°C, 50%RH

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Barrier Performance vs. Pasteurizing, Sterilizing and Temperature

Processing / sterilizing method	Condition	Oxygen Transmission Rate (cc/m².day.atm)	Water Vapor Transmission Rate (g/m².day)
Water immersion	120°C,30 min	0.4	0.2
	130°C,30 min	0.4	0.2
Spray	120°C,30 min	0.4	0.4
	130°C,30 min	0.4	0.2
Steam	120°C,30 min	0.4	0.3
	130°C,30 min	0.4	0.2
Boil	85°C,30 min	0.4	0.2

*Laminate: KURARISTER™ CF // 15μm BOPA // 50μm CPP

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Barrier Performance after Various Abuse

Item	Abuse condition	KURARISTER™ CF	Inorganic coated PET
Oxygen Transmission Rate (cc/m².day.atm)	After retort / folding	0.5	0.8
	After retort / 10 Gelbo cycle	2.5	4.8
	After retort / 50 Gelbo cycle	2.5	5.1
Water Vapor Transmission Rate (g/m².day)	After retort / folding	0.4	1.3
	After retort / 10 Gelbo cycle	1.0	2.9
	After retort / 50 Gelbo cycle	1.0	2.9

*Laminate: KURARISTER™ CF or inorganic coateded film // 15μm BOPA // 50μm CPP
*Measurement condition: (OTR): 20°C, 85%RH (out)-100%RH (in)
(WVTR): 40°C, 90%RH

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OTR and WVTR Performance in Stand up Pouch

Item	KURARISTER™ CF pouch *1		Inorganic oxide(s) PET Pouch *2	
	Body	Bottom	Body	Bottom
Oxygen Transmission Rate (cc/m²,day,atm)	0.3	0.6	0.3	3.9
Water Vapor Transmission Rate (g/m²,day)	0.1	0.3	0.3	1.1

*1 Pouch film structure: KURARISTER™ CF #ON 15μm #CPP 50μm (body, bottom)
*2 Pouch film structure: Inorganic oxide(s) PET #ON 15μm #CPP 70μm (body, bottom)

Measurement condition: (OTR) 20°C,85%RH (air),100%RH (N2)
(WVTR) 40°C,90%RH

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KURARISTER™ CF Physical Properties Basic

Item		Unit	KURARISTER™CF	OPET (Reference)
Tensile Modulus	MD	GPa	5.1	4.4
	TD		4.8	4.2
Tensile Strength at Break	MD	MPA	220	240
	TD		170	200
Elongation at Break	MD	%	130	140
	TD		170	200
Impact Strength		J	0.3	0.4
Puncture Strength		N	4.0	4.1
Total Light Transmission		%	91	90
Haze		%	2.5	3.2

*Measurement condition: 23°C, 50%RH

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Physical Property

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Processability

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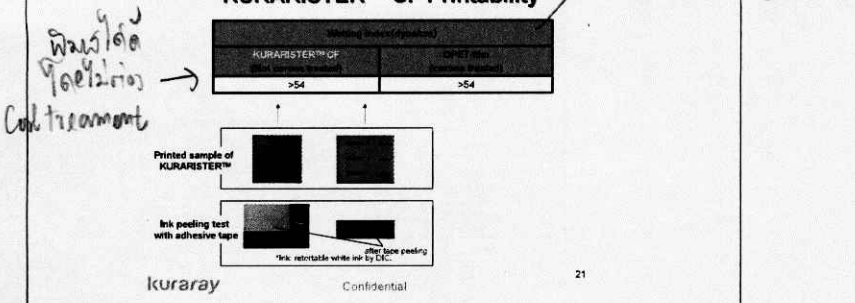
KURARISTER™ CF Printability



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Thank you for your attention!

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