Cellulose Based Packaging Recyclability

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PACKAGING PRODUCTS

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

Positive effect:

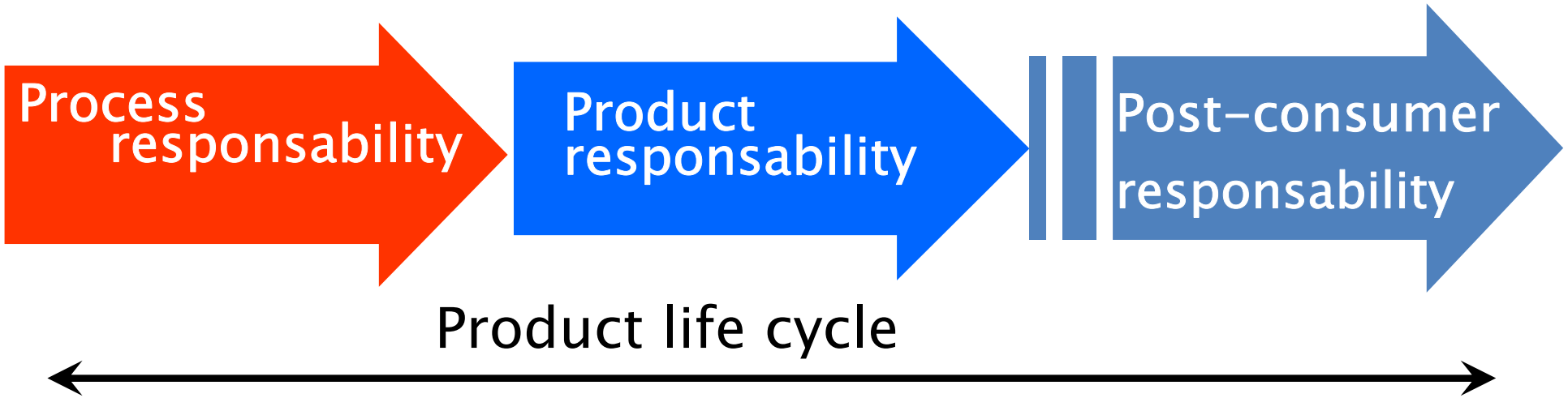
- Protection of goods
- food preservation
- decrease of food waste increasing shelf life
- provide information flow to consumer

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

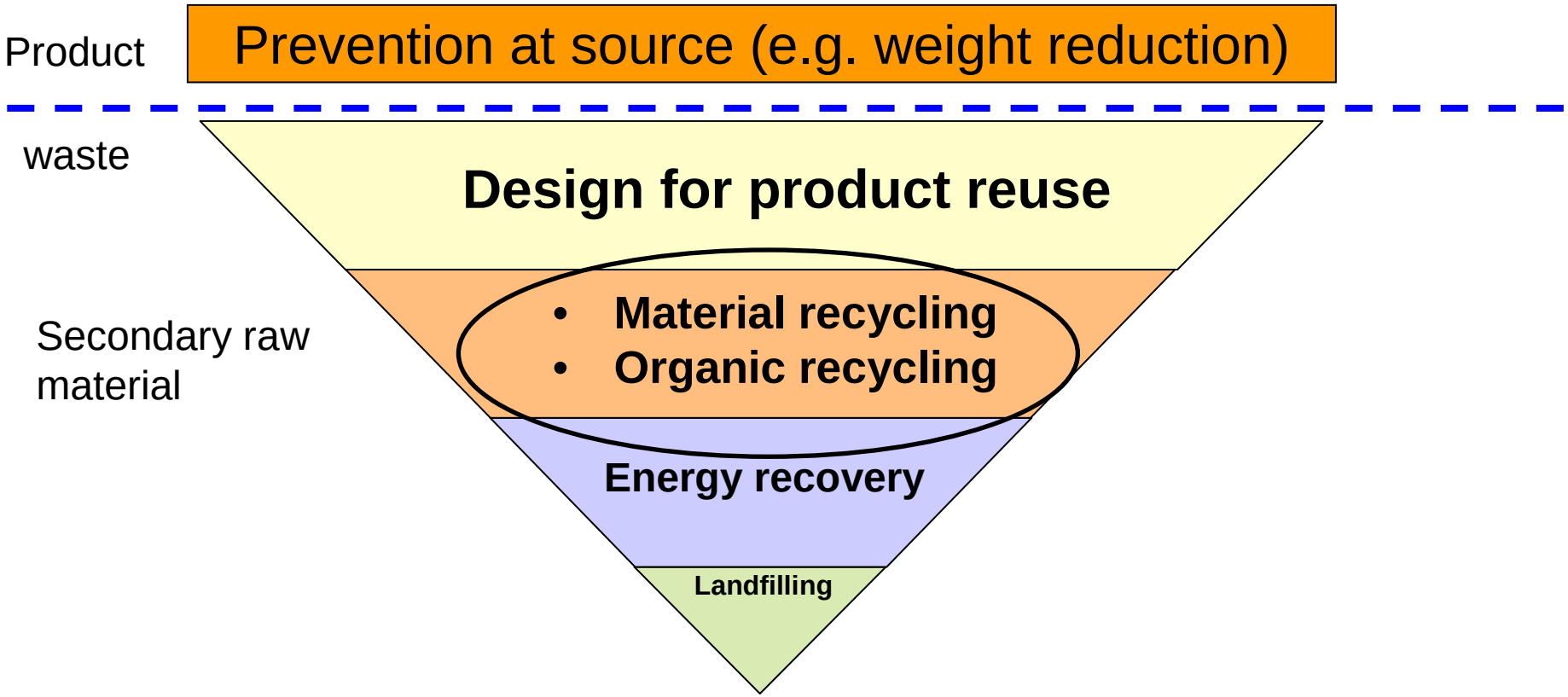
EN13427:2004

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	DESIGN FOR VALORISATION
EN 13429:2004 Packaging - Reuse	**1. EN 13430:2004- MATERIAL RECYCLING** **Packaging - Requirements for packaging recoverable by material recycling**
At least one option	**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

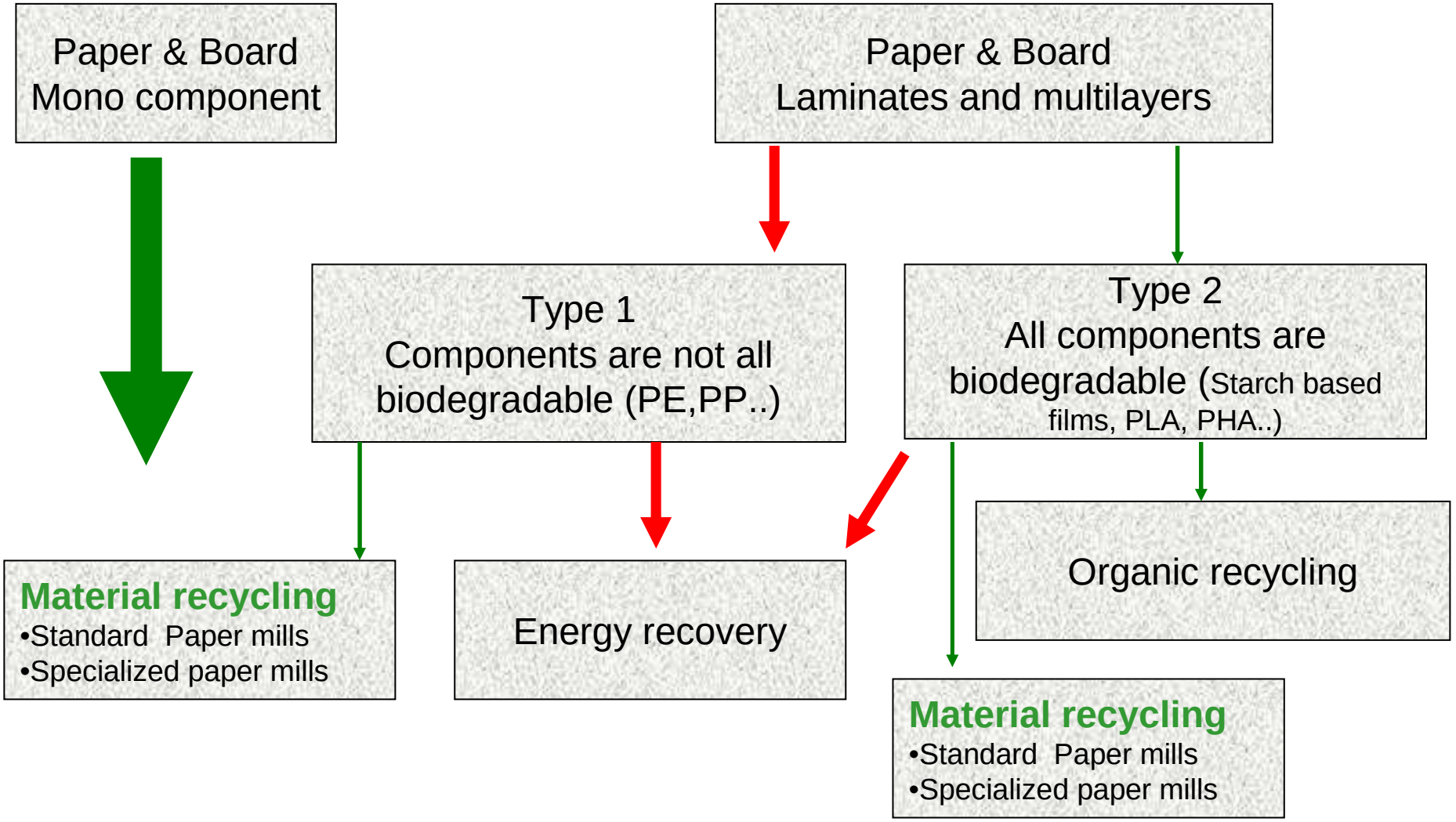
Waste Framework Directive - (2008/98/EC)

Hierarchy

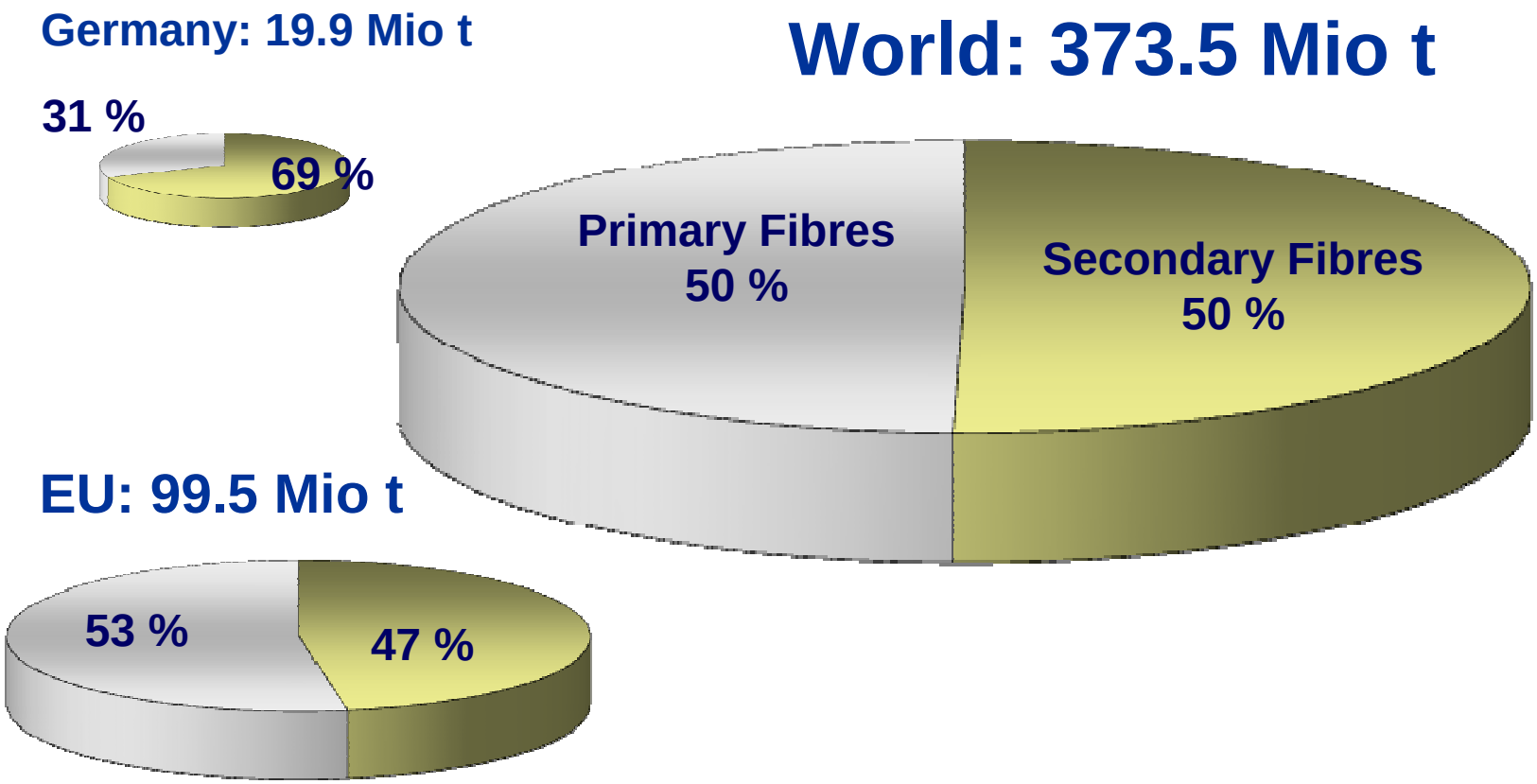


Material recycling allows to keep the material in the same value chain loop

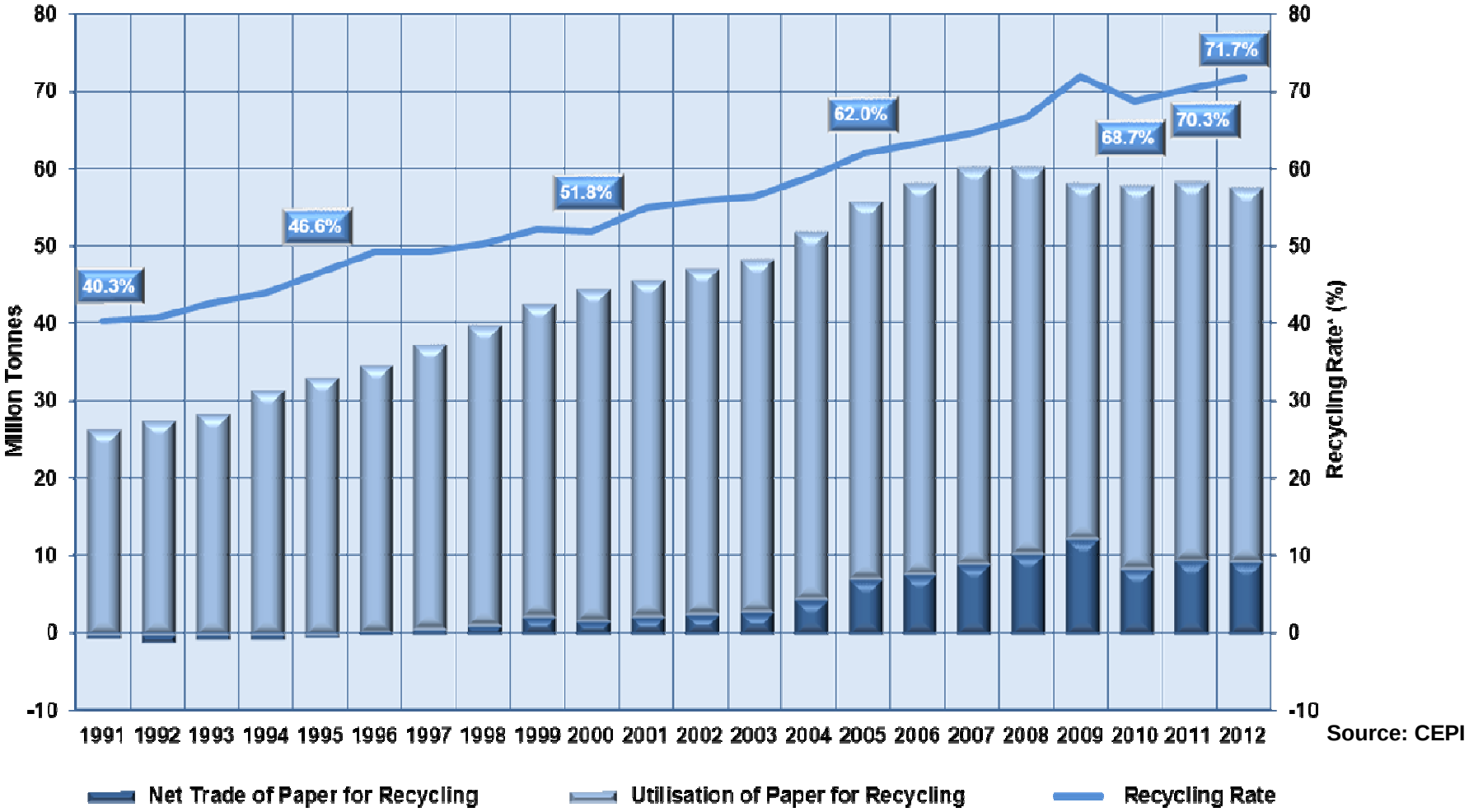
Present end-of-life of fibre based packaging



Fibre Raw Material Demand in the paper industry (2010)



Recycling rate and Utilization of Paper for Recycling in Europe



Source: CEPI

Quality of paper for recycling

Increasing the recycling rate decrease the quality of the paper for recycling

High quality of paper for recyling means:

- **Less waste**
- **Lower energy requirements & chemicals consumption**

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

Eco Design for the Enhancement of Central Europe **Paper** Based Products Recycling **Loop**

Programme: Central Europe 2013

Priority 3.4*: Using our environmental Responsibility - Supporting environmentally friendly technologies and activities*

Lead Partner: Innovhub-SSI (Milano, Italy)

Project time frame: September 2012 - December 2014

Goal

Improve the quality of paper for recycling

EcoPaperLoop

Partnership	Country
Innovhub-SSI	Italy
Paper Technology Consulting	Germany
University of Darmstadt	Germany
University of Dresden	Germany
ICP, Pulp and Paper Institute	Slovenia
University of Ljubljana	Slovenia
UWH,Paper Research Institute	Hungary
COBRO, Packaging Research	Poland
COMIECO consortium	Italy
Lombardy Region	Italy

Activity lines

- Public Awareness on recyclability
- Support best practices in collection strategies
- **Enhance life cycle thinking**
  - *recyclability design of paper based products*
  - *Life cycle assessment of different product design*

Recyclability: major outputs of the project

- ❑ New standard method to assess packaging paper products recyclability
- ❑ Regional database on printed and packaging products recyclability
- ❑ Developing a score card for packaging recyclability

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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.”

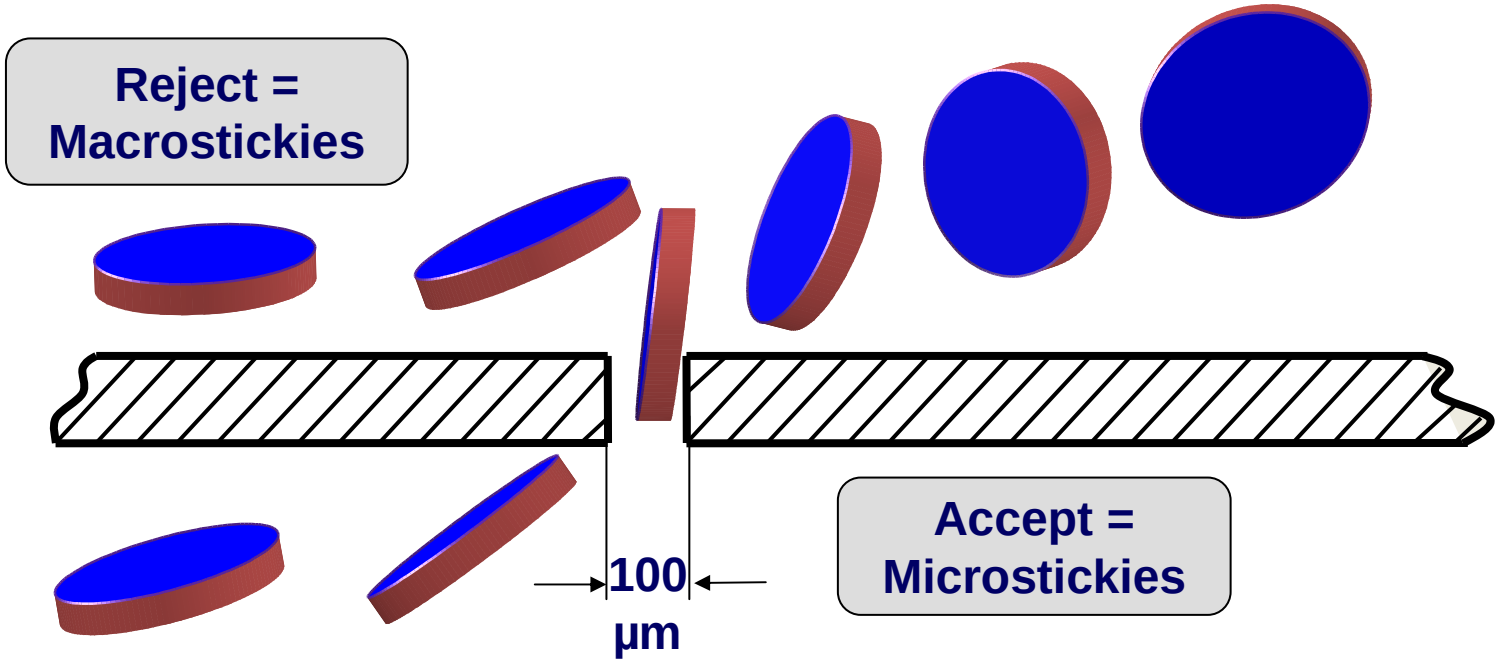
How do we evaluate it?

Scientific criteria based on the paper recycling process

Criteria for good Paper based Packaging Recyclability

- ☺ **Low amount of non-paper components**
  - ➢ ***less generated waste***
- ☺ **Good repulpability**
  - ➢ ***the product disintegrates easily in water into fibre elements***
- ☺ **Low sticky potential (adhesives removability)**
  - ➢ ***less deposits and paper machine stops, less energy and chemicals usage***

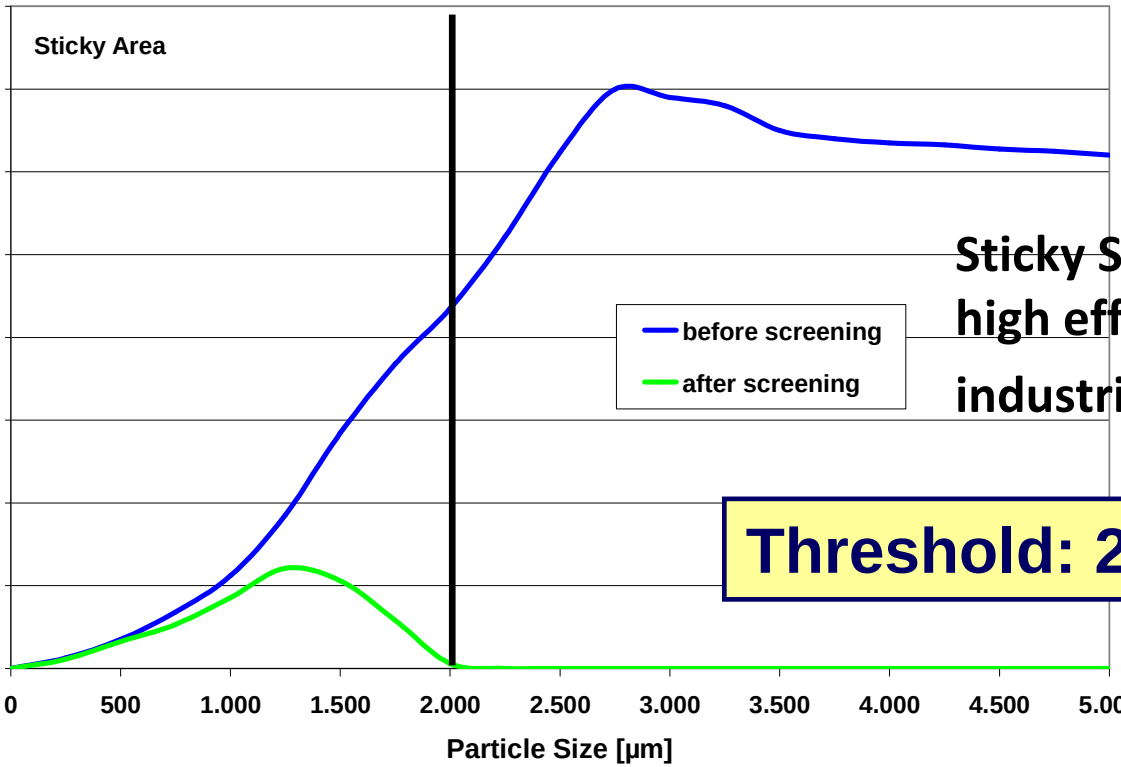
Macrostickies size and removal



Stickies particles present in recycled pulp slurry are normally removed by slotted screen in the recycling 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

Packaging design & recyclability

Monomaterial it is obviously better, however, paper products suffer of poor barrier propertiers (moisture, gases)

- ☞ Wet strenght resistance additives
- ☞ Surface treatments (e.g. hydrophobicity, metalization)
- ☞ Adhesives
- ☞ Varnishes
- ☞ Inks
- ☞ Composite paper products (plastic lamination, aluminium ..)

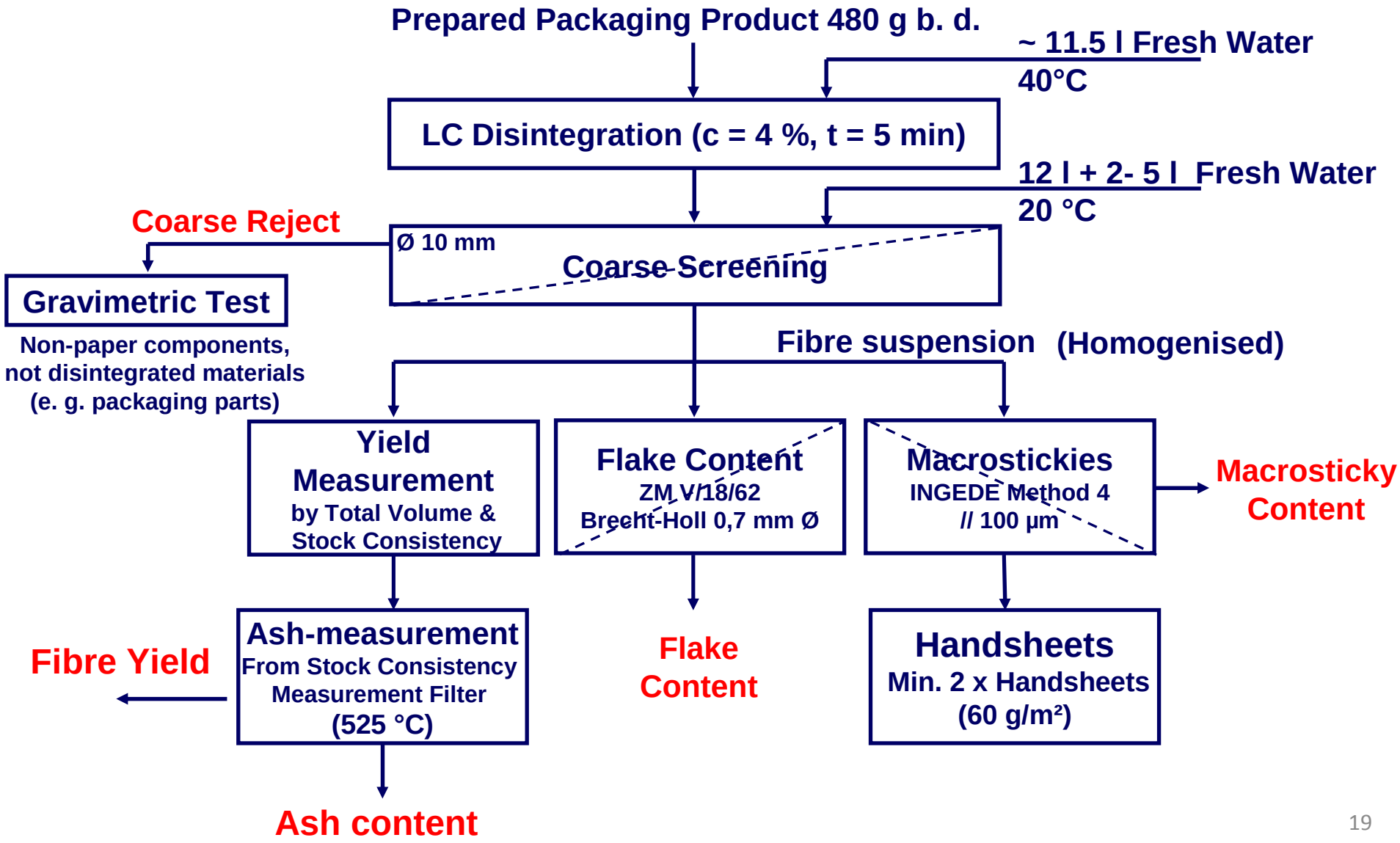
→Test Method: Simulated Stock Preparation of the paper recycling process

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**
- **Macrostickies evaluation**
  - Quantitative evaluation only in the Italian Aticelca method

- Low relevance with industrial plants of repulping and waste rejects results.

New Ecopaperloop method



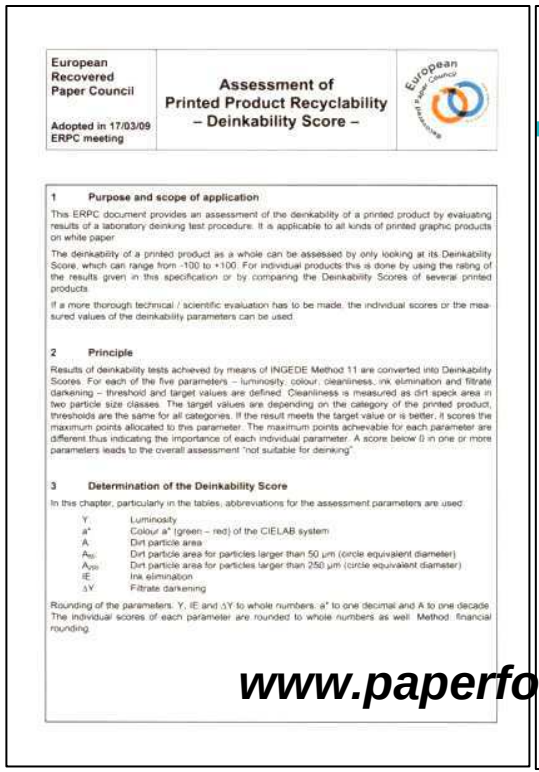
Advantages of Ecopaperloop Method

- Higher amount of tested product (500 g)
- Coarse rejects (non-fiber components)
- Flake content (for disintegration behaviour)
- Fibre yield evaluation
- Macrostickies area and distribution.

Scoring system analogue to existing ERPC Deinkability score for graphic products

Recycling Friendly Printed Products

For graphic paper products a procedure exists since 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".

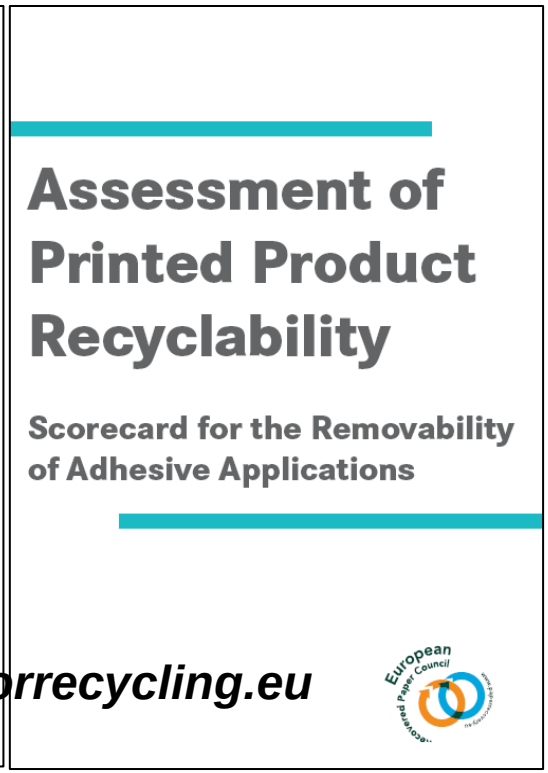
3 Determination of the Deinkability Score

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_{250}	Dirt particle area for particles larger than 250 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.

www.paperforrecycling.eu



Assessment of Printed Product Recyclability

Scorecard for the Removability of Adhesive Applications

European Recovered Paper Council

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

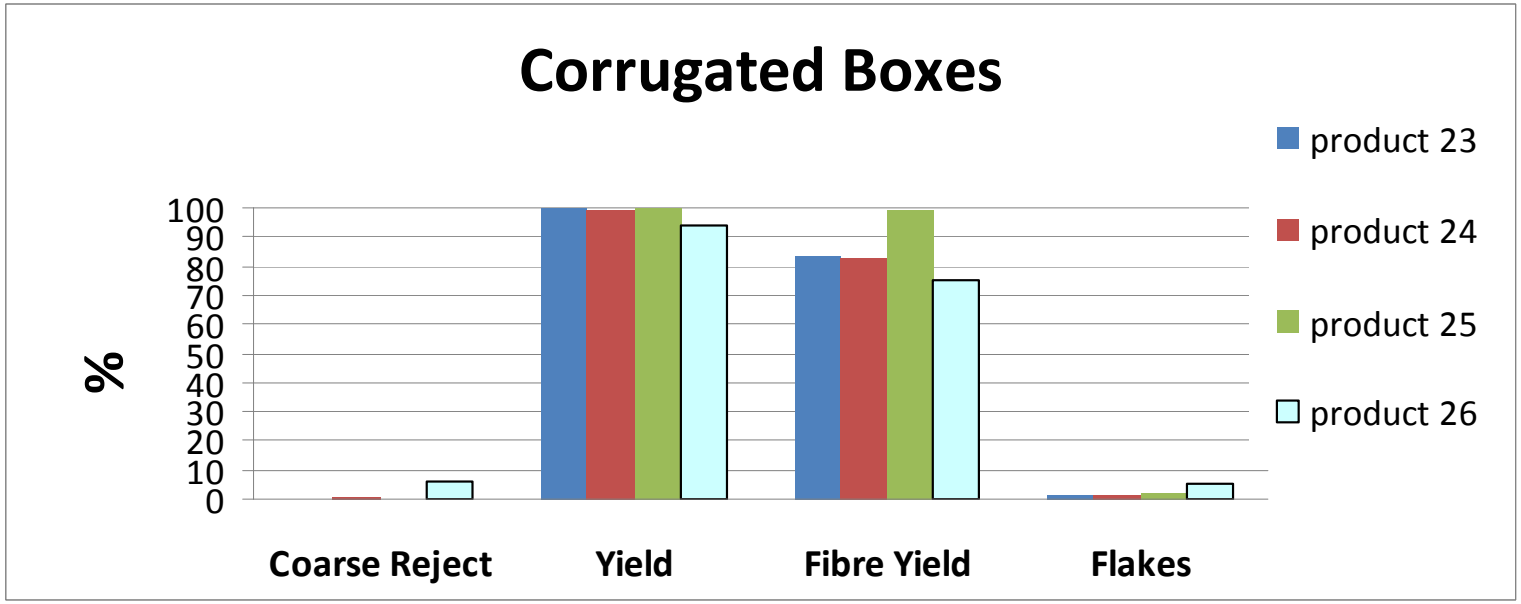
Ecopaperloop: recyclability database development

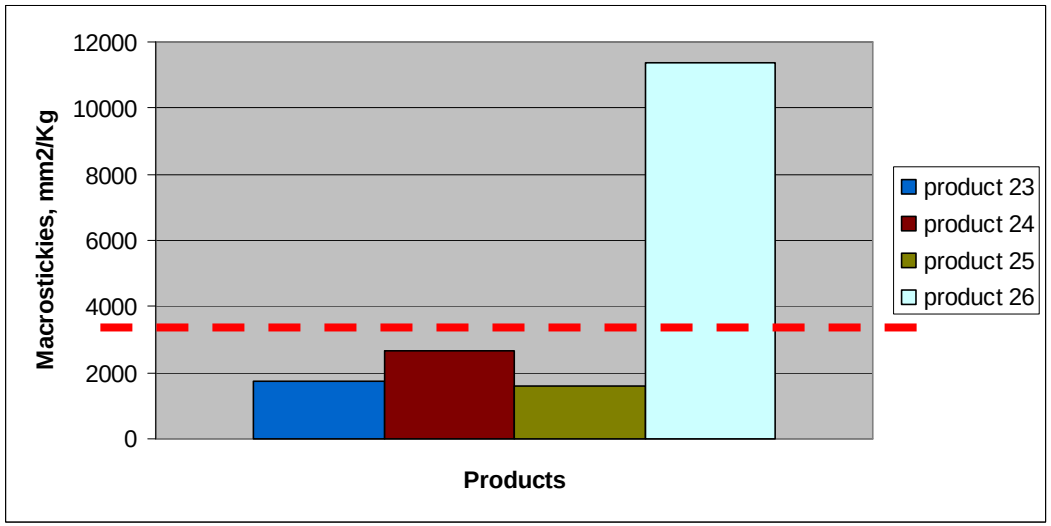
Approximately **160 products** are being tested in 5 countries (Germany, Italy, Poland,Hungary and Slovenia).

PRODUCT CATEGORIES

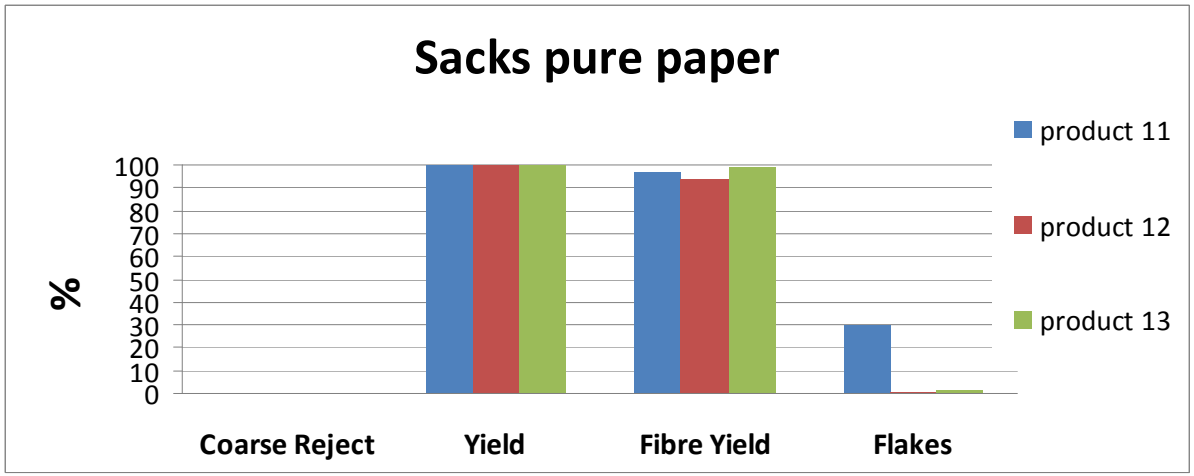
- Corrugated Boxes (all sizes)
- Folding Boxboard (incl. Solid board) – frozen food
- Folding Boxboard (incl. Solid board) – others
- Bags (open bags with handles)
- Sacks (all sizes) – pure paper
- Sacks (all sizes) – with composite material
- Liquid Packaging
- Moulded products
- Other

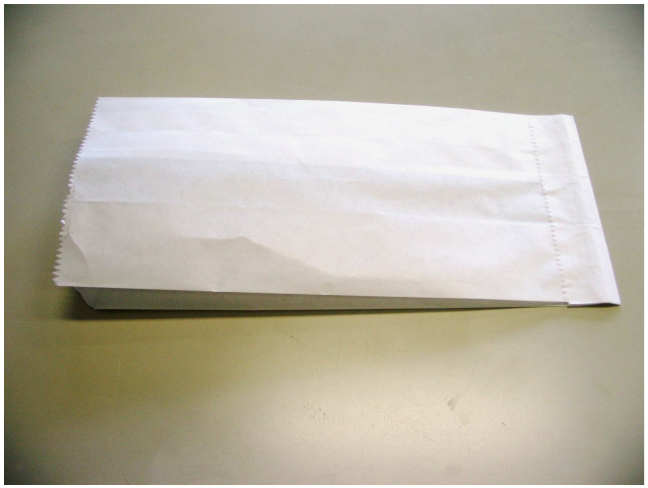
Corrugated boxes: results from Italian products

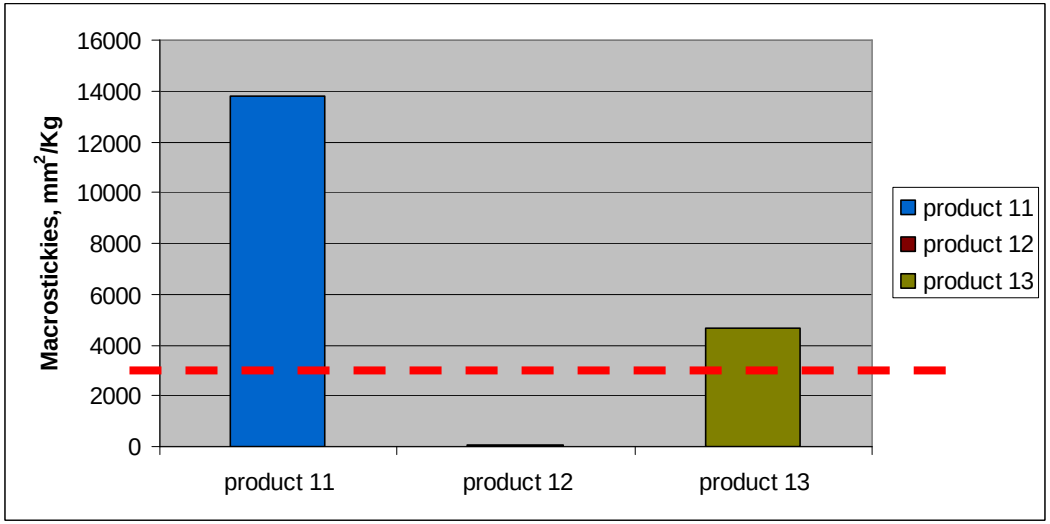


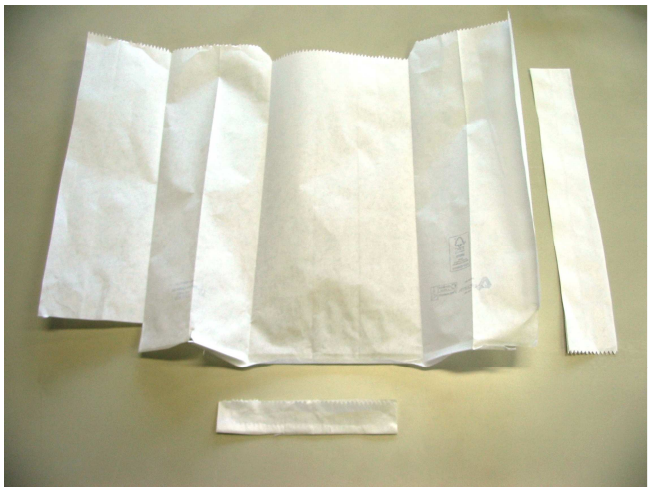


Sacks of pure paper: results from Italian products

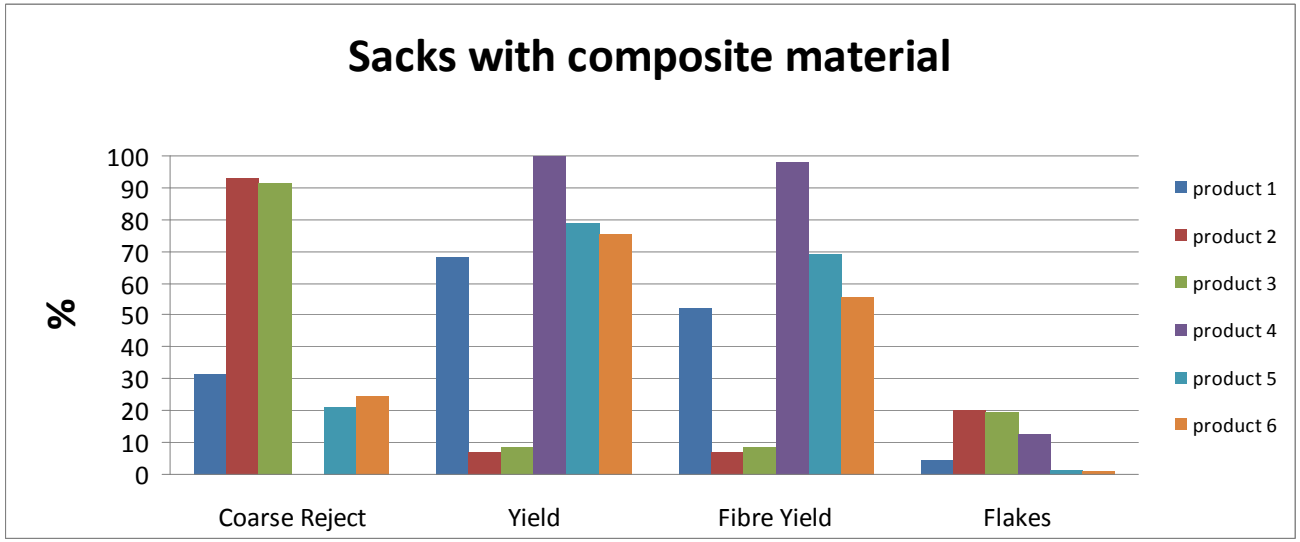




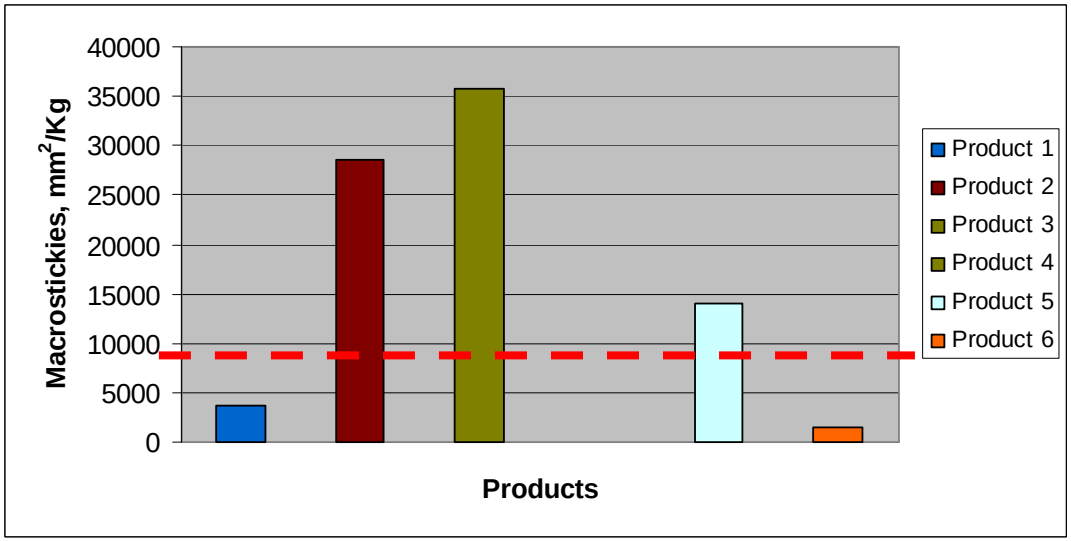




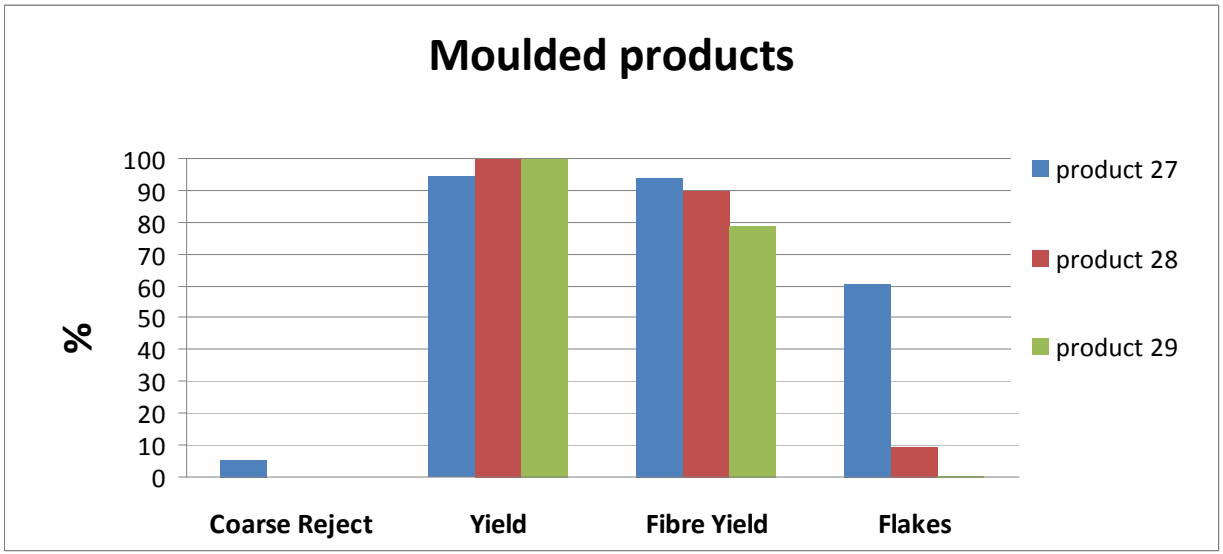
Sacks with composite material: results from Italian products

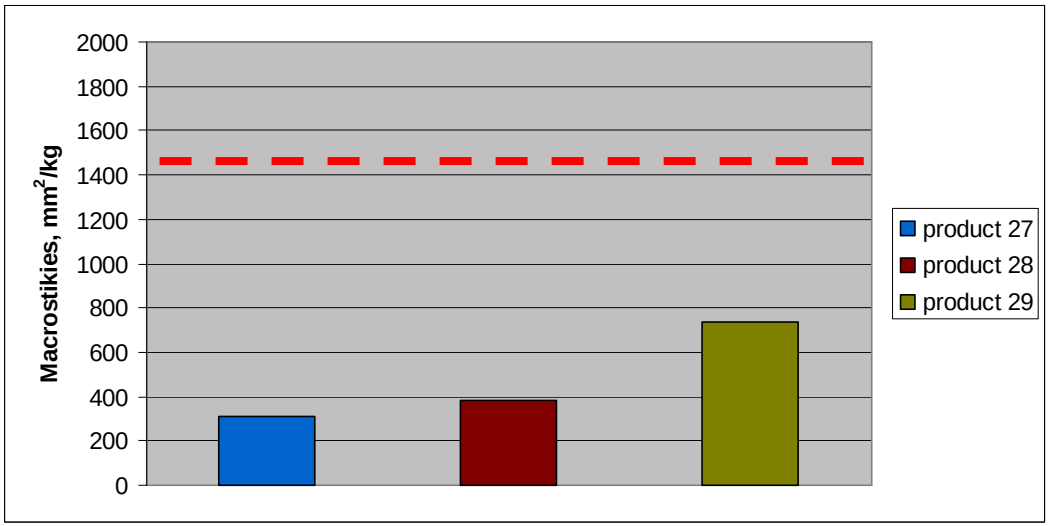


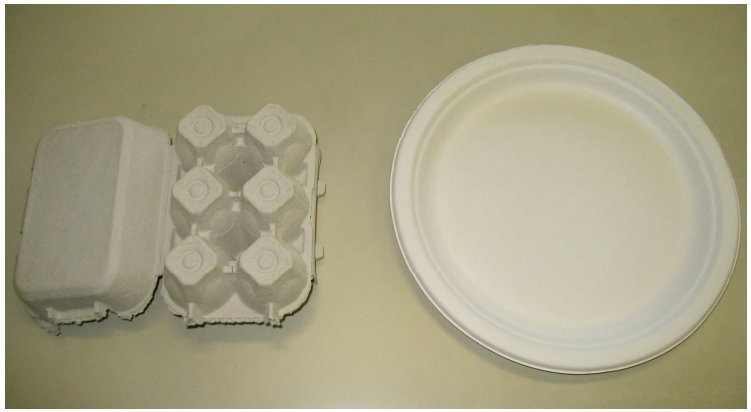
Coarse reject



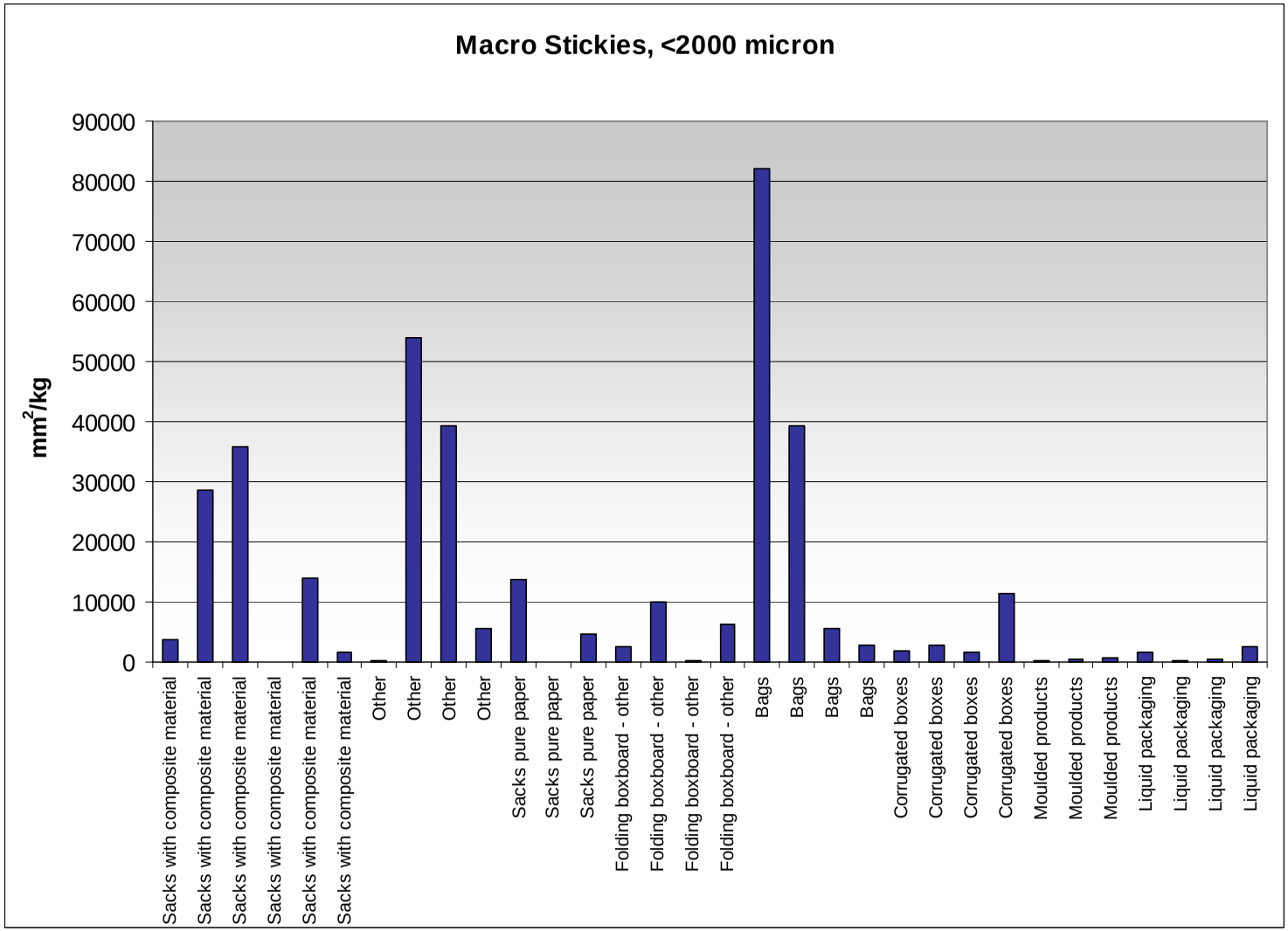
Moulded products: results from Italian products







Macrostikies in various product categories



Packaging score card

Purpose and scope of application

- **Applicable to paper and board grades 1 to 4 (according to EN 643)**
- **Applicable to grade 5 – special requirement has to be fulfilled**
- **Not applicable for grades which are usually intended for deinking purposes**

→ **Recyclability Score from -100 to +100**

Principle of packaging score card

- **Recyclability test: EcoPaperLoop Method 1**
- **Score card based on product category**

Objective	Parameter
Low waste/ high yield	**Coarse rejects**
repulpability	**Flakes**
Adhesives removability	**Macrostickies**
Optical homogeneity	**Visual aspect (dirt specks)**

Process parameters

Quality Parameters

Score card proposal: weighting the parameters

Parameter	Coarse Reject	Flake Content	Macro Stickies Area	Optical Homogeneity	Total
Maximum Score	35	15	40	10	100
	Quality Parameters		Process Parameters		

- **Score card is based on product category**
- **Threshold values:** *if not reached the product fail*
- **Target values:** *used to define the score*
- **Obtained from a large Central Europe database constructed in the Ecopaperloop project**

Database on market products

Overview: Results of recyclability tests of packaging products **02.07.2014**

x-(y)-z means: Minimum value - (Mean value) - Maximum value

	Amount of tested products	Coarse Reject in %	Fibre yield** in %	Flake content in %	Sticky Area in mm²/kg	
					Total area	< 2.000 µm
Corrugated Boxes	13	0 - (2) - 23	72 - (80) - 85 [8]	1,1 - (7,2) - 21,6	762 - (6.526) - 11.878	762 - (2.716) - 5.434
FBB (frozen food)	1	1	91	15	573	573
FBB (others)	20	0 - (0,1) - 1,5	73 - (80) - 90 [8]	0 - (2,8) - 9,2	200 - (11.650) - 23.451	200 - (2.706) - 10.040
Bags (handles)	12	0 - (10) - 56	41 - (76) - 95 [0]	0,4 - (14,4) - 52,3	220 - (64.505) - 161.386	220 - (22.251) - 82.028
Sacks (paper)	7	1 - (10) - 51	48 - (85) - 97 [0]	4,9 - (18,7) - 30,3	8 - (14.141) - 91.146	8 - (3.088) - 13.779
Sacks (composite)	14	0 - (24) - 93	7 - (57) - 98	0,6 - (12,1) - 23,2	313 - (17.777) - 42.531	313 - (8.097) - 35.848
Liquid Packages	5	36 - (44) - 54	41 [4]	1,9 - (7,7) - 14,8	612 - (34.699) - 164.679	612 - (1.632) - 4.338
Molded Products	4	0 - (1) - 24	n.a. [4]	1,0 - (4,7) - 13,3	1663 - (1.940) - 2.208	855 - (1.458) - 2.208
Others	2	9 - (12) - 14	76 - (81) - 85	3,4 - (4,1) - 4,7	115 - (184.251) - 368.386	115 - (27.041) - 53.967
Total amount of test	78					
Target of tested pro	160 (120)					

Score card proposal

Packaging Recyclability Score	Evaluation of Recyclability
71 to 100 Points	Good
51 to 70 Points	Fair
0 to 50 Points	Tolerable
negative (failed to meet at least one threshold)	Not suitable for use in paper industry

Stakeholders consultation

✓ Public phone conference consultation next 10 September 2014 organised by CEPI

✓ Discussion at next ERPC meeting on 2 October 2014

Conclusions

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

Perspectives

- **The score card will allow to benchmark the recyclability of paper based packaging**
- **Sustainable packaging products must fulfil both functionality and recyclability standards**
- **In the Ecopaperloop project the recyclability parameters will also be connected to pilot LCA studies on recycling oriented eco-design of paper products**

Thank you for your attention!

Innovhub SSI, Paper Division (Ecopaperloop coordinator)

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ECOPAPERLOOP FINAL CONFERENCE

KRAKOW (PL), 2 December 2014

www.ecopaperloop.eu