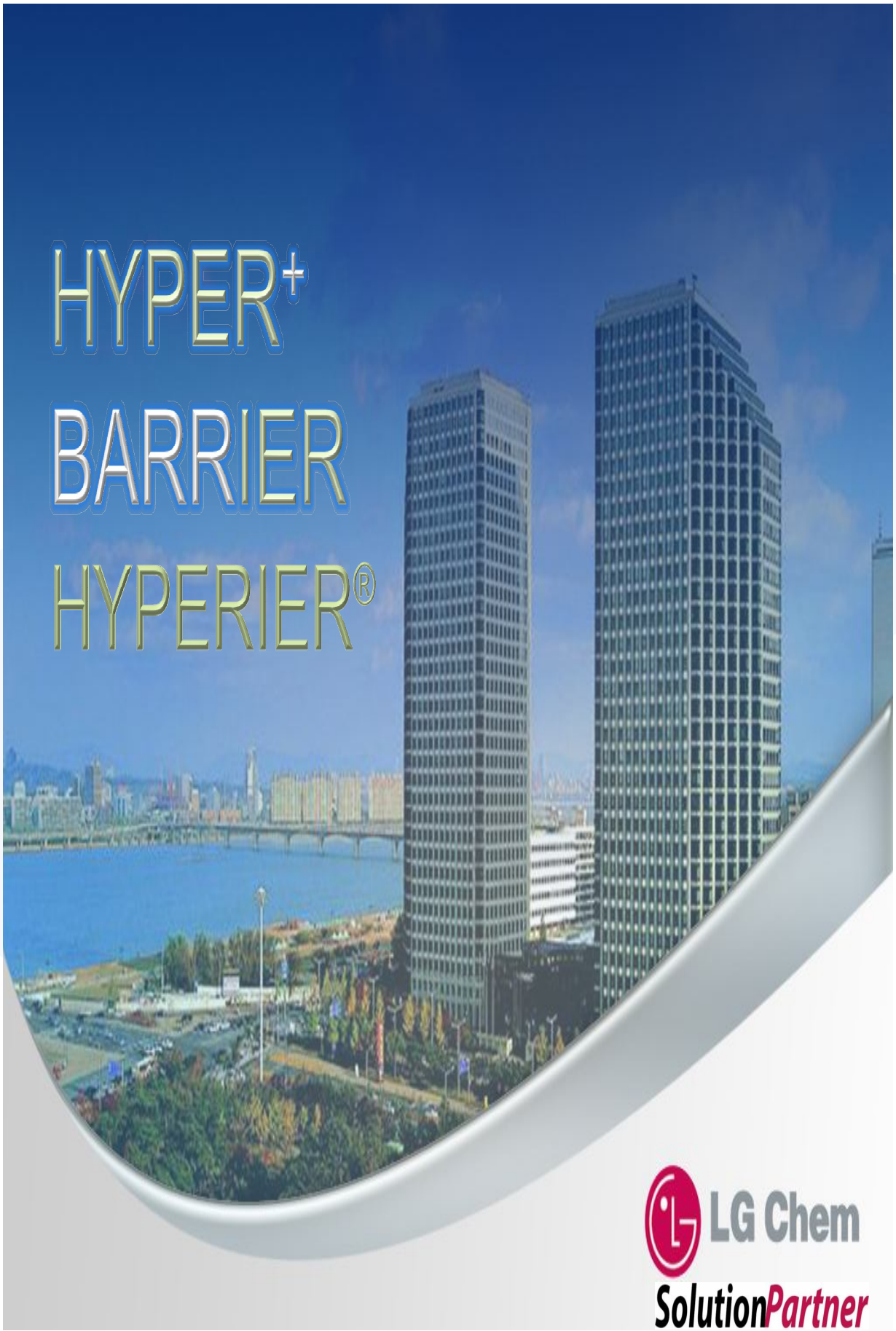


Contents

LG Chem

Why Barrier?

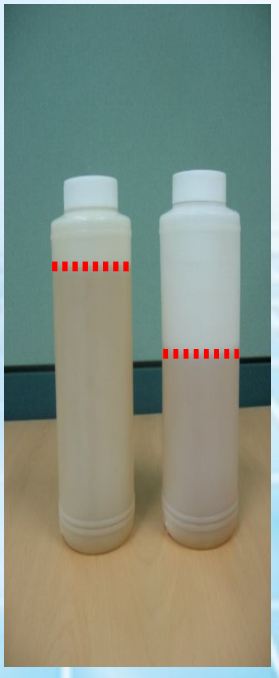
LG Chem

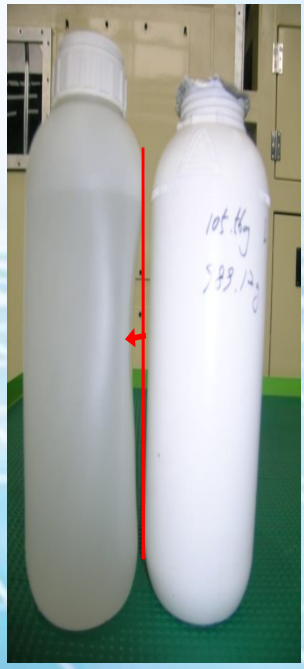
Shelf-life of Products

- Content loss
- Paneling (lateral deformation) of container

Other Issues

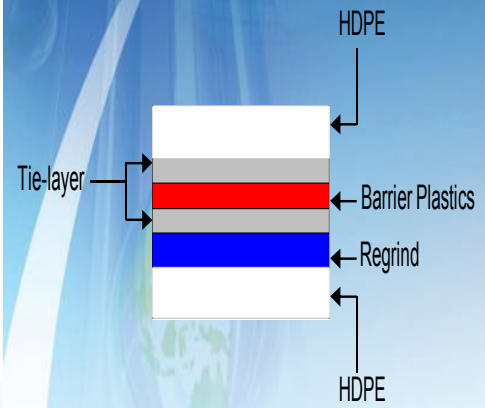
- Environmental pollution & health problems
- Regulations – EPA, CARB, etc.



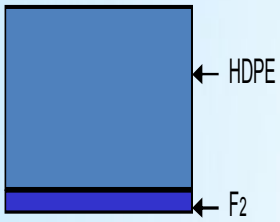


Solutions for Barrier

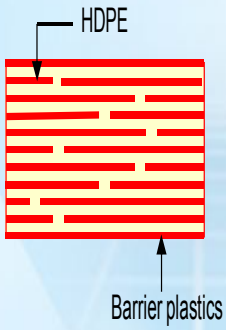
LG Chem



Multi-layer Co-Extrusion
EVOH or MXD6



Chemical Treatment
- Fluorination
- Sulphonation



Laminar Technology
- HYPERIER

What is HYPERIER®?

LG Chem

HYPERIER®

- A barrier additive, blended with polyolefins (HDPE, LDPE, PP) for blow molding applications
- Consists of PA nanocomposite and compatibilizer
- Formation of barrier layers or multiple lamellar structure within container walls

Why HYPERIER® ?

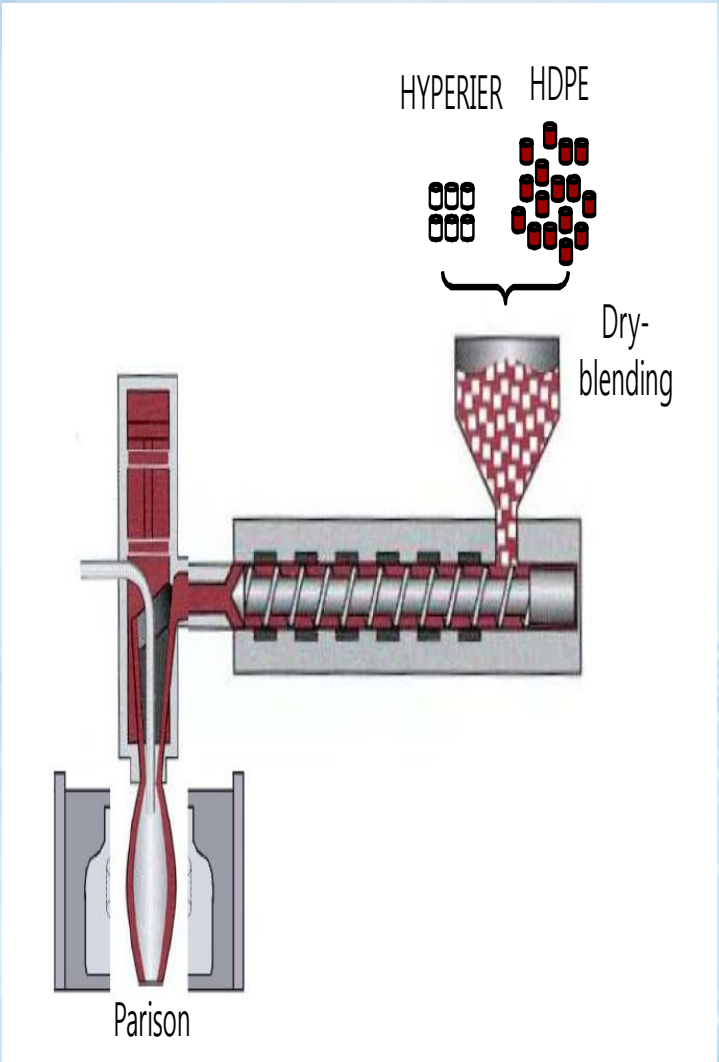
- Requires no additional blow molding equipment
- Applicable to both mono-/multi-layer blow molding
- Cheap and simple to process

HYPERIER® Processing

LG Chem

Processing Procedure

- Add HYPERIER®
- Set equipment to optimum processing conditions (temperature, screw rpm, etc.)

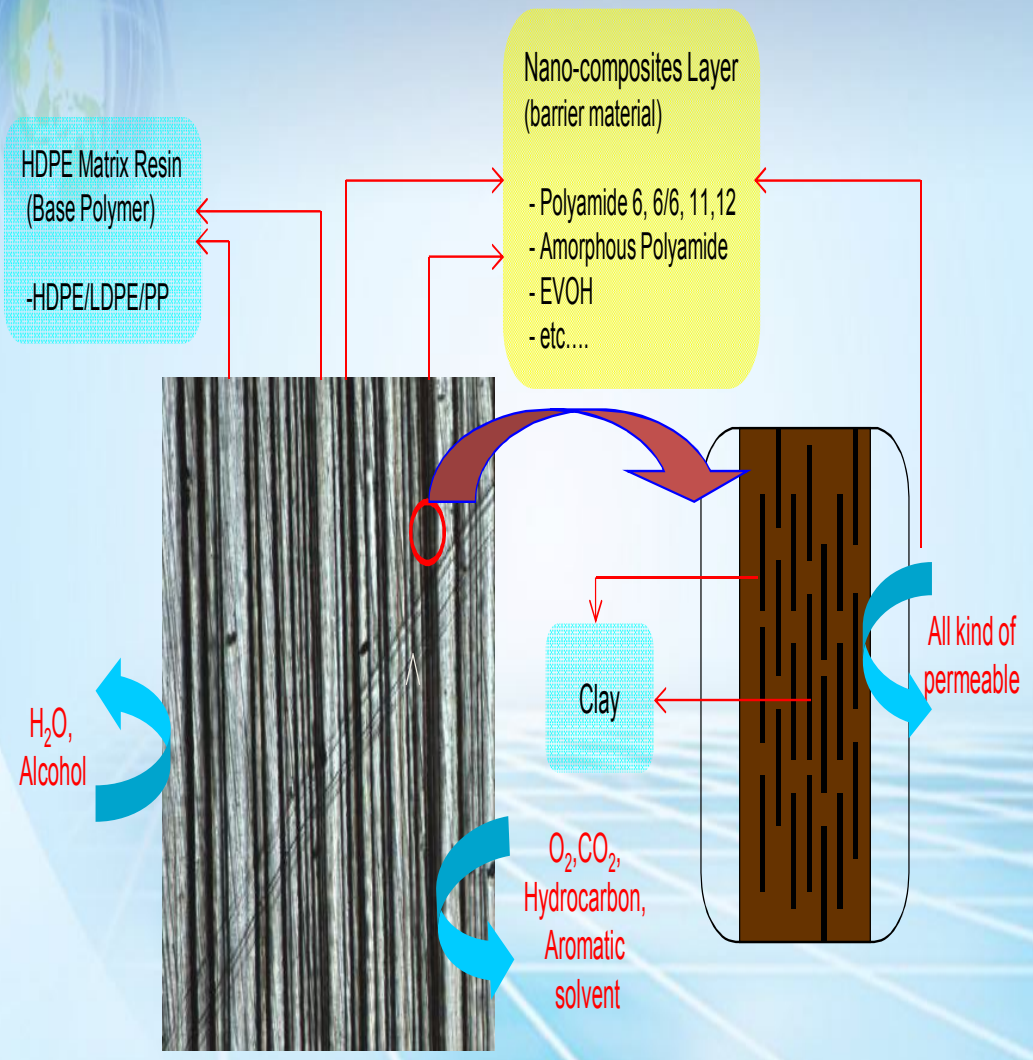


HYPERIER® Morphology

LG Chem

HYPERIER® Morphology

- Formation of overlapping barrier layers or multiple lamellar structure



Multiple Micro-layered Lamellar Structure
(X 50, 1N iodine solution stained by)

Benefits of HYPERIER®

LG Chem

Cost-effectiveness

- Utilizes current (mono-/multi-layer) blow molding machines and molds
- No transportation costs
- Recyclability

Safe & easy processing

- No use of harmful chemicals
- Simple processing procedure

Desirable Properties

- Adjustable degree of barrier performance in products
- Good mechanical properties
- Excellent barrier to most fuel types and agrochemicals
  - Suitable for agricultural packaging, fuel tanks and containers
- No degradation of barrier over time

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HYPERIER® vs. Other Solutions

LG Chem

Solution	HYPERIER®	Fluorination	Co-Ex EVOH
Characteristics	Nanocomposite blend	Surface treatment using F_2 gas	Co-polyamide, EVOH
Processing	Mono-/multi-layer extrusion blow molding	Monolayer extrusion BM + F_2 gas coating	6-layer extrusion blow molding
Advantages	➢ Meets new EPA/CARB requirements ➢ Uses existing BM machines ➢ High durability ➢ Lead time	➢ High impact property ➢ High durability	➢ Meets new EPA/CARB requirements ➢ Low material cost ➢ High durability
Disadvantages	➢ Need to optimize processing parameters	➢ Hard to meet new EPA/CARB requirements ➢ Toxic and hazardous ➢ High cost for Fluorination ➢ Loses barrier property over time	➢ Need for high machinery investment (new machines) ➢ Increasing process complexity ➢ Limited production flexibility

HYPERIER® Properties

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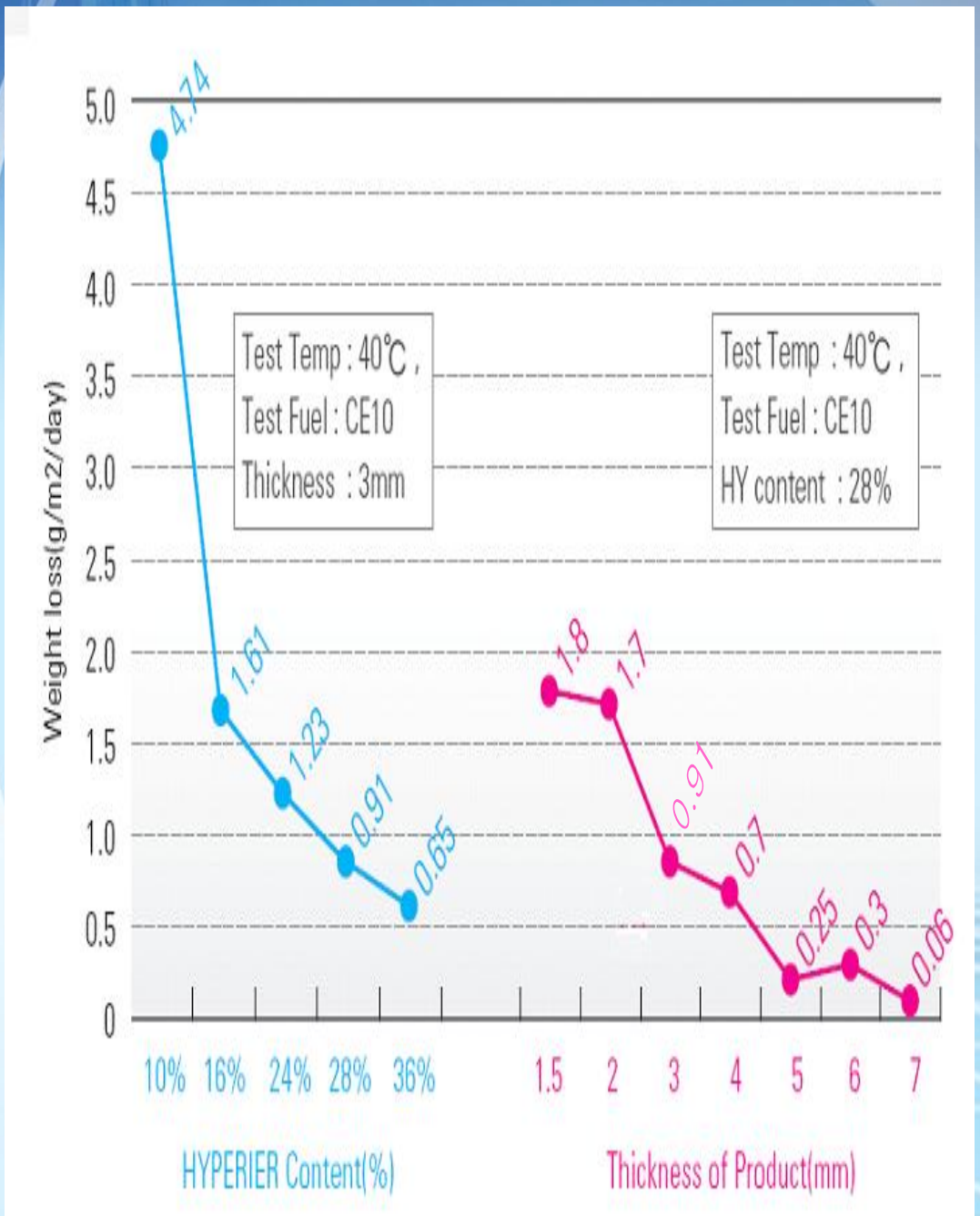
Effects of HYPERIER® Content & Container Thickness on Barrier Performance

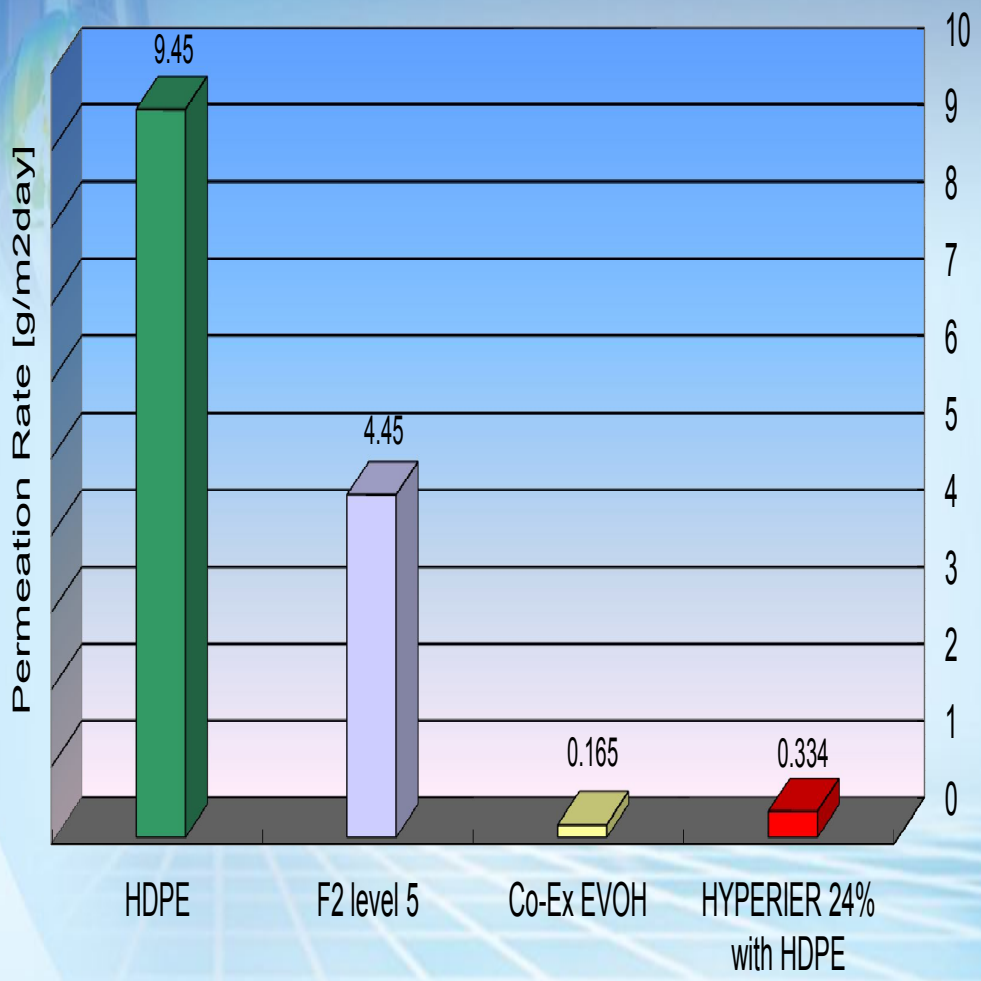


HYPERIER® Properties

LG Chem

Fuel C Permeation Results

Test Conditions: 70 L fuel tanks ~6mm thick, at 40℃

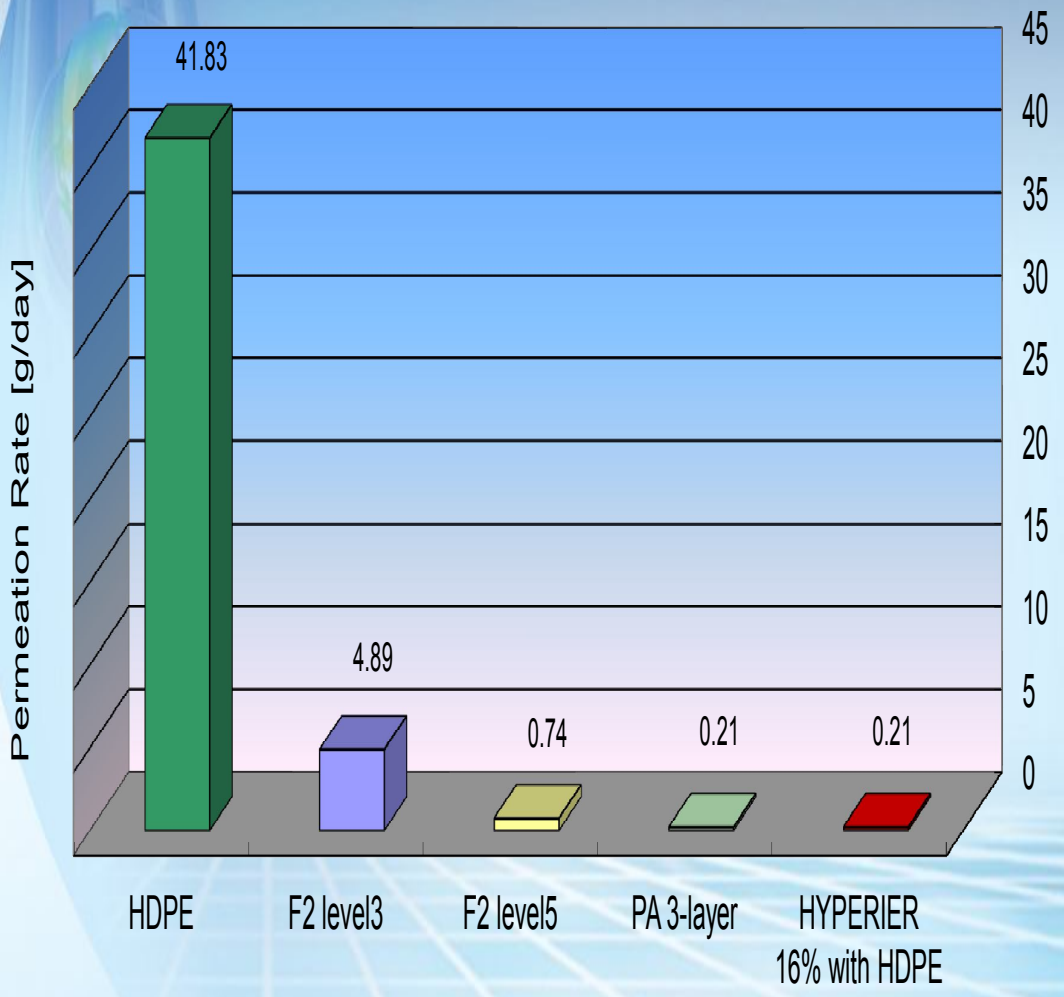


HYPERIER® Properties

LG Chem

Xylene Permeation Results

Test Conditions: 20L bottle, ~2mm thick, @ 54℃



HYPERIER® Grades

LG Chem

Grade Information

Grade	IP-1104	IP-1105	IP-1106
Higher Stiffness			
Higher Impact			
Applicable Container Size	20L~220L	5L~20L	1L~10L
Applications	Large drums, SORE* fuel tanks	Agrochemical Containers, SORE* fuel tanks, PFCs	
Specific Gravity	1.001	1.006	1.020
Melting Point	213°C	213°C	213°C

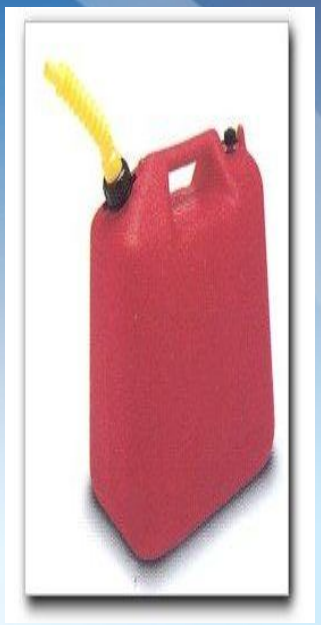
SORE * : Small Off-Road Engine,
* IP-1207B : IP-1106 dry-blended with HDPE,
* PLA containing grades are also available (>35%)

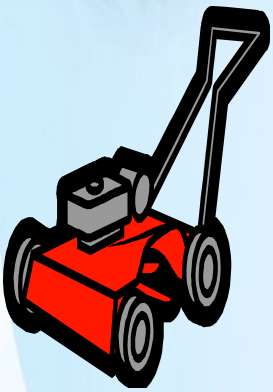
Applications of HYPERIER®

LG Chem

Fuel Tanks & Containers

- Portable Fuel Container (PFC)s
- Small Off-Road Engine (SORE) Fuel Tanks
- All Terrain Vehicle (ATV) Fuel Tanks
- Marine Boat Fuel Tanks



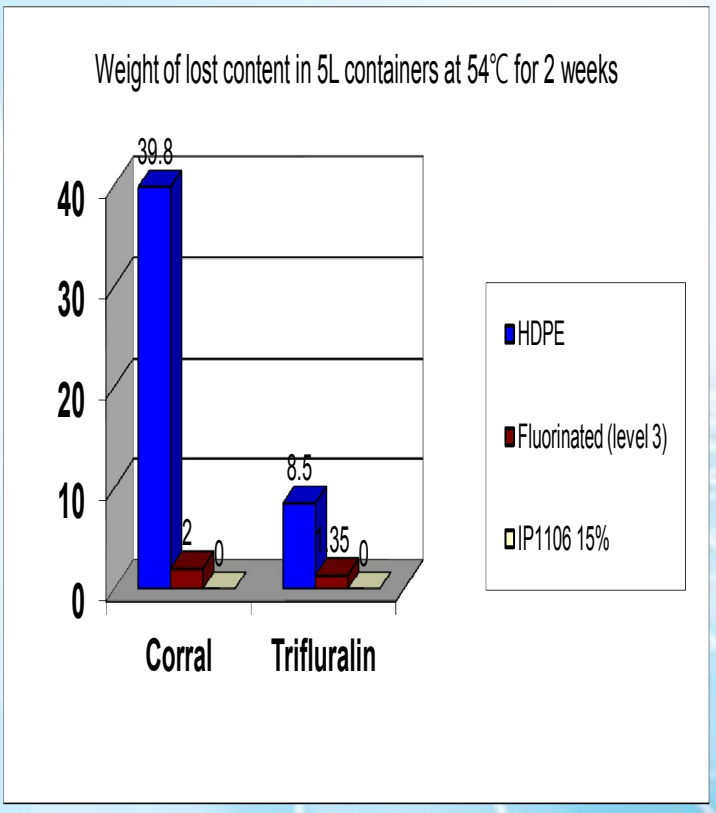


Applications of HYPERIER®

LG Chem

Agrochemical Containers

- 1L bottles
- 5L containers
- 20L jerrycans

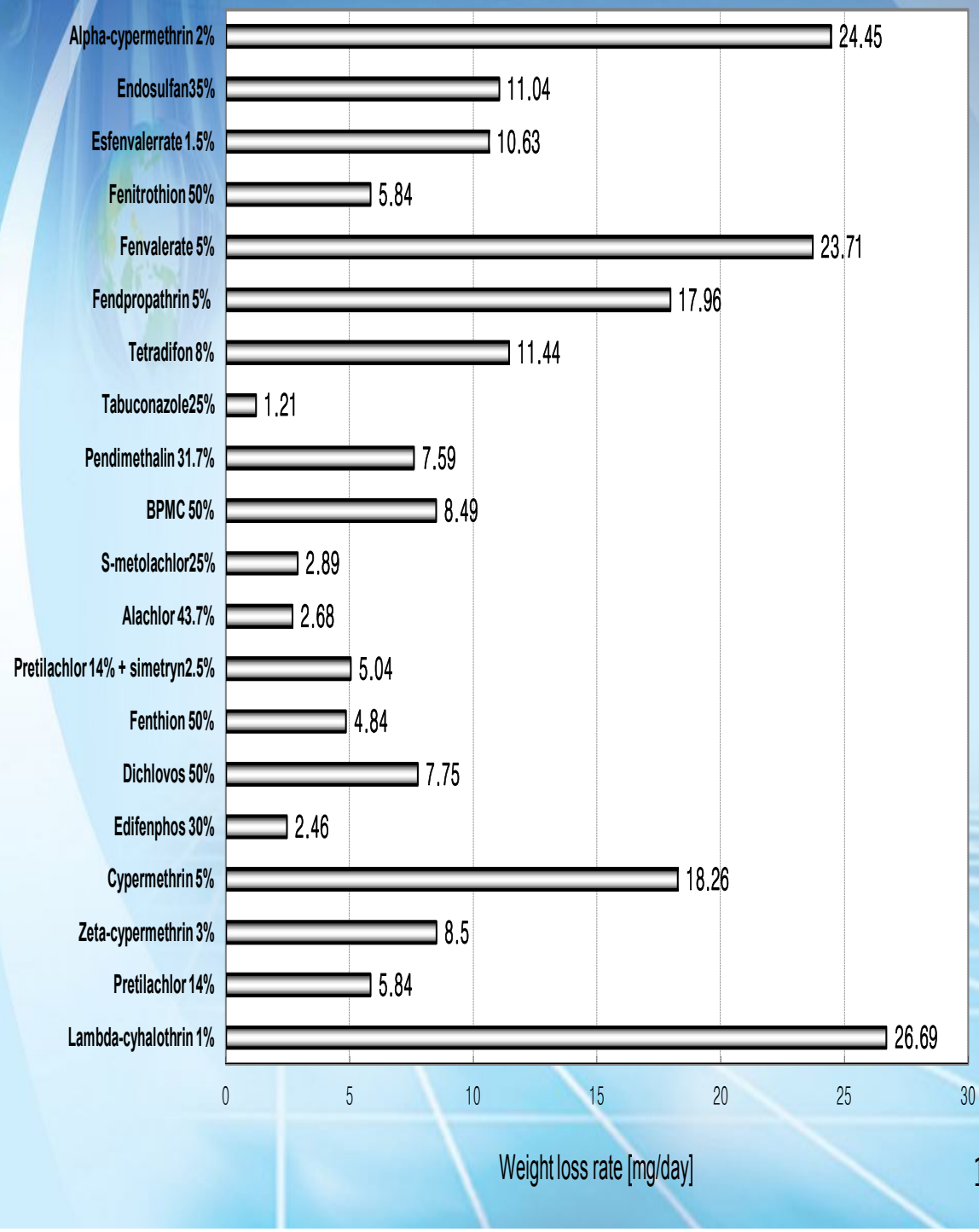


HYPERIER® Properties

LG Chem

Permeation Results of Different Agrochemical Solvents

Test Conditions: 500ml-size bottles, 65g ,1.3mm thick, at 54℃ for 4 weeks



Applications of HYPERIER®

LG Chem

Chemical Containers

- Fuel Additive Bottles
- Drums
- Intermediate Bulk Container (IBC)s
- Pipe lines