



AIMPLAS
PLASTICS TECHNOLOGY
CENTRE

FOOD CONTACT PLASTICS SEMINAR 2018
Ensuring safety of products:
Focus on retailers and consumers
19 & 20 April 2018 - Brussels



Recycled plastics for food contact applications

Enrique Moliner Santistevé
Sustainability and Industrial Recovery Dpt.
emoliner@aimplas.es

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About AIMPLAS

Technology Centre with more than 25 years of experience **helping companies in the plastic sector**

- > Technical assistance
- > Analysis & testing
- > R&D&I projects
- > Competitive intelligence
- > Training



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Introduction



Bottle made with
100% recycled PET

***What are the
benefits?***

Tray with **20% recycled PP**

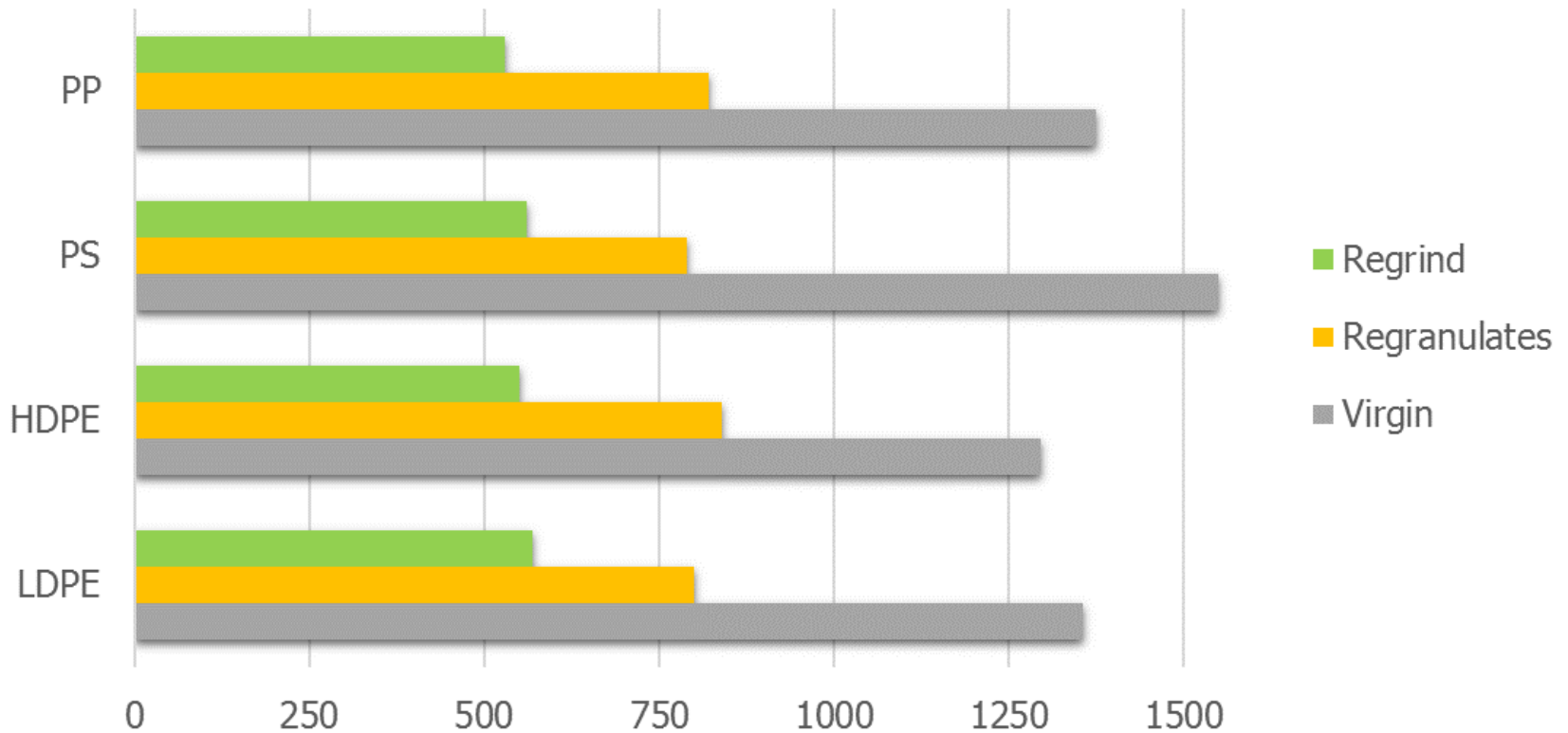
Multilayer: PP/EVOH/rPP/EVOH/PP



Introduction

Cost savings

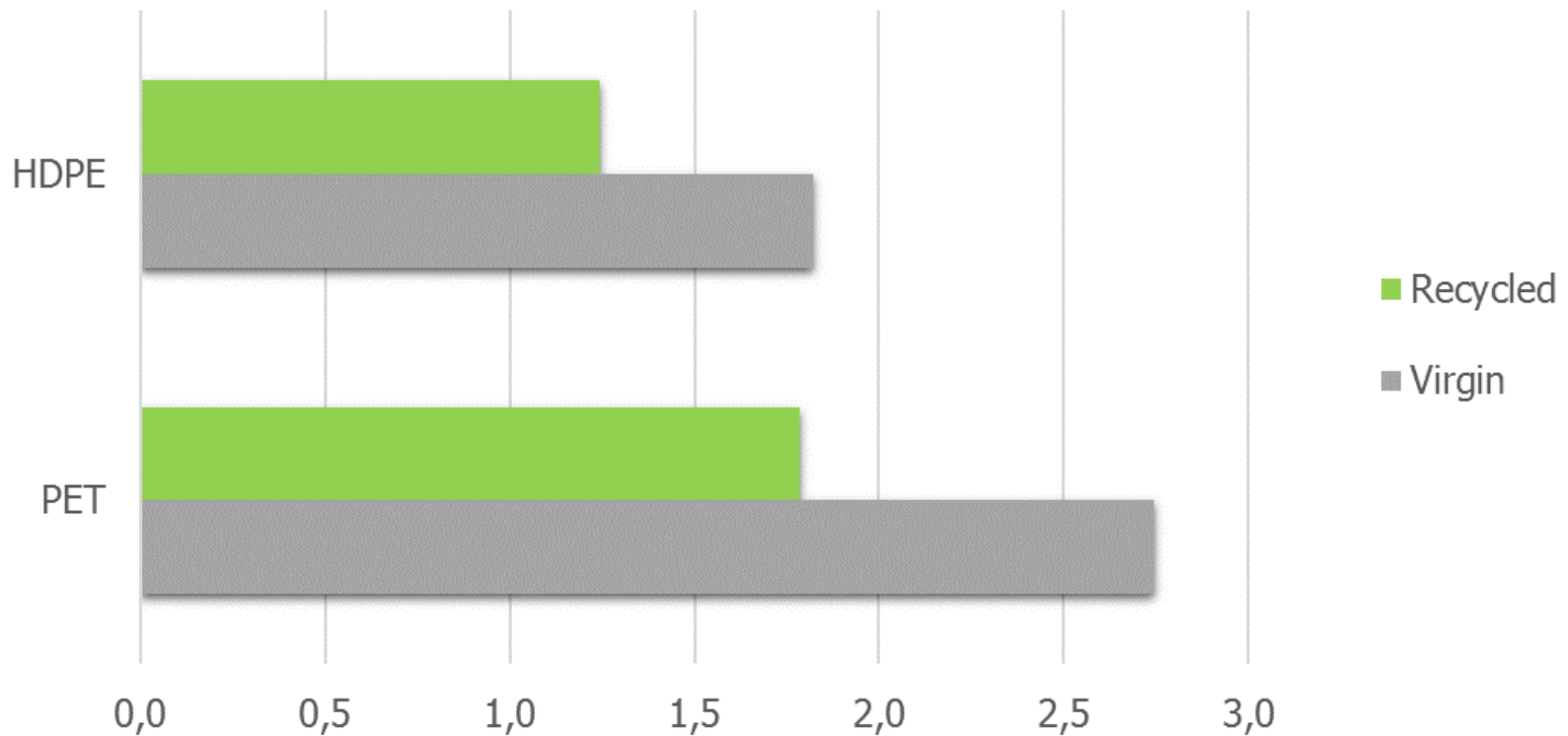
Average market price, Dec. 2017 (€/t)



Introduction

Environmental benefits

Carbon footprint (kg CO₂e/kg material)



Introduction

Other benefits

Marketing

New markets

*Environmental
legislation*

Eco-innovation

Costs

Quality

Increased competitiveness



Introduction

Green marketing

**notre petite bouteille
100% plastique recyclé :
une première mondiale.**

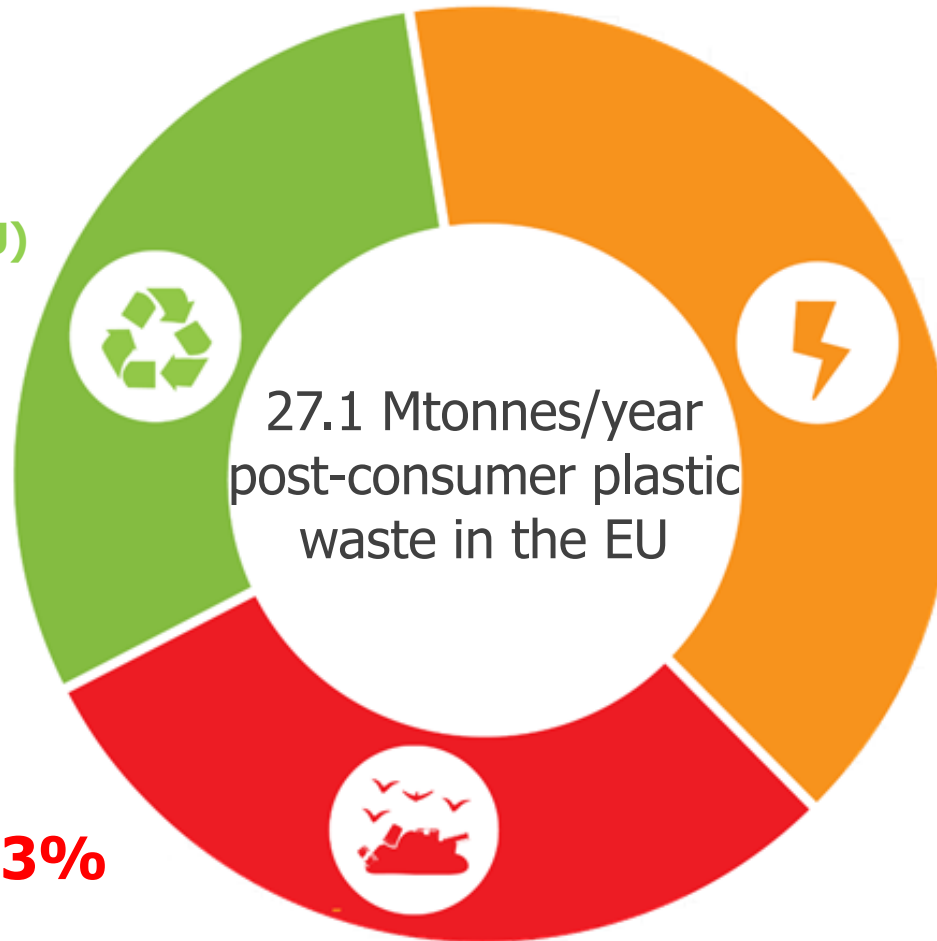


Introduction

A great opportunity...

Recycling
31.1%
(63% Inside EU)

Energy recovery
41.6%



Landfill 27.3%

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Recycled plastics in contact with food

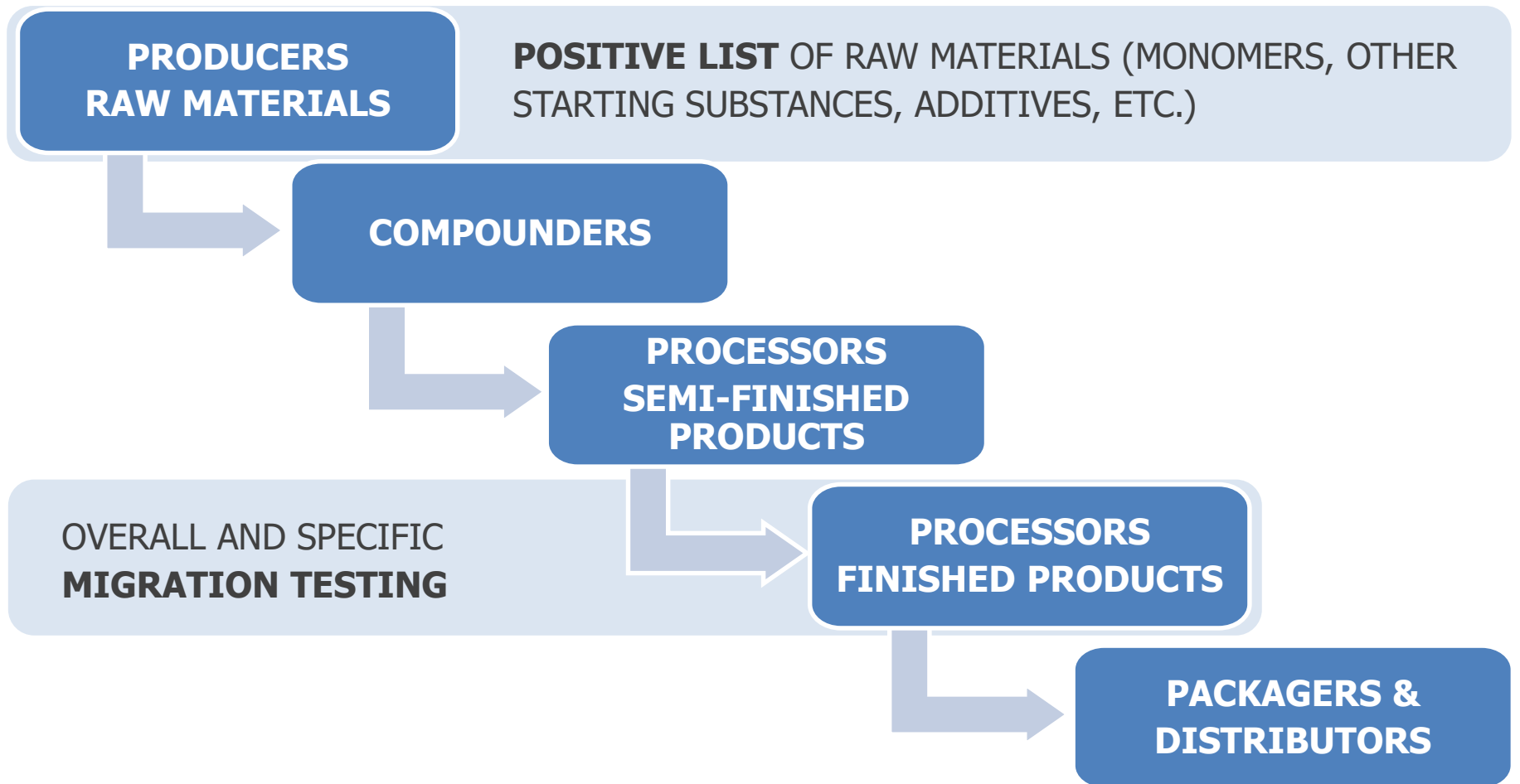
EU legislative overview on food contact materials

General regulations on FOOD CONTACT MATERIALS (FCM)	
EC 1935/2004	General basis covering all FCM for securing protection of human health: food safety, labelling, declaration of compliance, traceability
EC 2023/2006	Rules on good manufacturing practice for FCM : quality assurance and control systems, detailed rules for the application of printing inks
Specific regulations for PLASTIC MATERIALS	
EU 10/2011 & amendments: EU 321/2011 EU 1282/2011 EU 1183/2012	Authorised substances : positive list of raw materials Basic rules on (overall and specific) migration testing for final product Rules for plastic (& multi-material) multi-layer materials Restriction of use of certain substances (Ba, Li, etc.) Definition of functional barrier concept and application Requirements for declaration of compliance
Specific regulation for RECYCLED PLASTIC MATERIALS	
EC 282/2008	Requirement of individual authorization by EFSA for recycling process



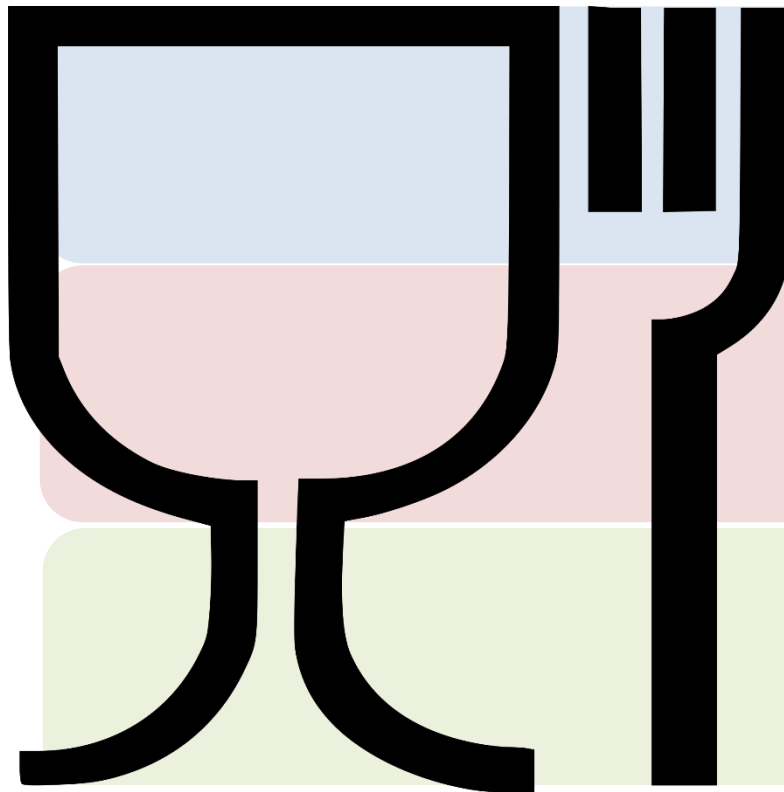
Recycled plastics in contact with food

Regulation EU 10/2011 (on plastic materials in contact with food)



Recycled plastics in contact with food

3 possibilities to use recycled plastic materials in contact with food



1. Offcuts and scraps from the production of plastic FCM
(Regulation EC 2023/2006)

2. Recycled plastics from processes **authorised by EFSA**
(Regulation EC 282/2008)

3. Recycled plastics used **behind a functional barrier**
(Regulation EU 10/2011)

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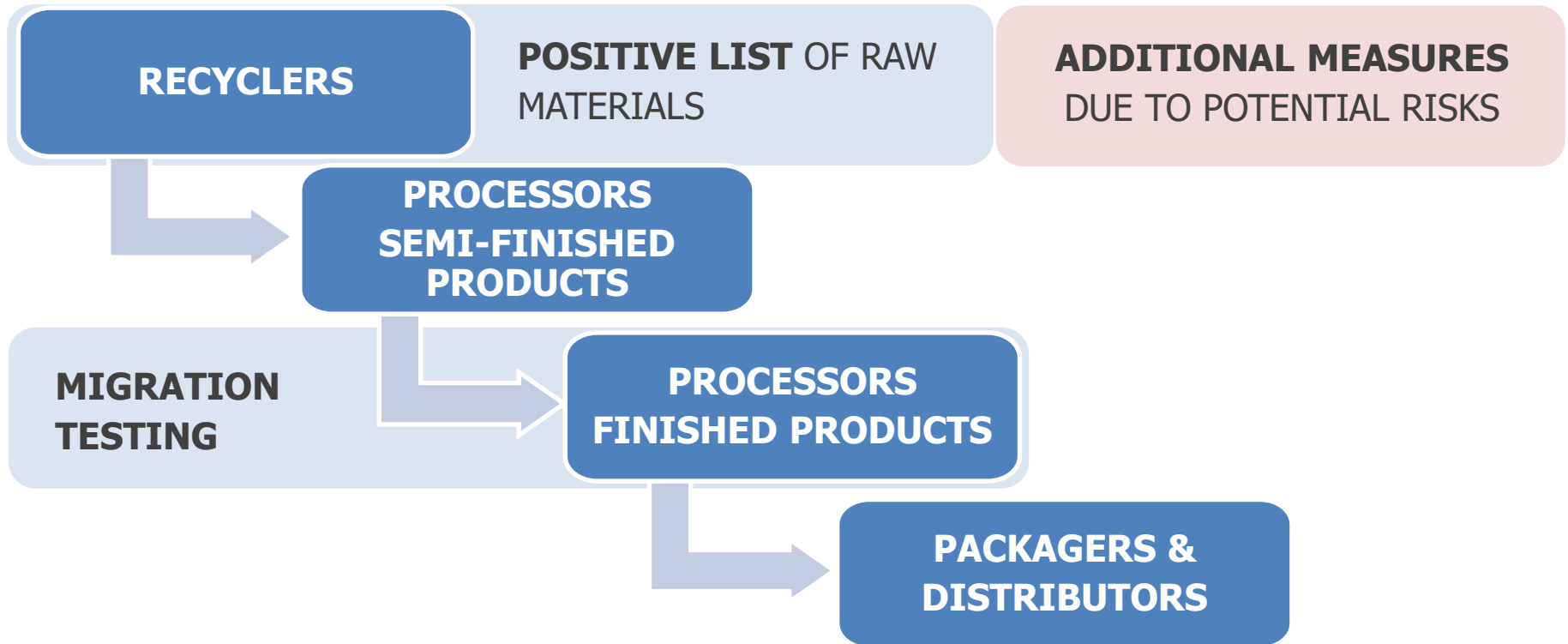
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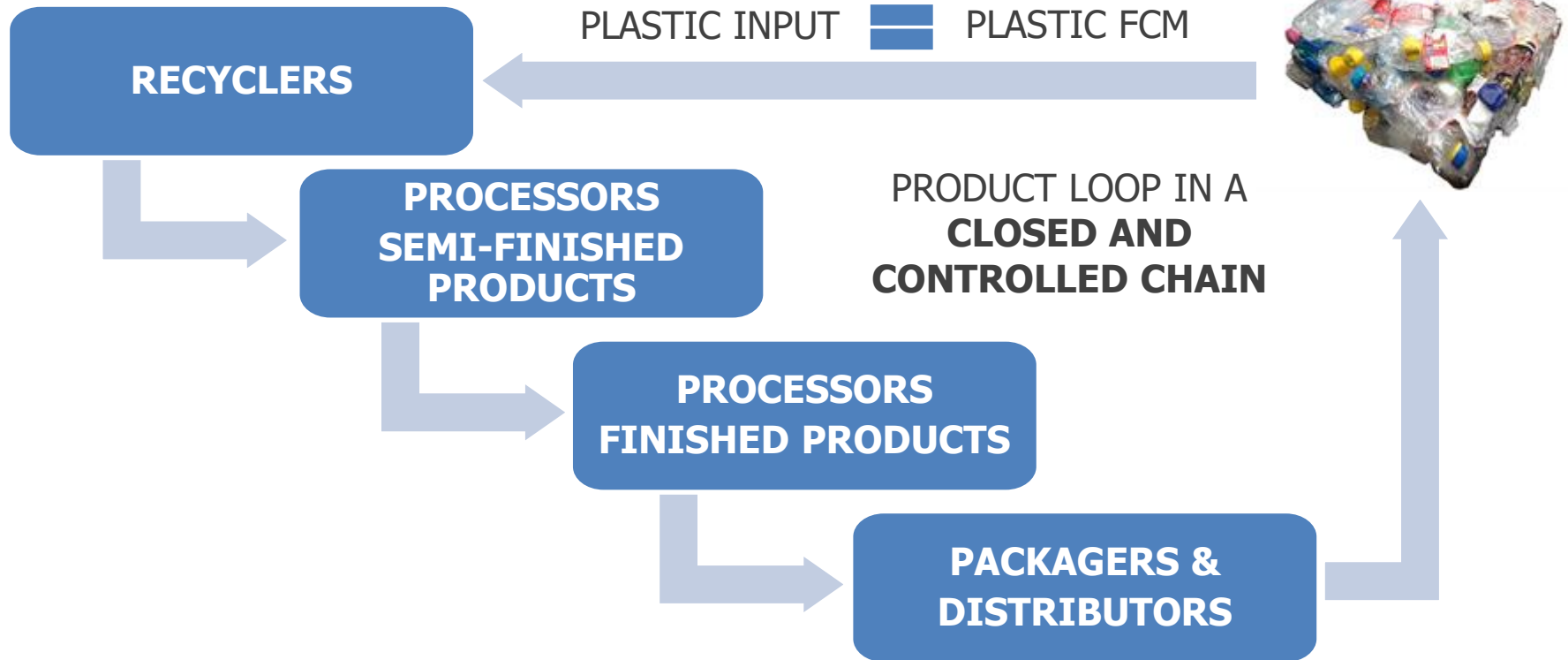
EFSA authorisation

Regulation EC 282/2008



EFSA authorisation

How to comply with positive list?



EFSA authorisation

How to comply with positive list?

Plastic input must originate from a product loop which is in a closed and controlled chain ensuring that only materials and articles which have been intended for food contact are used and any contamination can be ruled out

- Minimum unintentional introduction of external material
- Sorting efficiency of polyolefins must be 100% to ensure food safety
- Sorting efficiency of PET must be 95% to ensure food safety



EFSA authorisation

Examples of product loop in a closed and controlled chain



Necessary to **prove that contamination can be ruled out**



EFSA authorisation

What about kerbside collection systems?

Products are not in a closed and controlled chain

- Sorting efficiency necessary for each material must be identified on a case by case basis
- Additional measures are required due to potential contamination



EFSA authorisation

What additional measures?

It must be demonstrated that the process is able to reduce any contamination of the plastic input to a concentration that does not pose a risk to human health

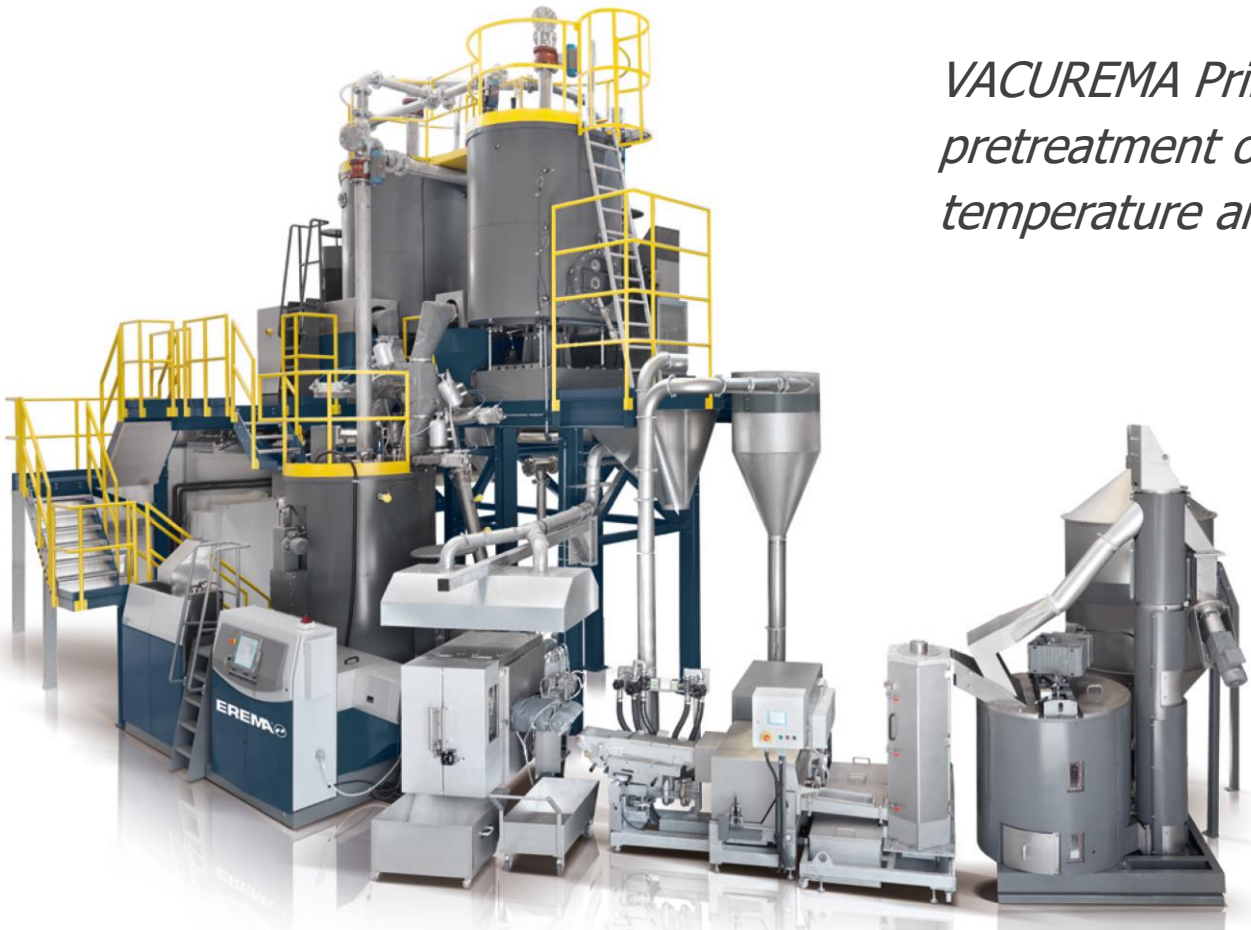
- By means of a challenge test
- By other appropriate scientific evidence



EFSA authorisation

Example of decontamination technology

VACUREMA Prime® technology for pretreatment of PET flakes at high temperature and vacuum



EFSA authorisation

Example of decontamination technology



EFSA Journal 2012;10(8):2827

SCIENTIFIC OPINION

Scientific Opinion on the safety evaluation of the following processes based on VACUREMA Prime ® technology used to recycle post-consumer PET into food contact materials¹

“Lux PET”, “Jayplas”, “PolyQuest” and “CIER”

EFSA Panel on food contact materials, enzymes, flavourings and processing aids (CEF)^{2,3}

European Food Safety Authority (EFSA), Parma, Italy

The opinion published on 21 November 2013 replaces the earlier version published on 2 August 2012⁴

EFSA authorisation

Example of decontamination technology

Scientific opinion based on the results of a challenge test

Table 1: Efficiency of the decontamination of the batch reactors (VACUREMA Prime ® technology)

Surrogates	Concentration* before decontamination (mg/kg PET)	Concentration* after decontamination (mg/kg PET)	Decontamination Efficiency (%)
Toluene	1190	< 0.7**	> 99.9
Chloroform	2078	0.4	99.9
Phenylcyclohexane	113.3	0.2	99.8
Benzophenone	410	0.7	99.8
Lindane	95.2	1.6	98.3

*Measured in green coloured contaminated flakes

** Not detected at the limit of detection of 0.7 mg/kg PET



PET Recycling processes Lux Pet, Jayplas, PolyQuest and CIER

Therefore, the recycled PET obtained from the processes LuxPET, Jayplas, PolyQuest and CIER intended for the manufacture of materials and articles for contact with all types of foodstuffs for hotfill and/or long term storage at room temperature is not considered of safety concern.

EFSA authorisation

Current situation of authorised recycling processes

- Positive scientific opinion by EFSA for over a hundred of safe recycling processes (still pending for final authorisation by EC)
- Transitional period with permits at the national level
- Most recycling processes for closed & controlled chain and/or for PET
- Some recycling processes for self-consumption (i.e., implemented at the converter facilities)



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Functional barriers

What is a functional barrier?

It is a layer (or multi-layer) within food contact materials and articles which prevents the migration of substances from behind that barrier into the food



Functional barriers

Behind a functional barrier, **non-authorised substances can be used**, provided they fulfil certain criteria and their migration remains below a given detection limit: 0.01 mg/kg in foodstuff (10 ppb)

Substances not covered by the functional barrier concept:

- Mutagenic
- Carcinogenic
- Toxic to reproduction
- Nanoparticles



Functional barriers

The **effectiveness of the functional barrier** depends on:

- Concentration and diffusion coefficient of contaminants in the recycled layer
- Chemical nature and thickness of the barrier layer
- Conditions of use:
 - Type of food
 - Temperature and time of use



Functional barriers

Types of functional barriers

Absolute barriers

Glass and some metals may ensure complete blockage of migration

Glass

Aluminium foil $\geq 8 \mu\text{m}$ thickness

Partial barriers

Plastics may reduce the migration of substances below specific migration limits or detection limits

If recycled PET/virgin PET at room temperature and below:
Virgin PET $\geq 25 \mu\text{m}$ thickness

If recycled PET/virgin PET at higher temperatures:
Virgin PET $\geq 50 \mu\text{m}$ thickness



Functional barriers

The **effectiveness as a functional barrier** of a given thickness of a virgin polymer **must be demonstrated**

Intentional contamination of polymer with a known concentration of surrogate substances (challenge test)



Incorporation of contaminated polymer into an inner layer of the finished article, using virgin polymer as the barrier layer



Migration testing with food simulants under worst foreseeable conditions of use



Functional barriers

Functional barrier films at contact conditions of 10 day @ 60°C


Film structure	Base polymer	Barrier material
36 µm O-PET corona treated	PET	PET
12 µm PET metallised	PET	metallisation
12 µm PET-SiOx 80 nm	PET	SiOx (coating)
6 µm aluminium/PE	PE	Aluminium
15 µm OPA	PA	PA
12 µm PET	PET	PET
PE/EVOH 3 µm/PE total 30 µm	PE	PE/EVOH

Source: **JRC draft for consultation** - "Technical guidelines for compliance testing in the framework of Regulation (EU) No 10/2011 on plastic food contact materials"




Functional barriers

Examples of functional barriers in multi-layer food packaging

	Semi-rigid multi-layer plastic packaging
Current structure	Ext PP/EVOH/PP Int
Processing technology	Co-extrusion
BANUS structure	Ext PP/Recycled PP/EVOH/PP Int
End-users application	


Functional barriers

Examples of functional barriers in multi-layer food packaging

	Flexible multi-layer multi-material packaging
Current structure	Ext Paper/PET metallised/PE Int
Processing technology	Lamination
BANUS structure	Ext Paper/Recycled Paper/PET met/PE Int
End-users application	

Functional barriers

Examples of functional barriers in multi-layer food packaging

	Coated paperboard packaging
Current structure	Ext Paperboard/Coating Int
Processing technology	Coating
BANUS structure	Ext Paperboard/Recycled PB/Coating Int
End-users application	



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Conclusions

- Several competitive advantages by using recycled plastics
- 3 options to use recycled plastics in food contact applications
- EFSA authorisation can allow to use up to 100% post-consumer recycled plastics → possible implementation at converter facilities
- Functional barriers allow to use post-consumer recycled plastics from non-food contact origin → control diffusion effects
- The conditions of use related to recycled food contact articles must be clearly established in the declaration of compliance
- Expected growing trend in the use of recycled plastics for food contact applications due to circular economy strategy





Thank you

Contact us:

www.aimplas.net

info@aimplas.es

Phone + 34 96 136 60 40

www.linkedin.com/company/aimplas

Twitter: @aimplas

