1. Kuraray Overview
2. EVAL™ Overview
3. Post Consumer Recycling in Europe
4. Contribution of EVAL™
5. Technical assessment by Kuraray group

Nahoto “Nat” Hayashi
Manager
Technical Service Gr.
Quality and Technology Management Dept.
EVAL Division
Overview

- **Name:** Kuraray Co., Ltd.
- **Representative Director and President:** Masaaki Ito
- **Established:** June 24, 1926
- **Capital:** 89 billion yen (as of December 31, 2017)
- **Employees:** 9,089 (consolidated, as of December 31, 2017)
- **Net sales:** 518.4 billion yen (consolidated, fiscal year ended December 31, 2017)
- **Major overseas bases:** U.S.A., Germany, Belgium, China, and Singapore
Kuraray’s core Vinyl Acetate businesses

The world’s largest producer of VAM derivatives

- PVB film
- Optical-use PVA film
- No.1 in the world
- No.2 in the world
- No.1 in the world
- EVAL
- No.1 in the world
- PVB resin
- Water-soluble PVA film
- PVA resin

Vinyl Acetate Monomer (VAM)

Share of Net Sales
43.0%

- Confidential -
Global Network

Main Overseas Subsidiaries
- ★ Overseas subsidiaries with regional management functions
- ■ Overseas subsidiaries with manufacturing functions
- ● Overseas subsidiaries with sales and marketing functions

Net Sales by Region

<table>
<thead>
<tr>
<th>Year</th>
<th>Japan</th>
<th>North America</th>
<th>Europe</th>
<th>Asia and Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>305.9</td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>363.2</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>518.4</td>
</tr>
</tbody>
</table>
EVAL™ Overview
Chemical Structure of EVOH

\[ \text{EVAL}^{\text{TM}}(\text{EVOH}) = \]

- Ethylene \((\text{CH}_2-\text{CH}_2)_m\)
- Vinyl Alcohol \((\text{CH}_2-\text{CH})_n\)  
  \text{OH}

- Melt molding
- Flexibility
- Barrier

High Barrier
- 24 M
- 27 L
- 32 F
- 35 C
- 38 H
- 44 E
- 48 G

High Flexibility

- Confidential
EVAL™ is used for food packaging or industrial use as a barrier layer of multilayer structure. Adhesive layer is required when used in combination with most of polyolefin. The regrind of the tank can be recycled and reused as “regrind layer”.
Thanks to its superior gas barrier properties, EVAL™ resin is mainly used as functional barrier in food packaging applications to extend shelf life of the content.

Application: Foods, Cosmetics, Medicals
EVAL™ is also used for industrial application for its excellent gas barrier property, solvent barrier property and solvent resistance.
Post Consumer Recycling in Europe
Post consumer plastic pollution
A socio/ecologic and economic issue

China Bans Imports of Foreign Waste to Combat Pollution

By Alexander Chipman Koty

China will ban the import of 24 types of waste by the end of the year as part of a campaign against "foreign garbage".

Before the January 1st ban, China was importing 500,000 tons of plastic for recycling each year. This allowed EU/US/Japan to export unwanted waste, without dealing with the problem at the local level.
Post consumer recycling – European level

**EU regulation behind the Circular Economy**

- In 2008, EU Regulation (EC) No. 282/2008 sets “the conditions for the re-use in food contacts.”

- "*European Strategy for Plastics in a Circular Economy*” was issued on the January 16th 2018, stating: “By 2030, all plastics packaging on the EU market will be recyclable or reusable.”

- In 2018, the commission is amending the EU Regulation (EC) No. 282/2008: So far mechanical recycling was the main subject, and it aims to integrate
  - Chemical recycling
  - Recycling behind functional barrier
  - Scraps and off cuts
  - Well controlled Close Loops processes

In those cases, No authorization process would be required but monitoring and registration will be mandatory.
**Post consumer recycling – European level**

**Single-use plastics issued on May 28th 2018**

The EU is now turning its attention to the 10 single-use plastic products and fishing gear that together account for 70% of the marine litter in Europe.

The new rules will introduce:

1. **Plastic ban in certain products:** Where alternatives are readily available and affordable, single-use plastic products will be banned from the market.

2. **Consumption reduction targets set by each country:** Member States will have to reduce the use of plastic food containers and drinks cups.

3. **Obligations for producers:** Producers will help cover the costs of waste management and clean-up, as well as awareness raising measures for food containers, packets and wrappers, drinks containers and cups, tobacco products with filters, wet wipes, balloons, and lightweight plastic bags.

4. **Collection targets:** Member States will be obliged to collect 90% of single-use plastic drinks bottles by 2025

5. **Labeling Requirements:** Certain products will require a clear and standardized labeling which indicates how waste should be disposed, the negative environmental impact of the product, and the presence of plastics in the products.

6. **Awareness-raising measures:** Member States will be obliged to raise consumers' awareness about the negative impact of littering of single-use plastics and fishing gear as well as about the available re-use systems and waste management options for all these products.
Post Consumer Recycling – National Level

- **UK 25-year environment plan**
  “Environment plan aims at **eradicating plastics pollution entirely by 2042** with measures to reduce the demand for single use plastic, reduce production of different types of plastics and increase recycling”
  January 2018

- **France recycling tax (France 24) law**
  France has set a goal to have 100% plastic collected for recycling by 2025 (January 2018)

  Published below lines on August 12th 2018
  - A tax on consumer products, which is packaged by unable recycled plastics
  - A tax on bottles and containers, which are produced by virgin plastic. Targeting on resulting in 10% and higher cost.
  - Establishment both deposits and short cover systems

- **Germany waste re-use law**
  The waste re-use will be regulated by a new law with raised recycling targets (which other countries are expected to follow): from 36% to 58% for plastics as of January 1st 2019

**Global definition of “plastic recyclability”**
“The term ‘recyclable’ is consistently used with packages and products without a defined reference point.”
by Steve Alexander, president and chief executive of The Association of Plastics Recyclers
## Next steps – Global base restriction

<table>
<thead>
<tr>
<th>Region</th>
<th>When</th>
<th>Move</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>2003</td>
<td>Deposit system of PET bottles</td>
</tr>
<tr>
<td>South Africa</td>
<td>2004</td>
<td>Tax on plastic bags</td>
</tr>
<tr>
<td>Italy</td>
<td>2011</td>
<td>Plastic bags to be all bio degradable</td>
</tr>
<tr>
<td>Philippine / Manila</td>
<td>2013</td>
<td>No single use plastic bag and PSP trays</td>
</tr>
<tr>
<td>US / California</td>
<td>2014</td>
<td>All single use plastic bags are banned</td>
</tr>
<tr>
<td>France</td>
<td>2016</td>
<td>No single use plastic bag, tray and cups</td>
</tr>
<tr>
<td>Malaysia</td>
<td>2017</td>
<td>No distribution of free plastic bags</td>
</tr>
<tr>
<td>Chile</td>
<td>2017</td>
<td>No plastic bags used at the coastal region of Pacific Ocean</td>
</tr>
<tr>
<td>Kenya</td>
<td>2017</td>
<td>Ban of plastic bags</td>
</tr>
<tr>
<td>India</td>
<td>2018</td>
<td>Use of recyclable material</td>
</tr>
<tr>
<td>Thailand</td>
<td>2018</td>
<td>No use of plastic bags in national parks</td>
</tr>
<tr>
<td>Spain</td>
<td>2020</td>
<td>50% of recyclable material is needed for package over 50μm</td>
</tr>
</tbody>
</table>
The European strategic industrial level initiatives

- **Polyolefins Circular Economy Platform**
  Polyolefins Circular Economy Platform launched at K2016
  A collaborative platform of PlasticsEurope, Plastics Recyclers Europe and European Packaging Converters.

- **European plastic industry**
  Ban to landfill recyclable plastic products by 2025

- **Packaging waste**
  Recycle 75% and more by 2030

- **Bioplastic**
  Expecting to increase its production capacity in Europe to 20 times more or c.a. 5.7 Million MT/year
Global Plastics Packaging Material Flow

98% Virgin Feedstock

78MM Tonnes / Annual

4% Process Losses

14% Collected for recycling

2% Closed-Loop Recycling*

8% Cascaded Recycling**

14% Incineration and/or energy recovery

32% Leakage

40% Landfilled


* : Recycling of plastics into the same or similar quality applications
** : Recycling of plastics into other, lower value applications
European Packaging Overview

84 Million Tonnes

Packaging material

20 Million Tonnes

Plastic packaging

4 Million Tonnes

Consumer flexible packaging

European Flexible Packaging Overview

Today
Recovery as Solid Recovered Fuel or Refuse Derived Fuel

Future
• Recycle structure with compatible polymers
• Recycle with chemical recycling and other new/existing recycling technologies
• Re-design the packaging to be recycled with existing recycled fractions

Mono PE or PP PE/PP mix.
Technically “recycling ready” if it can be sorted into PE or PP film fractions or a mixed PE/PP fraction

Contribution of EVAL™
Contribution of Kuraray Group through EVAL Europe

- Participation at European level in e.g.:
  - Plastic Europe
  - CEFLEX

- Post consumer recycling studies with Nextek (UK)
  *EVOH is not disturbing the post consumer recycling stream*

- Collaborations with national partners e.g. in Germany:
  - Der Grüne Punkt
  - Interseroh
  *EVOH is not disturbing the post consumer recycling stream*
Kuraray’s contribution

**CEFLEX**

CEFLEX is the collaborative project of a European consortium of companies representing the entire value chain of flexible packaging and continues the work of Project REFLEX and Project FIACE.

**Project Goals and Deliverables**

**By 2020** flexible packaging will be recycled in an increasing number of European countries, facilitated by project CEFLEX through:

- The development and application of robust Design Guidelines for both flexible packaging and the “End of Cycle” infrastructure to collect, sort and recycle them.
- The identification and development of sustainable end markets for the secondary materials recycled from flexible packaging.

**By 2025** the development of a collection, sorting and reprocessing infrastructure for post-consumer flexible packaging across Europe, facilitated by project CEFLEX through:

- A business case for collecting all flexible packaging
- Proof of principle from successful pilot projects

https://ceflex.eu/who-we-are/
11 companies make voluntary commitments/pledges including:

- For their packaging to be 100% designed to be reusable, recyclable or compostable packaging by 2025

- To set stretching targets for using post-consumer recycled content

- Calling for a Global Plastics Protocol setting common agreed definitions and industry standards on what materials are put into the marketplace

- To ensure their packaging is compatible with existing and cost-effective recycling infrastructures

- Recognizing the need for improvements to waste management infrastructure, including the implementation of Extended Producer Responsibility schemes

Voluntary commitments from the CEFELX members

Amcor
Danone/Evian
Ecover
L’Oréal
Mars
M&S
PepsiCo
The Coca-Cola Company
Unilever
Walmart
Werner & Mertz

https://ceflex.eu/
Guidelines for barrier packaging

### Guidelines – key requirements*

<table>
<thead>
<tr>
<th></th>
<th>Preferable for recycling</th>
<th>Acceptable for recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall characteristics</strong></td>
<td>Dimensions &gt; 20 x 20 mm&lt;br&gt;Overall density &lt; 1 g/cm³</td>
<td>Dimensions &gt; 20 x 20 mm&lt;br&gt;Overall density &lt; 1 g/cm³</td>
</tr>
<tr>
<td><strong>Material choice</strong></td>
<td>Mono PE or PP &gt; 90% of total structure&lt;br&gt;PVC or PET not permitted&lt;br&gt;PA, ethylene copolymers, etc. limited to &lt; 5%&lt;br&gt;Multi-layer structures with aluminium and paper not permitted (to be directed to respective recycling streams)</td>
<td>Mix of PE and PP &gt; 80% of total structure&lt;br&gt;PVC or PET not permitted&lt;br&gt;PA, ethylene copolymers, etc. limited to &lt; 10%&lt;br&gt;Multi-layer structures with aluminium and paper not permitted (to be directed to respective recycling streams)</td>
</tr>
<tr>
<td><strong>Barrier coatings</strong></td>
<td>Acrylic, EVOH, PVOH, SiOx, AlOx, metallisation limited to &lt; 5% of total structure&lt;br&gt;PVDC not permitted</td>
<td>Any non-halogen based coating permitted&lt;br&gt;≤ 10% of total structure&lt;br&gt;PVDC not permitted</td>
</tr>
<tr>
<td><strong>Adhesives</strong></td>
<td>Solvent-free adhesives &lt; 5% of total structure</td>
<td>Any adhesives &lt; 10% of total structure</td>
</tr>
<tr>
<td><strong>Printing</strong></td>
<td>Minimum level of print and lighter colours</td>
<td>Any level of print, less is better</td>
</tr>
<tr>
<td><strong>Masterbatch</strong></td>
<td>Carbon black not permitted</td>
<td>Carbon black not permitted</td>
</tr>
</tbody>
</table>
Technical assessment by Kuraray group
Recycling study in 2013

In cooperation with Nextek, [www.nextek.org](http://www.nextek.org)

- Nextek is a recognised consulting organisation in the field of recycling
- PP/EVOH/PP and HDPE/EVOH/HDPE recycling study on multilayer sheet and bottles was conducted
- First, Focus on PCR-PP* processing and thermoforming using up-to-date recycle stream
  - Description of the Process
  - Performance
  - Analysis
  - Summary
- Next, Multilayer HDPE/EVOH Packaging influence in Processing and Performance of Recycled HDPE for blow moulded articles was studied

* PCR = Post-Consumer Recycled
Recycling study

In cooperation with Nextek, [www.nextek.org](http://www.nextek.org)
Nextek is a leading provider of sustainable solutions for polymers in the packaging supply chain

**Past studies: Rigid**

<table>
<thead>
<tr>
<th>2014</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>Bottle</td>
</tr>
<tr>
<td>PP + EVOH</td>
<td>HDPE + EVOH</td>
</tr>
<tr>
<td>PCR PP</td>
<td>PCR HDPE</td>
</tr>
</tbody>
</table>
Recycling study stream

- **PP/regrind/EVOH/regrind/PP Co-extrusion**
- **Thermoforming**
- **Food Filling**
- **Collection and Sorting = R-PP**
- **Compounding + Decontamination 6 Hours 140°C Vacuum**
- **Decontamination 6 Hours 140°C Vacuum**
- **Compounding at 240°C 90% R-PP + 10% SCRAPs**
- **Extrusion and Thermoforming @ EVAL Europe: 100, 50/50, 75/25 %; Mono and Multi-layers**
- **Testing, migration and mechanical properties**
- **Regrind Compatabiliser Addition**
- **Industrial scraps RPC Bebo DE, Gizeh DE, Santis CH**
Collection and Sorting

Thanks to the cooperation of Systech Company

- www.gruener-punkt.de
- www.systech-plastics.de

**Observation:**

- In the region of Germany studied, about **2% of plastic waste** is barrier packaging.

- In these 2% barrier packaging:
  - 90% is for meat packaging
  - The remaining 10% is pâté, ready meals, cheese and fish salad
Sorting post-consumer waste

Different forms of PP/EVOH waste
Collection and Sorting = PCR-PP

Analysis of multilayer PP/EVOH/PP sheet with 4 to 6% EVOH

<table>
<thead>
<tr>
<th>Structure</th>
<th>(out) PP</th>
<th>Regrind</th>
<th>Adhesive</th>
<th>EVOH</th>
<th>Adhesive</th>
<th>Regrind</th>
<th>PP</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness (µm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>287</td>
<td>326</td>
<td>36</td>
<td>82.8</td>
<td>33</td>
<td>442</td>
<td>282</td>
<td>1489</td>
</tr>
<tr>
<td></td>
<td>168</td>
<td>930</td>
<td>33</td>
<td>107.6</td>
<td>33</td>
<td>985</td>
<td>166</td>
<td>2423</td>
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<tr>
<td></td>
<td>491</td>
<td>668</td>
<td>47</td>
<td>125.0</td>
<td>44</td>
<td>717</td>
<td>419</td>
<td>2511</td>
</tr>
</tbody>
</table>
Collection and Sorting = R-PP

Food Filling

Thermoforming

Regrind Compatibiliser Addition

PP/regrind/EVOH/regrind/PP Co-extrusion

Compounding + Decontamination 6 Hours 140°C Vacuum

Industrial scraps RPC Bebo DE, Gizeh DE, Santis CH

Compounding 6 Hours 140°C Vacuum

Decontamination 6 Hours 140°C Vacuum

Testing, migration and mechanical properties

Extrusion and Thermoforming @ EVAL Europe: 100, 50/50, 75/25 %; Mono and Multi-layers

- Confidential

Recycling study stream
Compatibility study ~ at PP ~

Multilayer PP/EVOH packaging in the PP recycling stream

Maximum is 4%, typically 2%

⇒ 10% study was made as a worst case

Millmeran

Granulated PP/EVOH (5%)  Food grade r-PP
10:90

Food grade decontamination process
6hr / 140deg.C
Recycling study stream

PP/regrind/EVOH/regrind/PP Co-extrusion

Thermoforming

Food Filling

Collection and Sorting = R-PP

Industrial scraps RPC Bebo DE, Gizeh DE, Santis CH

Compounding + Decontamination 6 Hours 140°C Vacuum

Compounding at 240°C 90%PCR-PP + 10% SCRAPS

Regrind Compatabiliser Addition

Testing, migration and mechanical properties

Extrusion and Thermoforming @ EVAL Europe: 100, 50/50, 75/25 %; Mono and Multi-layers

Decontamination 6 Hours 140°C Vacuum

R-PP+Scrap

R-PP
Compatibility study ~ at PP ~

**Multilayer PP/EVOH packaging in the PP recycling stream**

Maximum is **4%**, typically **2%**

⇒ **10%** study was made as a worst case

---

**Millmeran**

Granulated PP/EVOH (5%)

10:90

Food grade r-PP

Food grade decontamination process

6hr / 140deg.C

**EVAL Europe, PIRA**

Sheet / Film extrusion, analysis

☑️ Migration test
☑️ Tensile / Impact
☑️ MFR / Density

w or w/o vPP

<table>
<thead>
<tr>
<th>Structure</th>
<th>Virgin PP</th>
<th>Adhesive</th>
<th>25% PCR-PP/EVOH (white)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness (µm)</td>
<td>222</td>
<td>86</td>
<td>479</td>
<td>787</td>
</tr>
</tbody>
</table>

PCR-PP, EVOH / EVOH sheet samples

<table>
<thead>
<tr>
<th>Structure</th>
<th>Virgin PP</th>
<th>Adhesive</th>
<th>EVOH</th>
<th>Adhesive</th>
<th>25% PCR-PP/EVOH (white)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness (µm)</td>
<td>208</td>
<td>37</td>
<td>30.4</td>
<td>29</td>
<td>490</td>
<td>794</td>
</tr>
</tbody>
</table>
Recycling study stream

PP/regrind/EVOH/regrind/PP Co-extrusion

Thermoforming

Food Filling

Collection and Sorting = PCR-PP

Industrial scraps RPC Bebo DE, Gizeh DE, Santis CH

Compounding + Decontamination 6 Hours 140°C Vacuum

Testing, migration and mechanical properties

Extrusion and Thermoforming @ EVAL Europe: 100, 50/50, 75/25 %; Mono and Multi-layers

Decontamination 6 Hours 140°C Vacuum

Compounding at 240°C 90%PCR-PP + 10% SCRAPS = PCR-PP,EVOH

R-PP+Scrap
PCR-PP, EVOH / EVOH thermoforming samples

0.5/1 and 1/1 samples were produced with monolayer sheet

Nice trays could be produced without issue
Performance of the samples (I)

**Overall Migration tests conducted at SMITHERS PIRA**

- Overall migration, by filling, into simulants iso-octane; exposure conditions 24 hours at 40°C as detailed in EU Regulation No 10/2011.

<table>
<thead>
<tr>
<th>Method</th>
<th>EN-1186-14 Migration into iso-octane mg/dm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replicates</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>42.4</td>
</tr>
<tr>
<td>2</td>
<td>40.1</td>
</tr>
<tr>
<td>3</td>
<td>42.9</td>
</tr>
<tr>
<td>Mean result</td>
<td>41.8</td>
</tr>
<tr>
<td>Limit</td>
<td>#40.0</td>
</tr>
<tr>
<td>Tolerance</td>
<td>#*1.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>EN 1186-15 Migration into iso-octane (rapid extraction) mg/dm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replicates</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8.8</td>
</tr>
<tr>
<td>2</td>
<td>10.9</td>
</tr>
<tr>
<td>3</td>
<td>9.9</td>
</tr>
<tr>
<td>4</td>
<td>10.1</td>
</tr>
<tr>
<td>Mean result</td>
<td>9.9</td>
</tr>
<tr>
<td>Limit</td>
<td>10.0</td>
</tr>
</tbody>
</table>

- The samples are all OK for packaging food according to EU regulation 10/2011,
- EVOH provides efficient way to reduce Overall migration as functional barrier
Mechanical properties of R-PP-S

- Notched Izod Impact strength of Injection moulded R-PP-S(25) and R-PP pieces were determined; No difference observed (8 KJ/m²)

- Tensile test on 15mm wide strips cut out from the sheet (MD) was conducted. E-Modulus, Strain at Break and Maximum stress were determined.

---

**Mechanical parameters**

<table>
<thead>
<tr>
<th></th>
<th>E-Modulus (Mpa)</th>
<th>Strain at Break (%)</th>
<th>Maximum Stress (Mpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virgin PP 800 µm</td>
<td>534</td>
<td>722</td>
<td>30.0</td>
</tr>
<tr>
<td>25% PC-PP/100% EVOH 800 µm</td>
<td>510</td>
<td>1456</td>
<td>28.7</td>
</tr>
<tr>
<td>25% PC-PP/100% EVOH 800 µm</td>
<td>566</td>
<td>59</td>
<td>28.6</td>
</tr>
<tr>
<td>50% PC-PP/100% EVOH 800 µm</td>
<td>652</td>
<td>37</td>
<td>33.6</td>
</tr>
<tr>
<td>50% PC-PP/100% EVOH 1600 µm</td>
<td>545</td>
<td>43</td>
<td>31.3</td>
</tr>
<tr>
<td>100% PC-PP/100% EVOH 1600 µm</td>
<td>668</td>
<td>34</td>
<td>34.6</td>
</tr>
</tbody>
</table>

---

“Mono layer sheet”

“Multi layer sheet”
Summary recycling study

**EVOH impact on the Performance of Recycled PP and HDPE**

- Overall migration tested with simulant D1 The use of EVOH in multi-layer barrier packaging for long-time food preservation does not affect the recycling possibilities or opportunities.

- It has now been demonstrated that:
  - EVOH does not affect the recycling stream of PP and HDPE (polypropylene)
  - It brings new opportunities to recycle PCR-PP (or HDPE) even in the food packaging applications.

- The use of EVOH as functional barrier certainly opens new doors to the plastic industry.

- Recycling codes used to identify the material from which an item is made, to facilitate easier recycling or other reprocessing:
  - #5 PP is applicable to PP/EVOH
  - #2 HDPE is applicable to HDPE/EVOH
Advanced recycling study

In cooperation with Nextek, [www.nextek.org](http://www.nextek.org)

*Nextek is a leading provider of sustainable solutions for polymers in the packaging supply chain*

---

**Past studies: Rigid**

- **2014 Form**
  - PP + EVOH
  - PCR PP

- **2016 Bottle**
  - HDPE + EVOH
  - PCR HDPE

**Circular Economy Demand**

**Study needed at each stream**

**Flexible**

- PET/EVOH/PO
- PET/PA/EVOH/PO
- PA/EVOH/PO
- EVOH/PO
Thank you for your attention!!