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Eco Paper Loop

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PAPER DIVISION

Criteria for a sustainable paper recycling loop

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OUTLINE

- Legislative framework
- Current End-of-life paper waste stream
- What does influence recyclability?
- Recyclability Criteria
- New Ecopaperloop test method
- Preliminary results
- Conclusions & Perspective

PACKAGING PRODUCTS

Packaging is used on a daily basis by a large part of the global population

Positive effect:

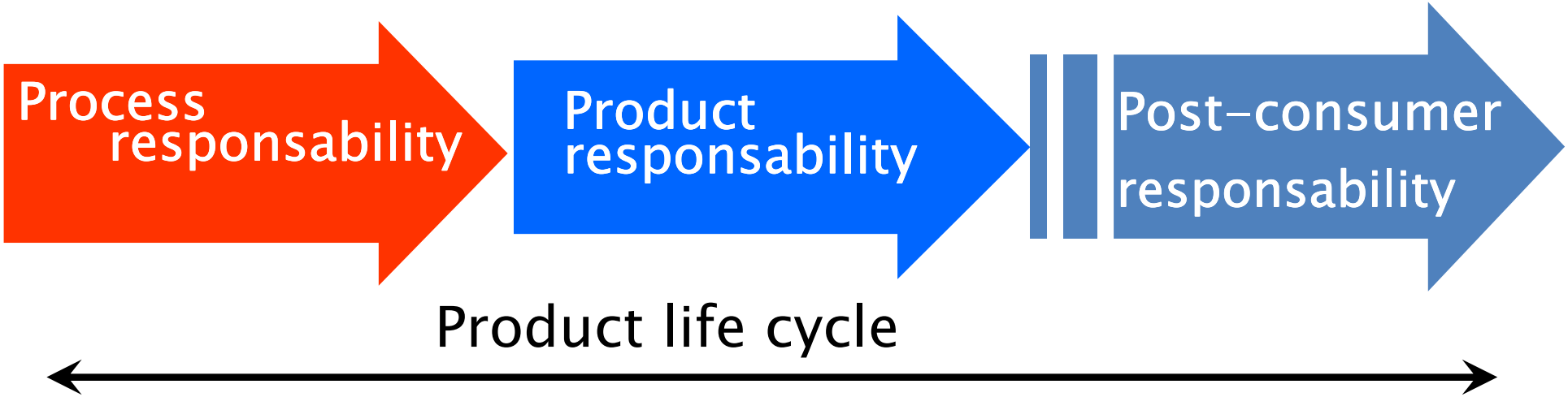
- Protection of goods
- food preservation
- decrease of food waste increasing shelf life
- provide information flow to consumer

Negative effect:

it generates waste

Packaging and Packaging Waste Directive
(94/62/CE amended by 2004/12/EC)

Producer responsability.....



Harmonised standards under Directive 94/62/EC

EN13427:2004

EN 13428:2004
Packaging - Requirements specific to manufacturing and composition - Prevention by source reduction
CR 13695-1/2
Heavy metals and other dangerous goods

DESIGN FOR REUSE

EN 13429:2004
Packaging - Reuse

At least one option

DESIGN FOR VALORISATION

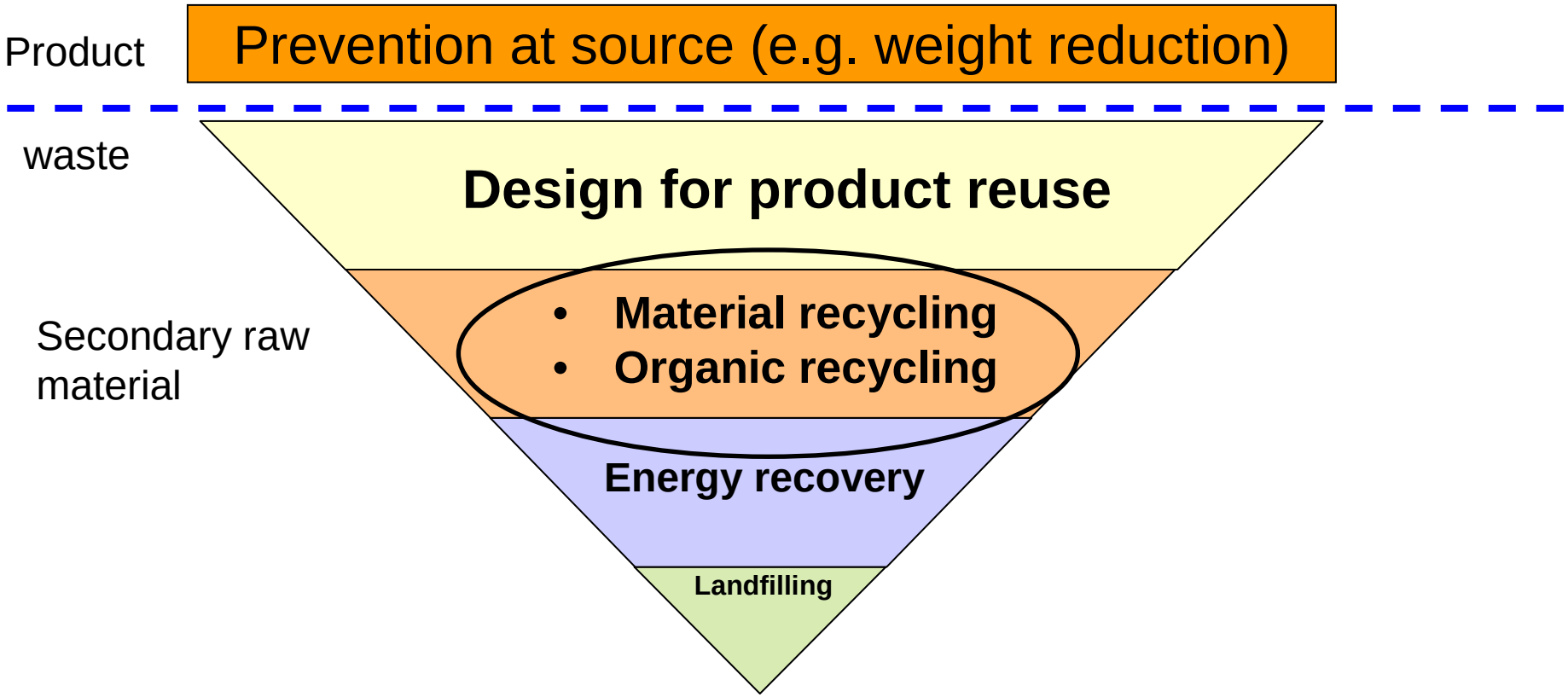
1. EN 13430:2004- MATERIAL RECYCLING
Packaging - Requirements for packaging recoverable by material recycling

2. EN 13431:2004- ENERGY RECOVERY
Packaging - Requirements for packaging recoverable in the form of energy recovery, including specification of minimum inferior calorific value

3. EN 13432:2000- ORGANIC RECYCLING
Packaging - Requirements for packaging recoverable through composting and biodegradation - Test scheme and evaluation criteria for the final acceptance of packaging

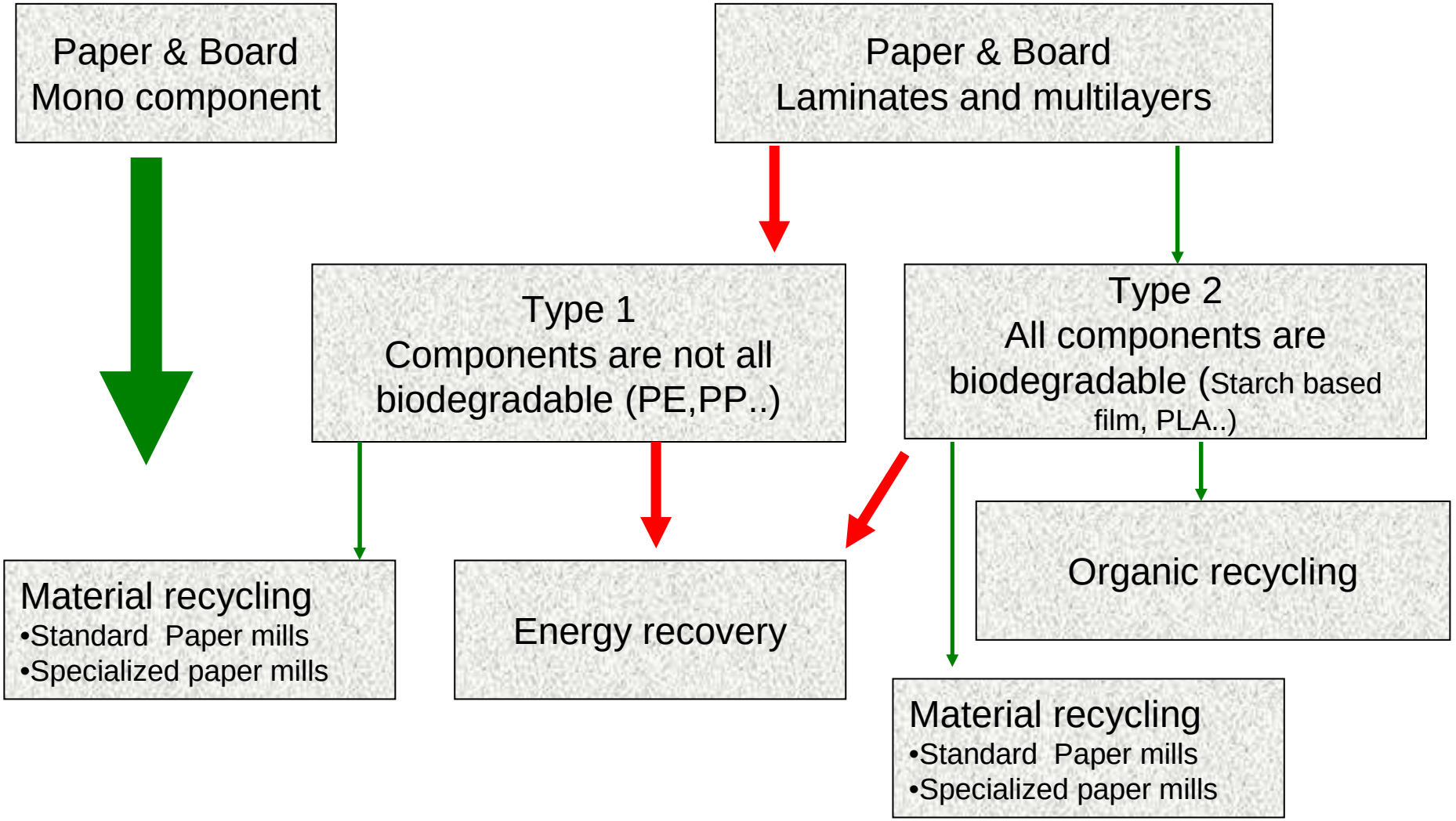
Waste Framework Directive - (2008/98/EC)

Hierarchy



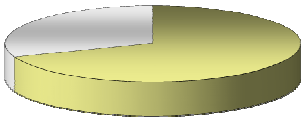
Material recycling allows to keep the material in the same value chain loop

Fibre based packaging: current end-of-life stream

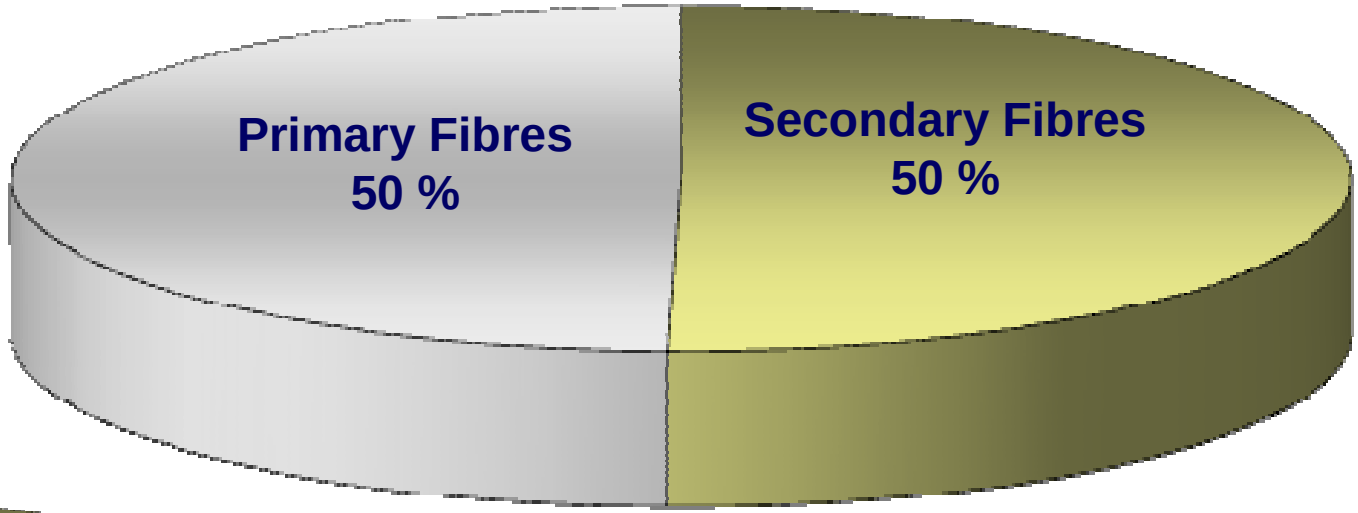


Fibre Raw Material Demand 2010

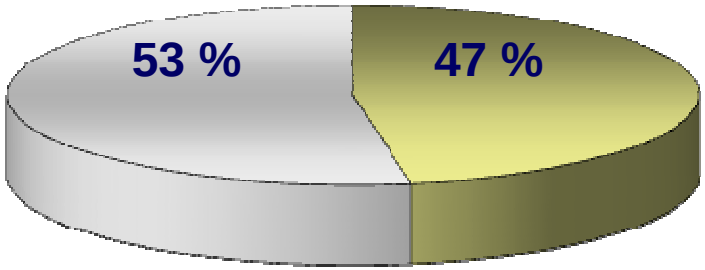
Germany: 19.9 Mio t



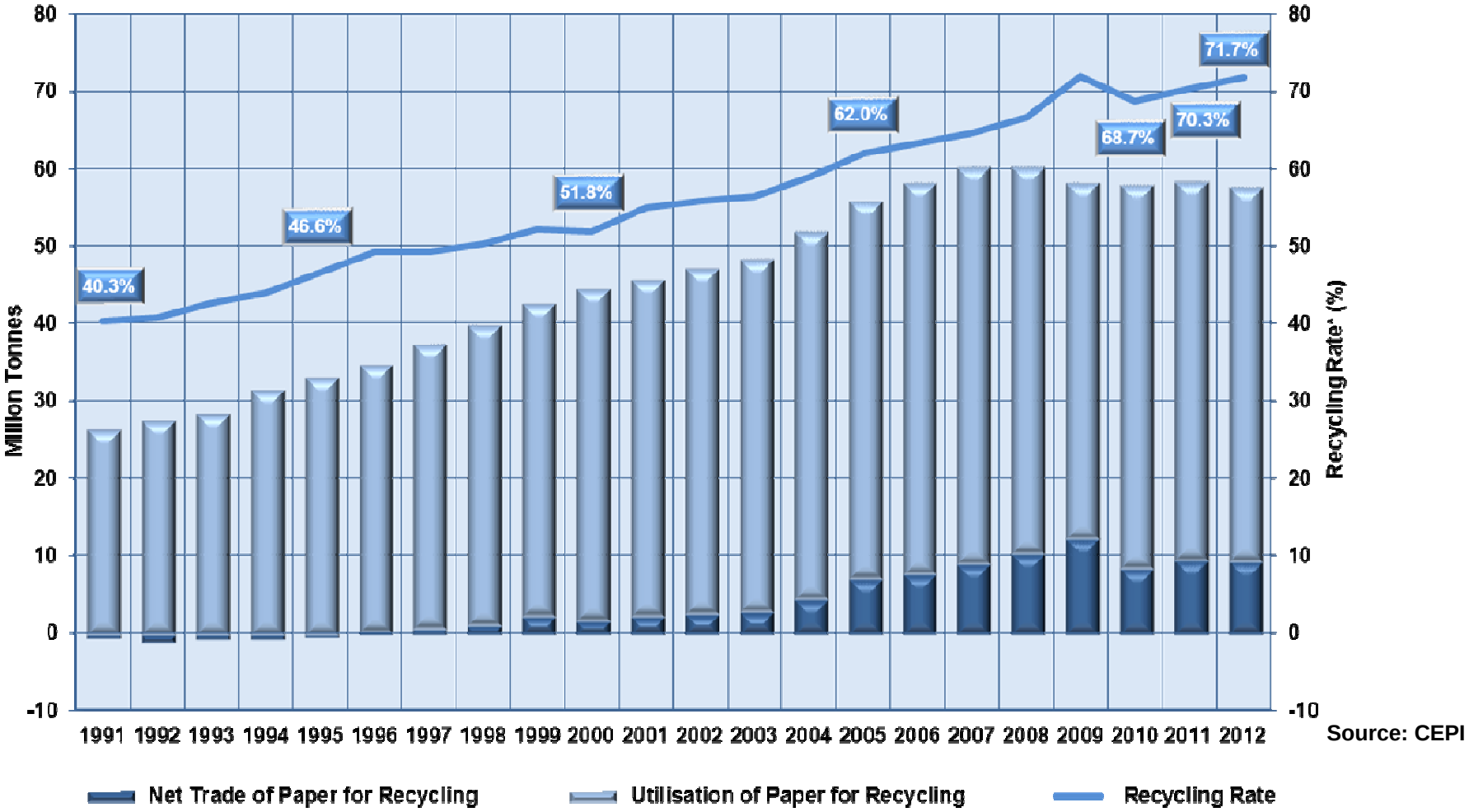
World: 373.5 Mio t



EU: 99.5 Mio t



Recycling rate and Utilization of Paper for Recycling in Europe



Source: CEPI

European Declaration on Paper Recycling

- Definition of Recyclability -

"Design, manufacturing and converting of paper based products in such a way as to enable a high quality recycling of fibres and other materials in a manu-facturing process in compliance – where appropriate – with current standards in the Community."

High quality paper for recycling is essential for the sustainability of the paper loop

Innovative fibre based packaging

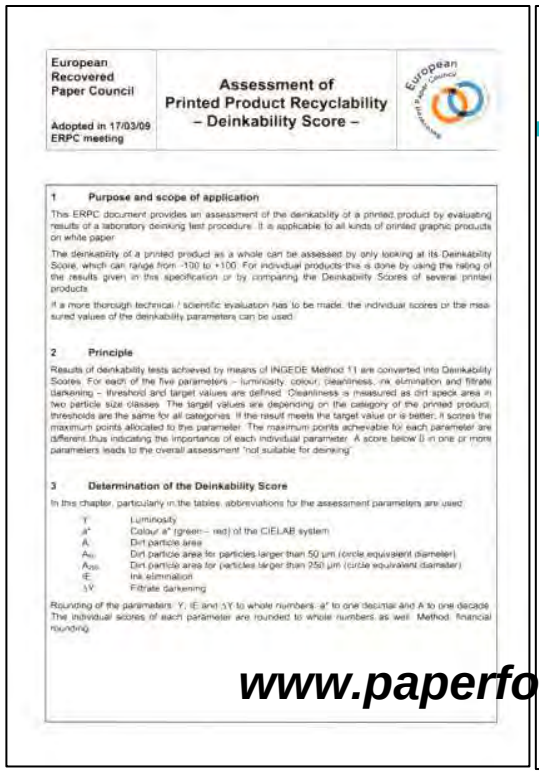
INNOVATION TRENDS	RISKS FOR MATERIAL RECYCLING
Weight reduction Reinforcement agents (e.g. nanofibres) Functional barriers Replacement of petroleum based plastics with bioplastic New dispersion barrier coatings	Difficult repulpability Greater fragmentation of bioplastic components with respect to PE/PP? Sticky behaviour Soluble components: influence on process water (COD load, microstickies, anionic trash)

Difficult recyclability increases waste, energy and chemicals consumption in the paper recycling process.

Responsibility for Recycling Friendly Printed Products

For graphic paper products a procedure exists since 2008 (adopted in 2009) to evaluate the deinkability. Product specific requirements are fixed in the "Deinkability Scorecard".

Since 2011 a comparable evaluation exists on the removability of adhesive applications on graphic paper products.



European Recovered Paper Council

Adopted in 17/03/09 ERPC meeting

Assessment of Printed Product Recyclability – Deinkability Score –

1 Purpose and scope of application

This ERPC document provides an assessment of the deinkability of a printed product by evaluating results of a laboratory deinking test procedure. It is applicable to all kinds of printed graphic products on white paper.

The deinkability of a printed product as a whole can be assessed by only looking at its Deinkability Score, which can range from -100 to +100. For individual products this is done by using the rating of the results given in this specification or by comparing the Deinkability Scores of several printed products.

If a more thorough technical / scientific evaluation has to be made, the individual scores or the measured values of the deinkability parameters can be used.

2 Principle

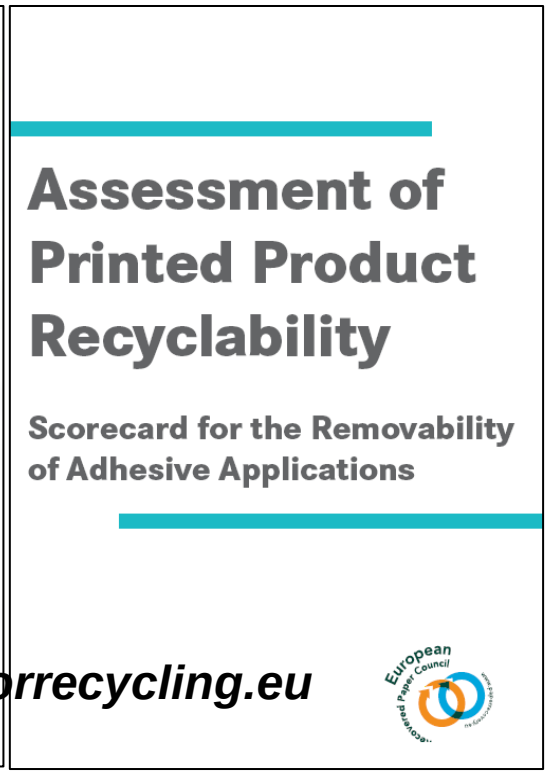
Results of deinkability tests achieved by means of INGEDE Method 11 are converted into Deinkability Scores. For each of the five parameters – luminosity, colour, cleanliness, ink elimination and filtrate darkening – threshold and target values are defined. Cleanliness is measured as dirt speck area in two particle size classes. The target values are depending on the category of the printed product, thresholds are the same for all categories. If the result meets the target value or is better, it scores the maximum points allocated to this parameter. The maximum points achievable for each parameter are different thus indicating the importance of each individual parameter. A score below 0 in one or more parameters leads to the overall assessment "not suitable for deinking".

3 Determination of the Deinkability Score

In this chapter, particularly in the tables, abbreviations for the assessment parameters are used:

Y	Luminosity
a*	Colour a* (green – red) of the CIELAB system
A	Dirt particle area
A_{50}	Dirt particle area for particles larger than 50 µm (circle equivalent diameter)
A_{150}	Dirt particle area for particles larger than 150 µm (circle equivalent diameter)
IE	Ink elimination
ΔY	Filtrate darkening

Rounding of the parameters Y, IE and ΔY to whole numbers, a* to one decimal and A to one decade. The individual scores of each parameter are rounded to whole numbers as well. Method: financial rounding.



Assessment of Printed Product Recyclability

Scorecard for the Removability of Adhesive Applications

www.paperforrecycling.eu

Ecolabel of printed products (2012/481/UE-16 august 2012) includes **recyclability criteria**

Responsibility for Recycling Friendly Packaging Products?

Assessment of Packaging Material Recyclability

Scorecard for paper based packaging products?

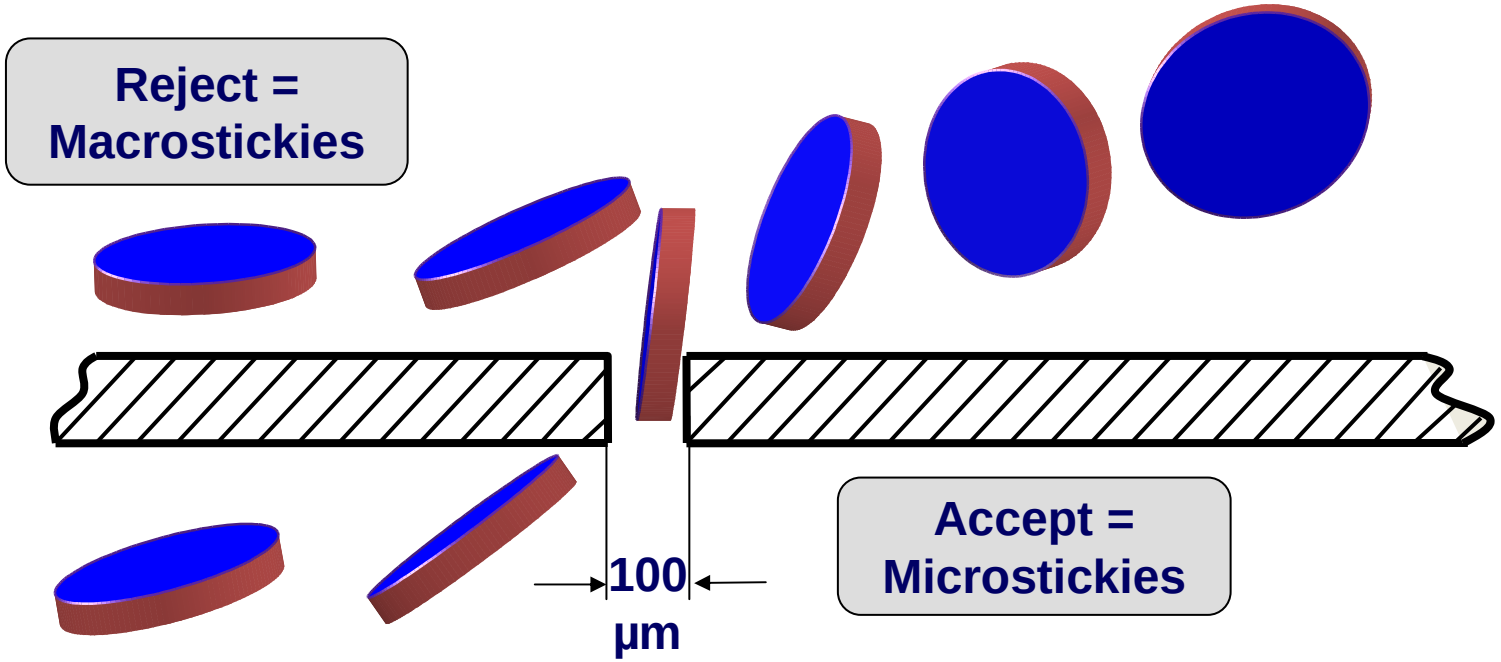
Not available yet

Not available yet

No general agreement exists for an assessment on packaging paper products until now.

Need of a common standard method

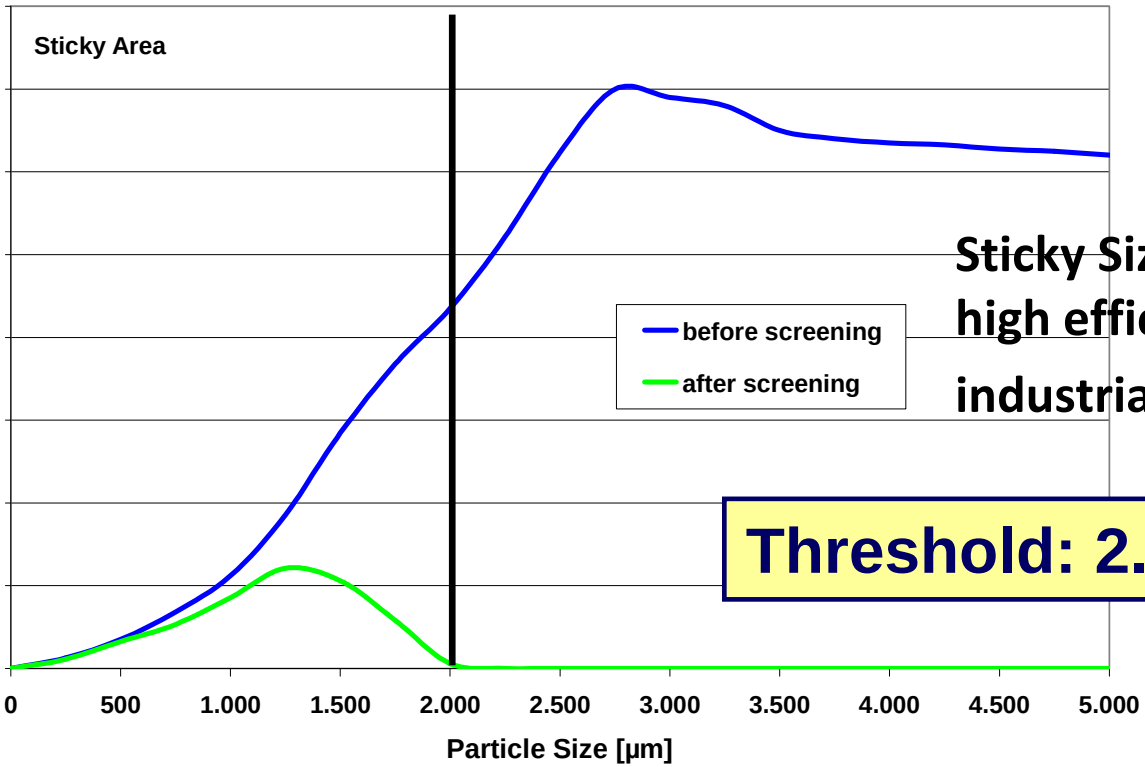
Macrostickies size and removal



Stickies particles present in recycled pulp slurry are normally removed by slotted screen in the recovered paper process.

Size Distribution of Macrostickies in Industrial Recovered Paper Processes

Development of less detrimental adhesives



Sticky Size > x_{min} (Ø 2 000 µm)
high efficiency of
industrial screening

Threshold: 2.000 µm

Parameters affecting the quality of Paper for Recycling

- **Non-Paper components** → Waste (plastic, aluminium etc.)
- **Ash content** → Low fibre yield, WASTE
- **Stickies content** → Paper machine deposits
- **Strenght properties** → Function of the recovered paper grade

Stickies are tacky particles deriving from adhesives (e.g. hot melts or pressure sensitive adhesives), inks, binders, waxes, polymers, wet strength resins etc. **They are tacky at certains temperatures under pressure**.

Their particle size is reduced in the paper recycling process steps by slushing, deflaking, dispersing, kneding or refining.

Stickies that are not removed, enter the paper machine producing deposit on clothing, rolls or cylinders leading to **paper web breaking (production stops).**

Criteria for good Paper based Packaging Recyclability

Good repulpability

Low amount of non-paper components

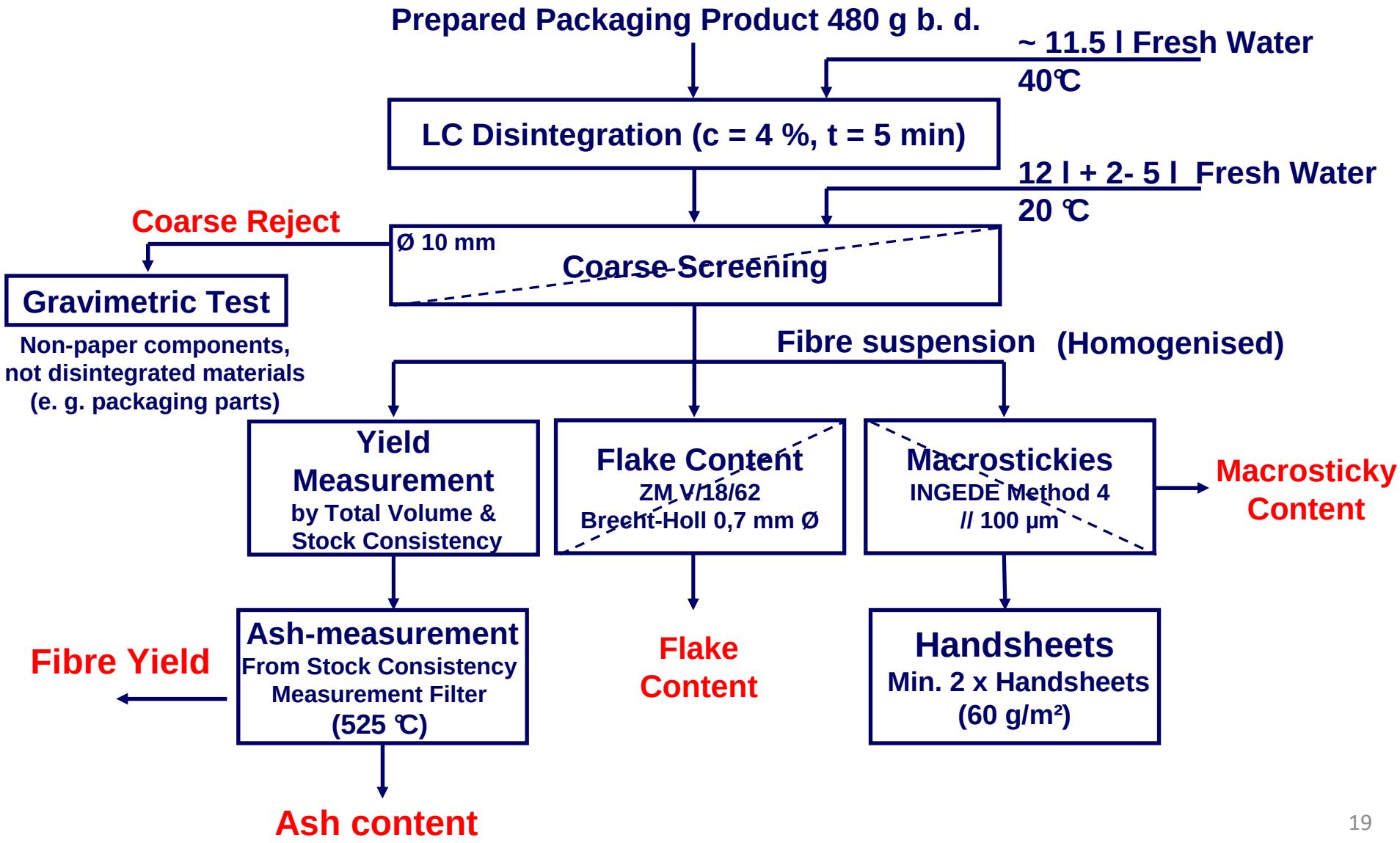
Low sticky potential (adhesives removability)

→ Test Methods: Simulated Stock Preparation

Paper packaging recyclability available methods: PTS-RH021/97 (DE) e Aticelca MC 501-13 (IT)

- **Low amount of packaging sample (50 g)**
- **Long pulping time (20 min)**
- **Coarse screen rejects and flakes are not measured**
- Low relevance with industrial plants of repulping and waste rejects results**.**
- **Macrostickies**
  - Quantitative evaluation only in the Aticelca method

New Ecopaperloop method



Major Equipment

LC-Disintegration

Coarse Screening

Flake Content & Sticky Evaluation

Possible Assessment

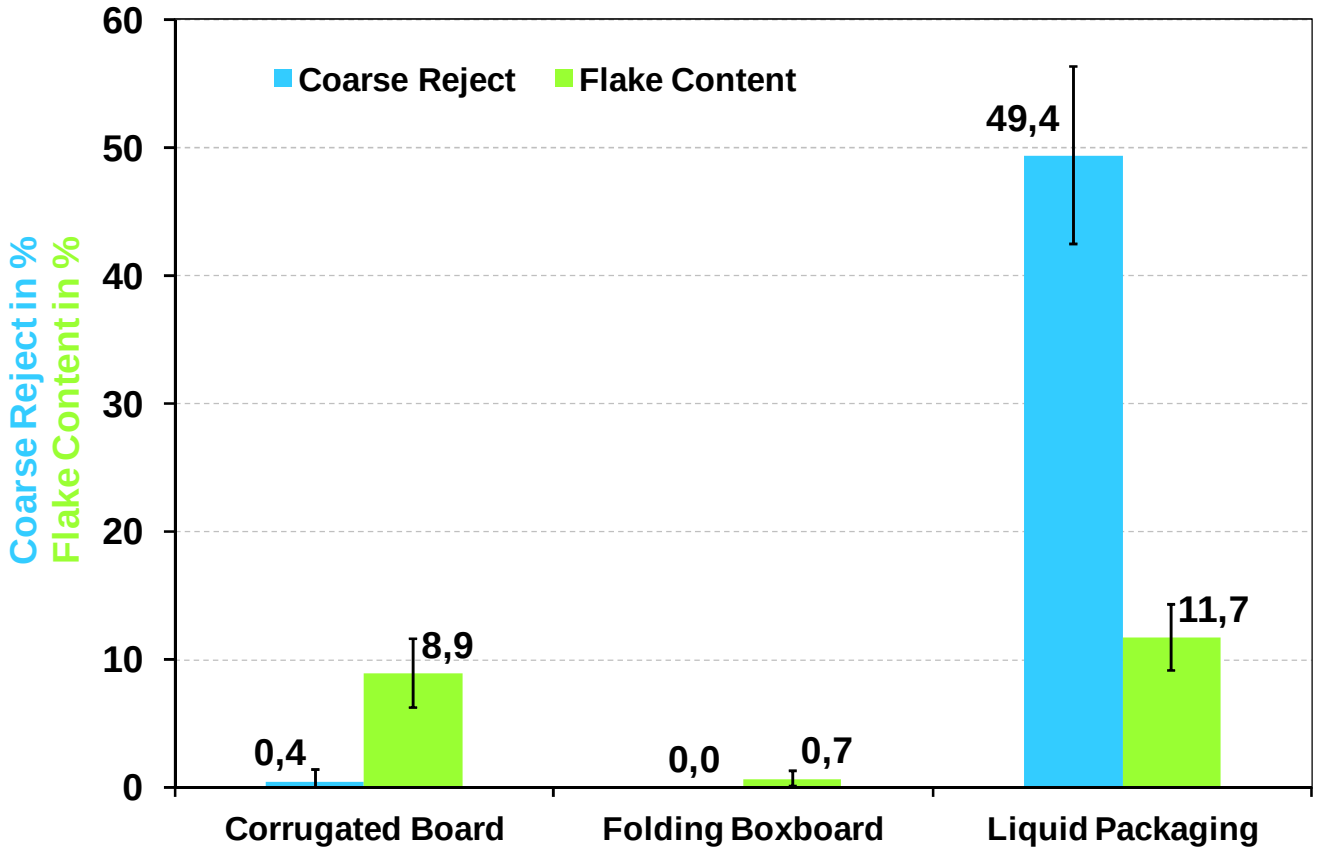
- Non-fiber components
- Flake content (for disintegration behaviour)
- Sticky content
  - Share of stickys e. g. < 3.000 µm
  - Theoretical total sticky area after screening

→ Scoring system analogue to deinkability or removability score

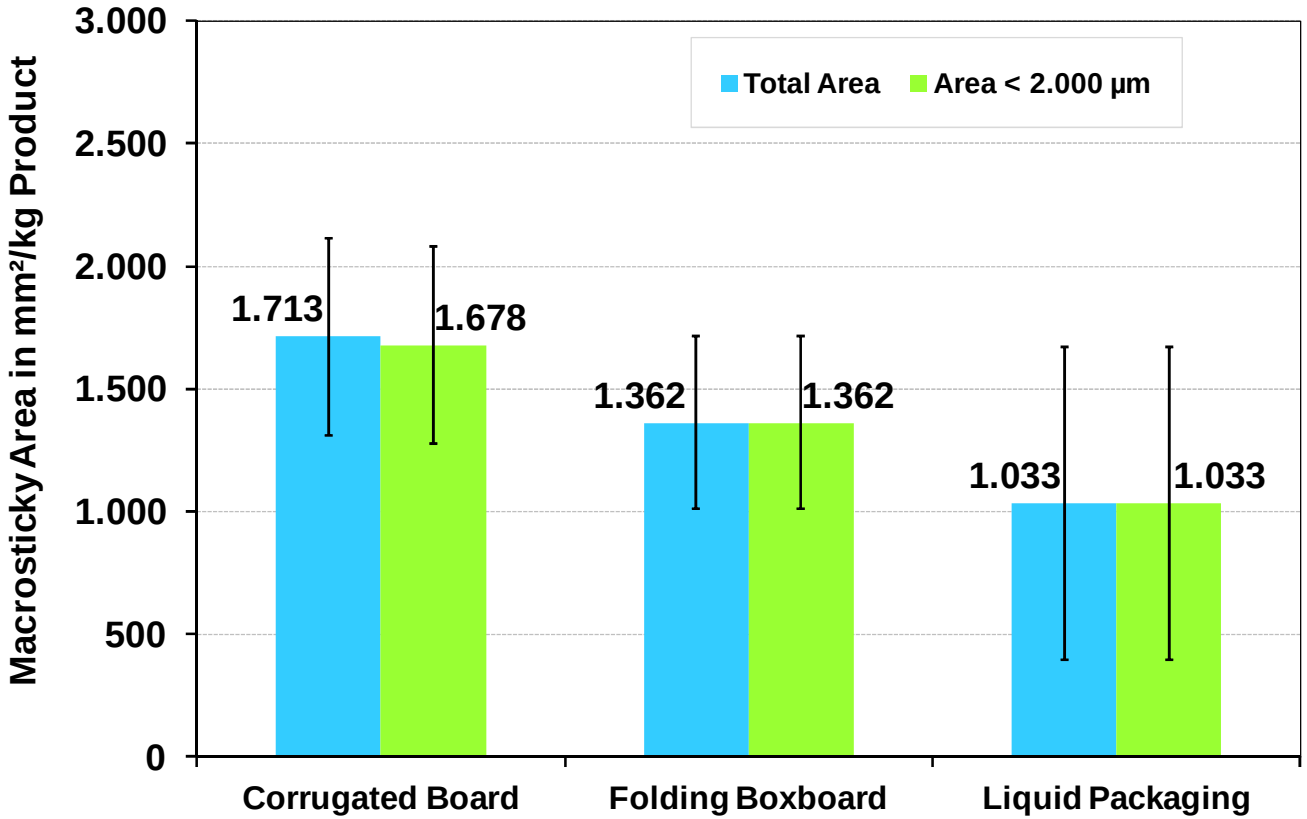
Advantages of Ecopaperloop Method

- Higher amount of tested product (500 g)
- Coarse rejects evaluation
- Flake content
- Fibre yield evaluation
- Macrostickies area and distribution.
- Industrial relevance of the assessed parameters

ROUND ROBIN TEST- COARSE REJECTS & FLAKES



ROUND ROBIN TEST - MACROSTICKIES



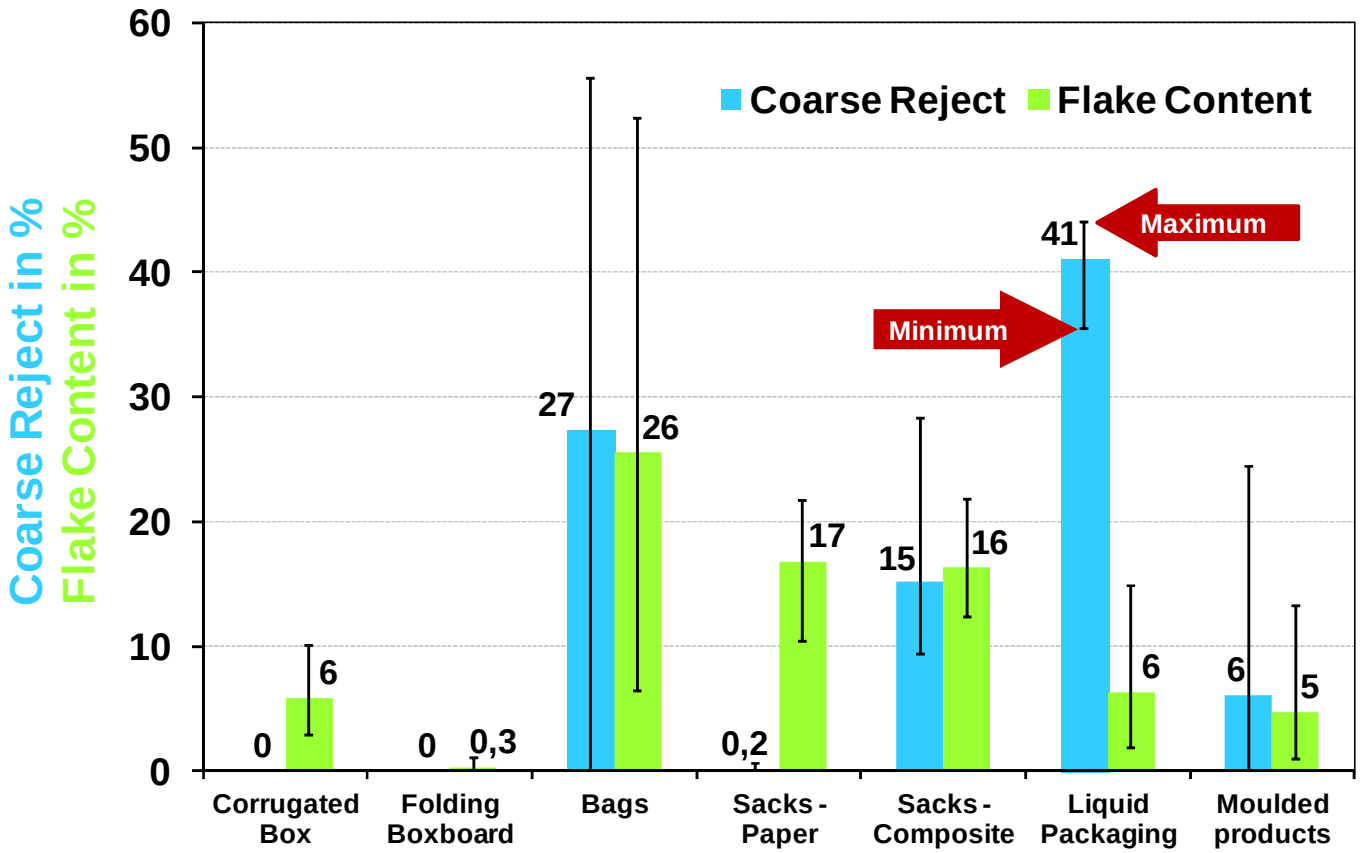
Ecopaperloop: recyclability database development

Approximately **160 products** are being tested in 5 countries (Germany, Italy, Poland,Hungary and Slovenia).

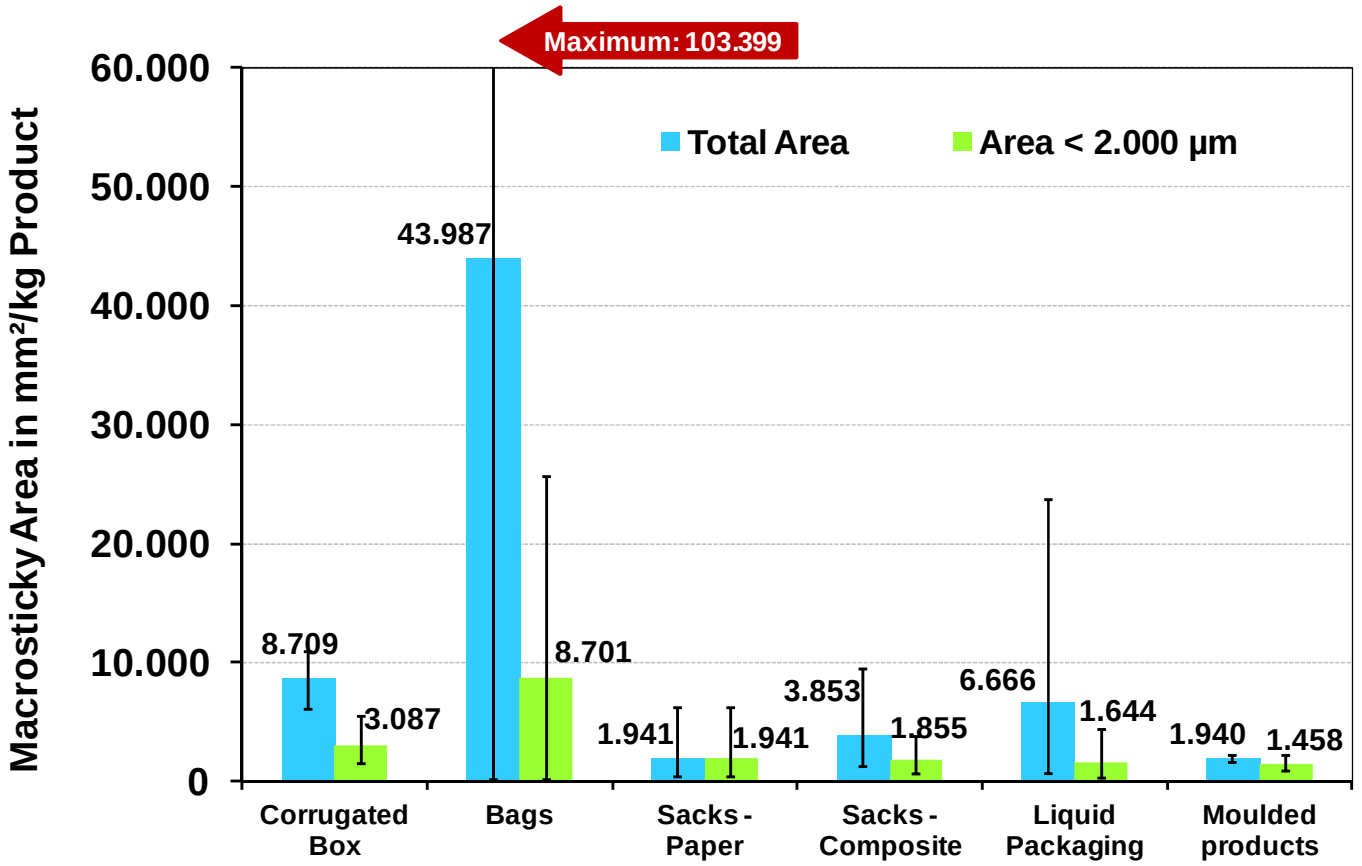
PRODUCT CATEGORIES

- Corrugated Boxes (all sizes)
- Folding Boxboard (incl. Solid board) – frozen food
- Folding Boxboard (incl. Solid board) – others
- Bags (open bags with handles)
- Sacks (all sizes) – pure paper
- Sacks (all sizes) – with composite material
- Liquid Packaging
- Moulded products
- Other

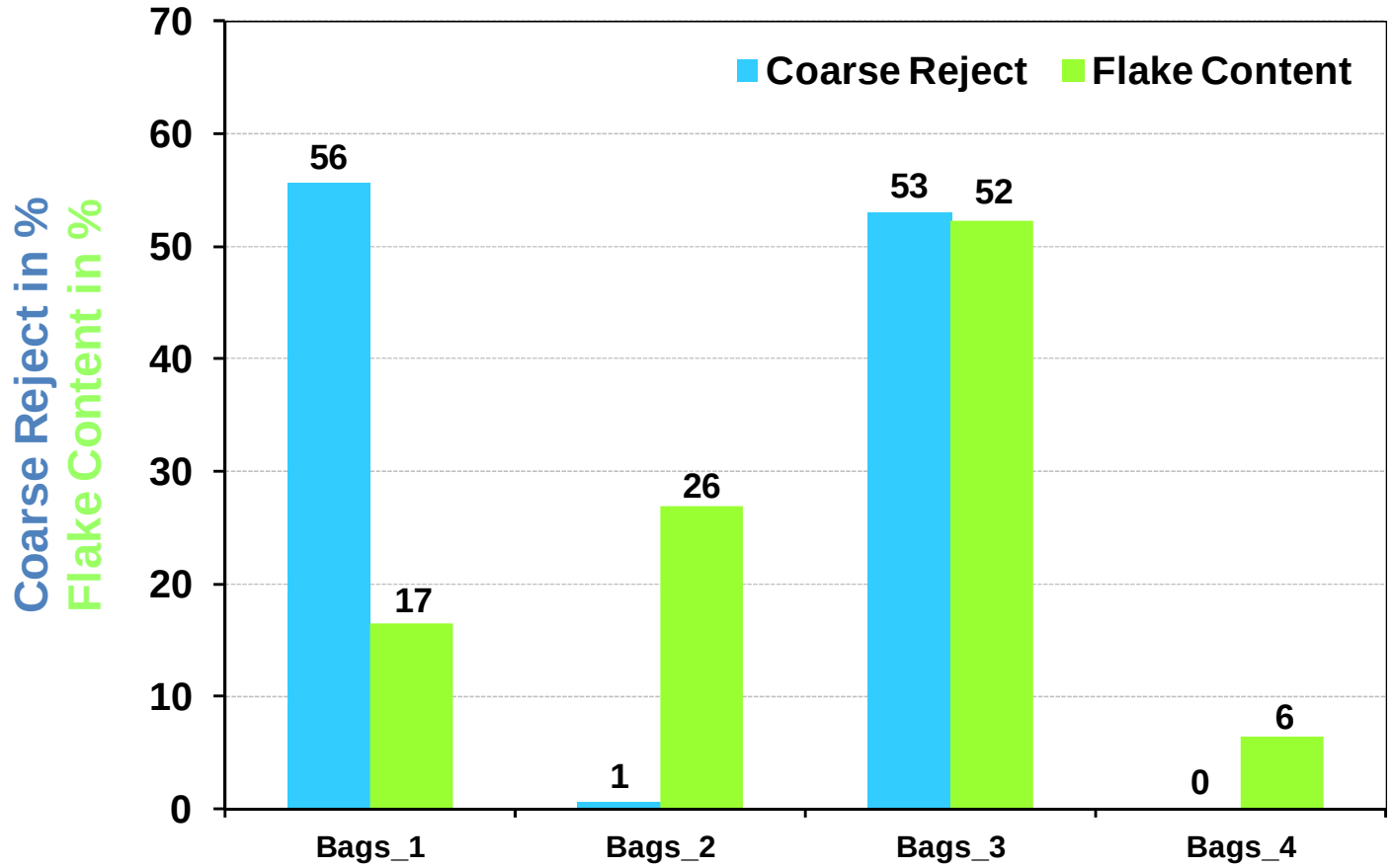
Coarse rejects & Flakes- Hungarian products



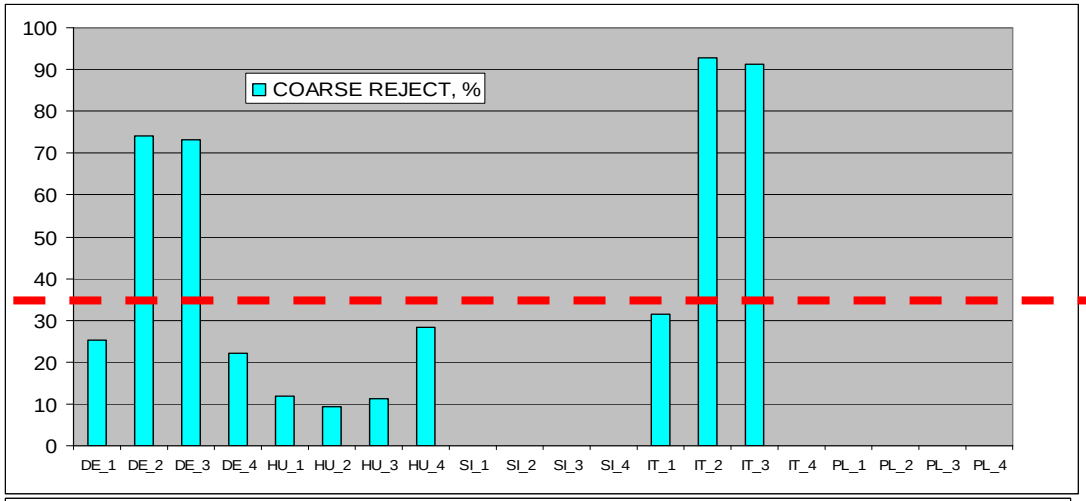
Macrostikies- Hungarian products

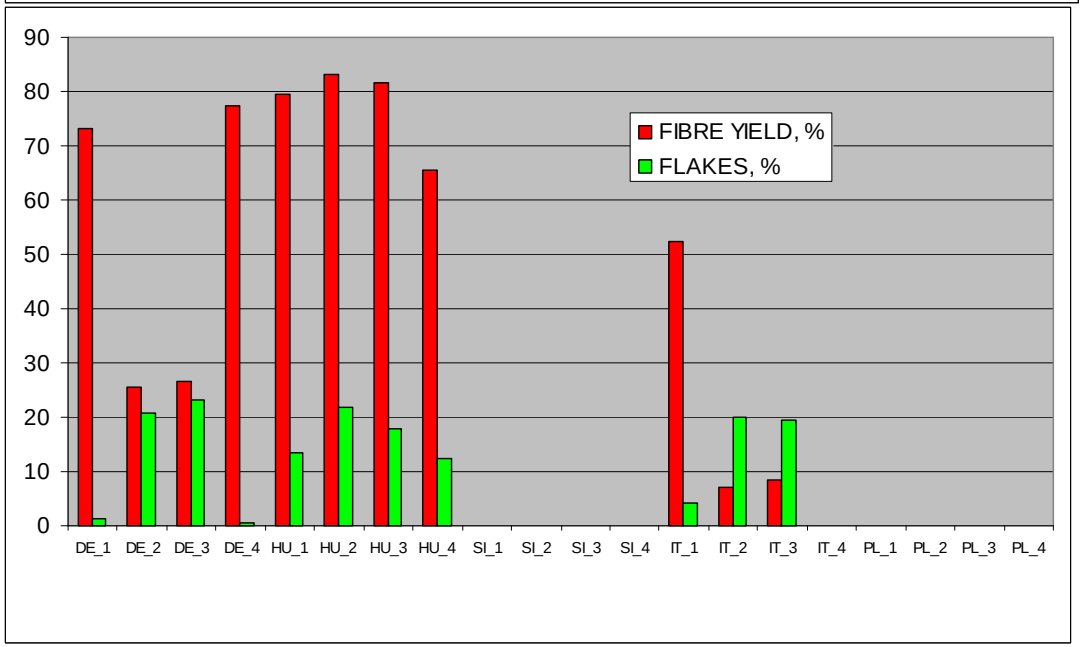


BAGS RECYCLABILITY



COMPOSITE SACKS RECYCLABILITY





Several samples show high coarse rejects and flakes

?

How do we define suitable threshold and target values?

Recyclability evaluation of packaging

Objectives	Parameter
Low waste	**Coarse rejects**
repulpability	**Flakes**
Adhesives removability	**Macrostickies**
Fibre availability	**Process Yield ?**

Score card based on product category ?

Score	Assessment
71 to 100 Points	Good
51 to 70 Points	Fair
0 to 50 Points	Poor
negative (failed to meet at least one threshold)	Not suitable for recycling

Conclusions

- **Recycling friendly products are necessary to support the Eco-Paper Recycling loop**
- **A large recyclability database will be available soon to define thresholds and cut-off criteria**
- **A new score card proposal for paper based packaging will be presented to ERPC**

Perspectives

- **In Ecopaperloop project the recyclability parameters will be connected to pilot LCA studies on recycling oriented eco-design of paper products**
- **A score card will be available to benchmark the recyclability of paper based packaging**
- **Innovative sustainable packaging products must fulfill both functionality and recyclability standards**

Thank you for your attention!

Innovhub SSI, Paper Division (Ecopaperloop coordinator)

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KEEP UPDATED ABOUT

ECOPAPERLOOP FINAL CONFERENCE

KRAKOW (PL), 2 December 2014

www.ecopaperloop.eu

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