



Barrier Shrink film

 **EVAL**



kuraray

Adding function to fresh meat packaging

Shrink film and bags are widely used for packaging fresh meat. When heat is applied the film/bag shrinks to fit firmly around the portion of meat, adapting itself to the individual shape.

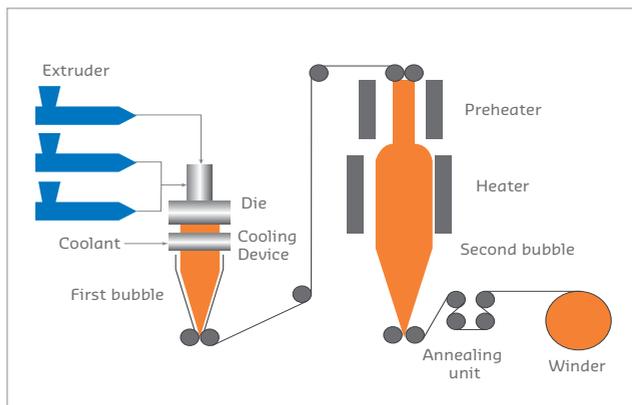
Shrink film/bags are convenient since standard sized bags **adapt themselves to the individual sizes** of each portion. They provide clarity and enhance the appearance of the packaged meat. They are tamper evident and maintain product quality. By adding a high barrier layer of EVAL™ to the shrink film/bag structure, **oxygen permeation is blocked and shelf life is extended**. The packaged product retains its freshness longer, protecting value and reducing waste.

In order to achieve a sufficient shrink ratio, so called **“double bubble”** blown film coextrusion is increasingly popular. The coextruded blown film structure is **heated**

and blown a second time, ensuring desired shrinkage when the film/bag is subsequently heated when packaging. In the past, this secondary orientation was technically challenging for EVOH, which is a relatively stiff material. However, Kuraray has developed the orientable

EVAL™ SP grade series, which significantly widen EVAL™’s processing window, and make them suitable for this process without compromising on barrier properties.

Typical double bubble blown film process.



EVAL™ EVOH resins

EVAL™ is the registered trademark for Ethylene Vinyl-Alcohol (EVOH) copolymer resins manufactured and marketed by Kuraray since 1972.

EVAL™ EVOH resins have gas barrier properties nearly **10,000 times greater than those of an equivalent thickness of low density polyethylene (LDPE)**. An EVAL™ layer of only a few microns in a multilayer structure adds a powerful and effective barrier function against gas and aroma. Oxygen is kept out to avoid spoilage, flavour is locked inside where it belongs.

Technological innovation has created the world’s widest range of available EVOH grades, suitable for the production and secondary processing of fresh food packaging.

EVAL™ SP types are orientable, and especially suited to double bubble

processing. They offer superior barrier properties while maintaining desired clarity and shrink ratios.

EVAL™ G type has a higher ethylene content, which allows excellent flexibility and easy processing.

EVAL™ H type combines high barrier properties with long-term run stability and thermoformability. The higher ethylene content allows easier processing and longer running times on older coextrusion equipment, especially for blown flexible structures.

Type	EVAL™ SP482B	EVAL™ SP292B	EVAL™ G156B	EVAL™ H171B
Ethylene content (mol%)	32	44	48	38
Density ⁽¹⁾ (g/cm ³)	1,16	1,13	1,12	1,17
MFR ⁽²⁾ (g/10 min)	2,0	2,1	6,9	1,7
Tm (°C)	181	161	160	172
Tg ⁽³⁾ (°C)	41	48	50	53
OTR ⁽⁴⁾ (cc.20µm/m ² .day.atm)	0,6	3,1	3,2	0,7

⁽¹⁾ 20°C ⁽²⁾ 190°C, 2160g ⁽³⁾ dry ⁽⁴⁾ OTR, 20°C, 65% RH (ISO 14663-2)

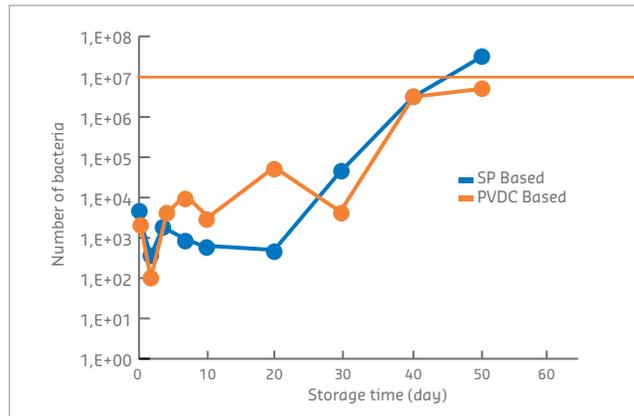
High performance, prolonged freshness, reduced waste

EVAL™ resins' functional barrier blocks oxygen permeation into shrink film packaging. This makes it possible to **protect value and extend product shelf life by limiting bacteriological growth**. Prolonging freshness and avoiding waste brings welcome flexibility and cost savings to the distribution chain.

Currently PVDC shrink structures are commonly used for packaging fresh meat, especially for intermediate processing and distribution that is often not seen by the end consumer.

EVAL™ offers an effective alternative choice to PVDC, with barrier properties that provide similar protective performance for shrink film.

Freshness of meat (amount of bacteria in package at 2°C)

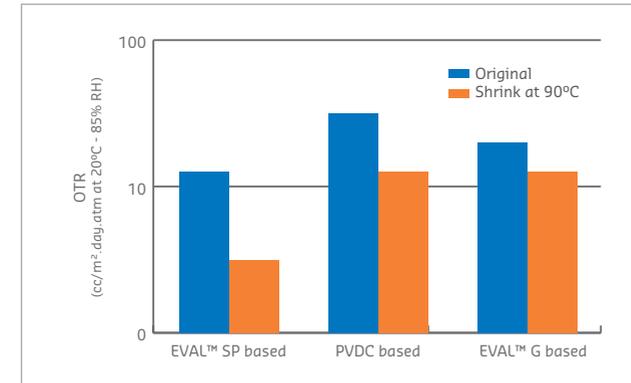


acceptable level

Shrink performance of EVAL™ resins

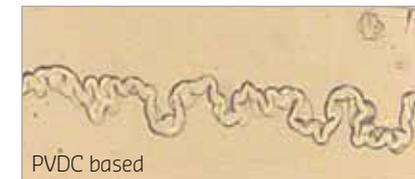
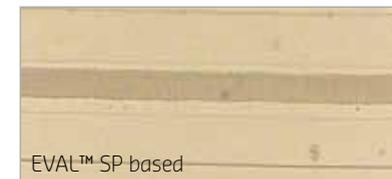
Due to orientation, **the barrier properties of EVAL™ resins actually improve with shrink treatment**. This is most visible with the orientable SP grade series. The barrier properties are so good that it is often possible to reduce the amount of raw materials used without compromising on value protection.

Barrier performance before and after shrink



The EVAL™ layer shrinks similarly to other polyolefines in a multilayer structure. This ensures a reliable barrier layer, without compromising on haze or clarity due to layer instability.

Cross section of multilayer structure after shrink

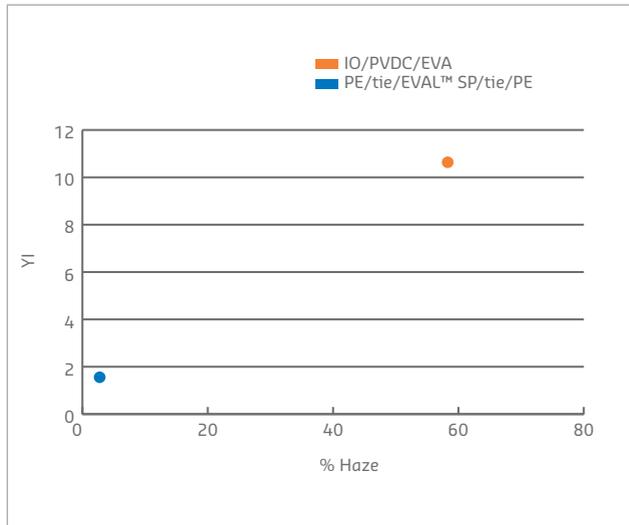


Appearance

Exceptional clarity

EVAL™ contains relatively low haze, providing **excellent clarity and fresh appearance to shrink film packaging**. Compared to PVDC, appearance is further enhanced by its relatively low Yellow Index (YI).

Haze and Yellow index



Shrink Tension

Compared to PVDC, EVAL™ has a **slightly lower shrink tension**. This means that barrier shrink structures with EVAL™ fit firmly to packaged meat, but will not squeeze too tightly, which tends to force unsightly fluids into the edges of the package. Combined with the exceptional clarity of EVAL™, **product attractiveness is further enhanced** without compromising on function and protection of quality.

Effect of shrink tension and yellow index on product appearance



PVDC based

EVAL™ SP based

PVDC based

EVAL™ SP based

Reducing environmental impact with EVAL™ resins

Functional, recyclable and recoverable

A one millimetre thickness of EVAL™ EVOH has about the same gas barrier properties as ten metres of LDPE. With such high performance, EVAL™ layers of only a few microns can add real function to multilayer structures.



Barrier performance previously only available from metal or glass can thus be added to light weight structures based on other recyclable and energy recoverable plastics, or renewable resources like PLA and paperboard.

Although product development tends to focus specifically on EVAL™'s functional barrier properties, **EVAL™ helps conserve resources and avoid waste throughout a product's life cycle.** Reducing waste, and thus avoiding the loss of all resources invested in the production and distribution of fresh food, is the best way to **reduce environmental impact.**

When used in shrink film packaging, EVAL™ layers of just a few microns allow to use fewer resources while providing valuable barrier function. Optimized portion size, light weight and extended freshness help improve the efficiency of storage, transport and display, saving costs and preserving resources.

EVAL™ EVOH is recyclable, and will not disrupt polyolefin or PET recycling streams.

EVAL™ has **excellent and safe energy recovery properties**, often reducing the amount of extra fuel necessary for energy generation from the thermal disposal of sorted waste.

Under perfect combustion, the few microns of EVAL™ in the package emit only small amounts of CO₂ and water vapour.

Introducing Kuraray and EVAL™



Kuraray and EVAL™

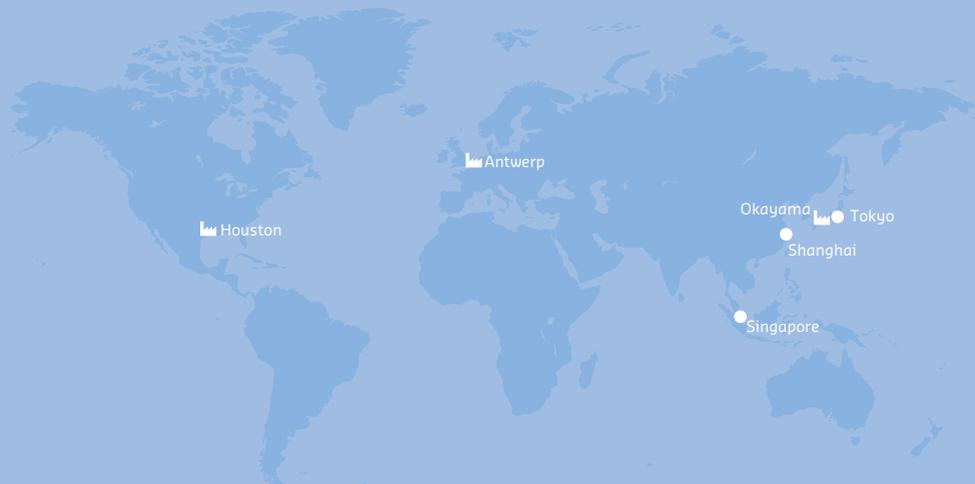
Kuraray Co., Ltd. was established in 1926 in Kurashiki, Japan, for the industrial manufacture of chemical fibres. As the **world's largest producer of vinyl acetate monomer (VAM) derivatives**, Kuraray has long been a **leader in high gas barrier technology and development**. Today the Kuraray Group consists of about 70 companies, employing around 7,000 people worldwide.



Kuraray has been manufacturing and marketing **ethylene vinyl-alcohol copolymers (EVOH) under the name EVAL™** since 1972, and remains the world leader in EVOH production and market development. EVAL™ is one of Kuraray's core businesses and is produced globally in Japan, the USA and Europe. The sales and technical development of EVAL™ is supported by specialised local teams in each region.

Building better barriers

EVAL™ adds superior barrier functionality to multilayer plastic structures. Since 1 mm of EVAL™ provides about the same gas barrier properties as a 10 metre thickness of LDPE, even very thin EVAL™ layers provide excellent results. EVAL™ is widely used as a **functional gas and flavour/aroma barrier** in food, medical, pharmaceutical and cosmetic packaging, and as a **gas and solvent barrier** in industrial, construction, agricultural and automotive fuel system applications.



EVAL™ the world's leading EVOH

Europe

EVAL Europe nv (Antwerp, Belgium)

Capacity: 24,000 tons/year

Europe's first and largest EVOH production facility

Americas

EVAL Company of America (Pasadena, Texas, USA)

Capacity: 35,000 tons/year

The world's largest EVOH production facility

Asia-Pacific

Kuraray Co., Ltd. (Okayama, Japan)

Capacity: 10,000 tons/year

The world's first EVOH production facility

NOTICE

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