

Trends in paper based food packaging and products with increased recyclability

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LUCENSE



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Horizon 2020
European Union Funding
for Research & Innovation



OUTLINE

1. Paper based packaging: context and outlook
2. Recyclability with paper: guidelines and standards
3. Case study: Ecofunco demonstrator of disposable product for food and beverage
4. Conclusions



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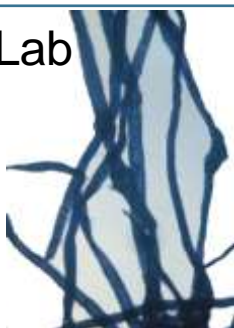
Technology transfer and **innovation consultancy**
to local SMEs and Industries

CENTRO QUALITA' CARTA Laboratory



Independent and accredited laboratory on cellulose based materials and products

Fiber Lab



Tissue Lab



Packaging Lab



Green Lab



Chemical and
MOCA Lab



www.cqc.it



CELLULOSE BASED PACKAGING



Predominantly cellulosic materials:

sheets of paper or cardboard intended for paper converting, paper reels that need to be transformed, etc. (made up of at least 50% paper)

Cellulosic products:

finished products such as packaging, wrapping, bags, boxes, books, handkerchiefs, etc. (made up of at least 50% paper)

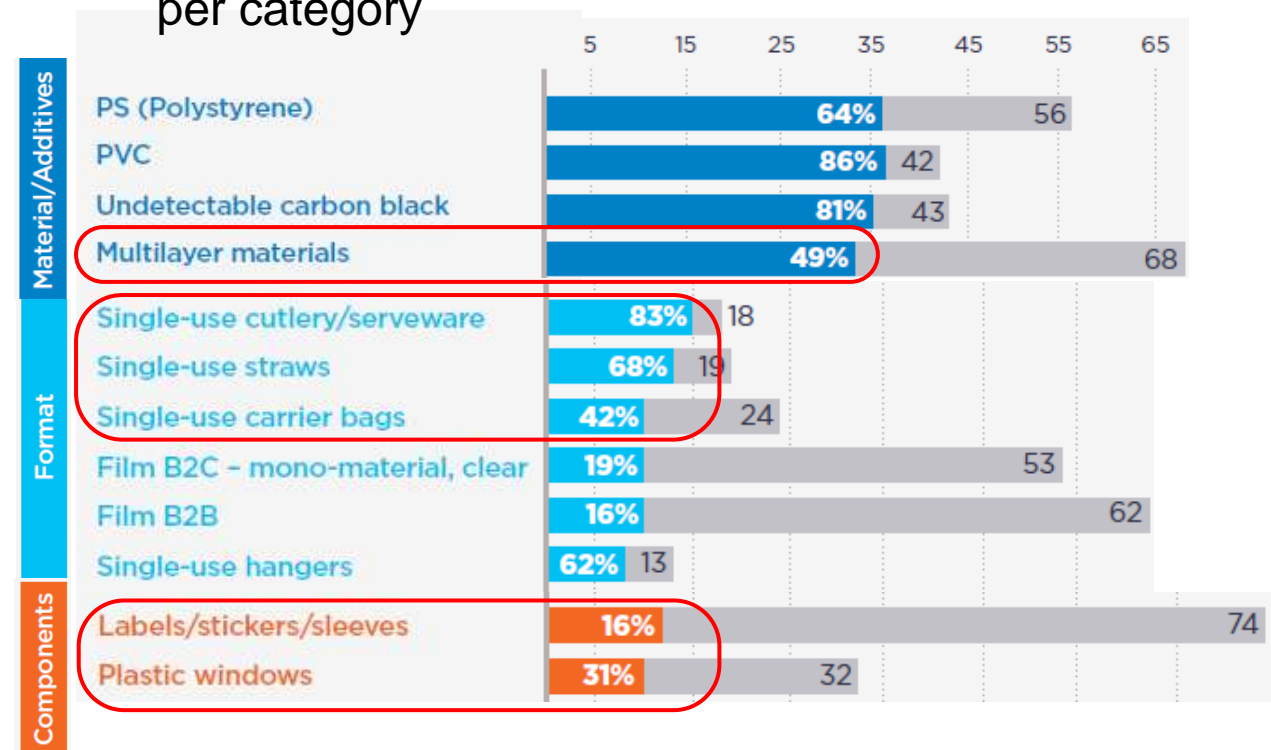
COMMITMENT TO PLASTIC REDUCTION IN PACKAGING

Main strengths of paper

- **highly sustainable** and circular product
- it comes from **renewable** biobased resources
- excellent **recyclability** rate: 73.9% in EU (82.3% for paper packaging alone)¹
- increasing utilisation of **paper for recycling** in the Cefi area: 50.5 Mt in 2021 (out of a total production of 90.2 Mt)²
- highly **appreciated by consumers**³:
 - 63% of consumers choose it for being better for the environment

1, 2 CEPI 2022 Environmental Footprint Report
3 Survey commissioned by Twosides

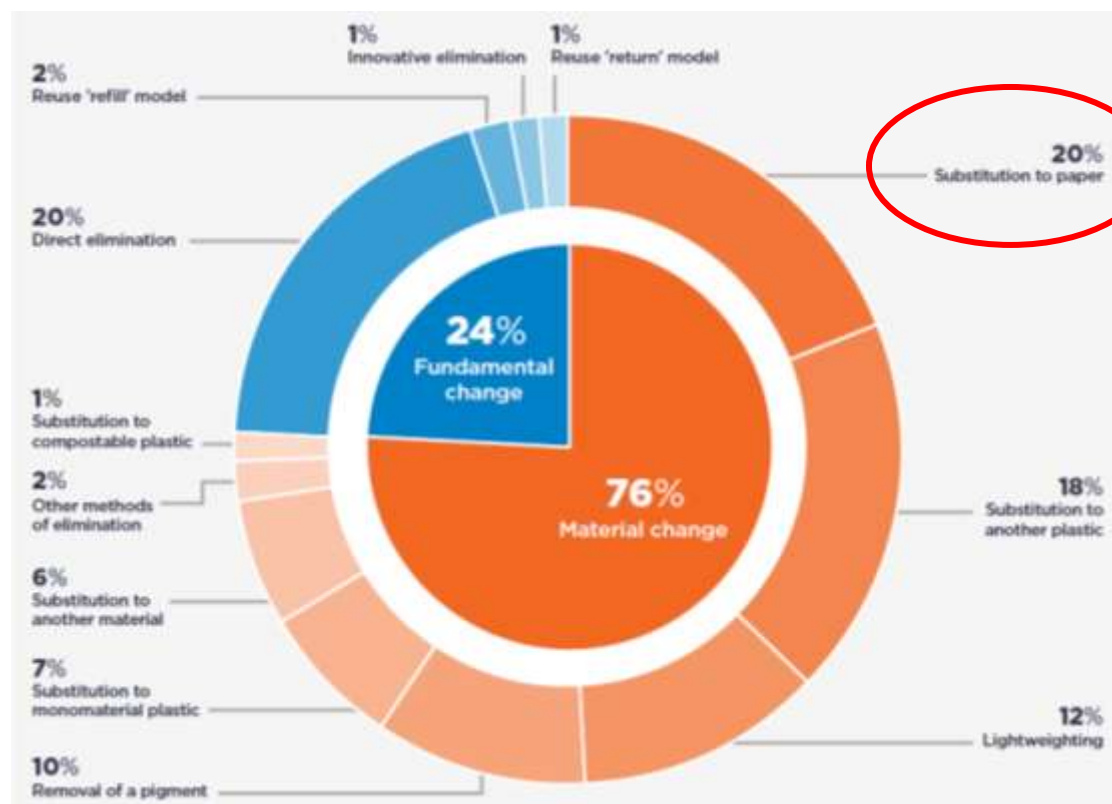
Number of packaging producers, brand and retail signatories eliminating/reducing plastic per category



The global commitment progress report 2021 – Ellen McArthur Foundation

PAPER BASED PACKAGING MARKET OUTLOOKS

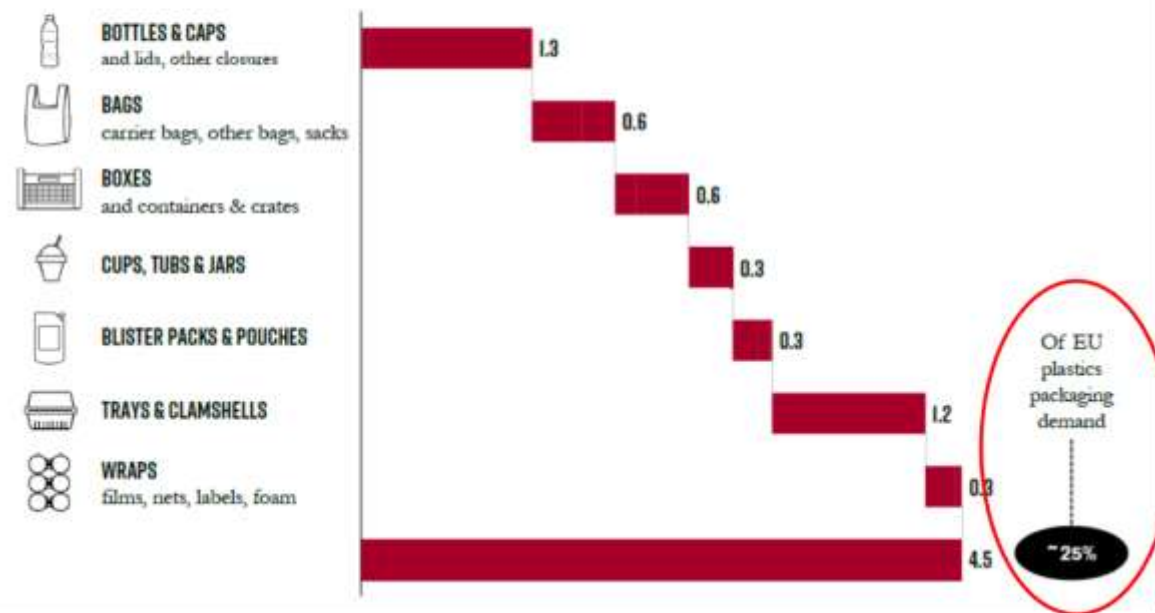
Plastic elimination method used by brand, retail and packaging producers signatories



The global commitment progress report 2021 – Ellen McArthur Foundation

EXHIBIT 2: SUBSTITUTING PLASTIC PACKAGING WITH FIBRE-BASED ALTERNATIVES

EU PLASTIC PACKAGING SUBSTITUTION POTENTIAL Mt PLASTICS PACKAGING, NET POTENTIAL



Report Material economics: a net-zero transition for EU industry (pulp and paper) 2020

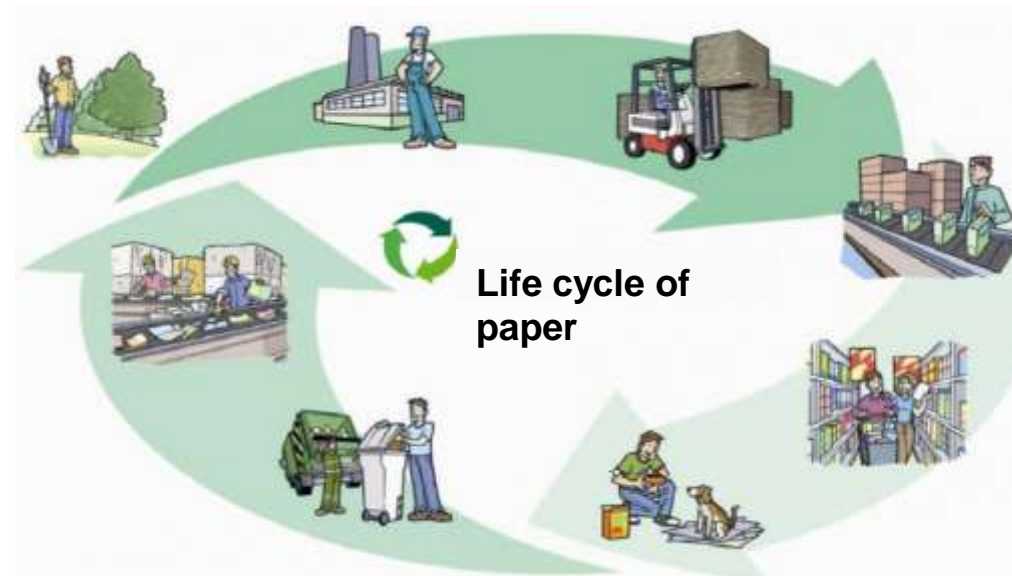


CHALLENGES FOR CELLULOSE-BASED PACKAGING

- Barrier properties: water, oxygen, water vapour, grease...
- Combination with other materials, in the form of coatings or films, to create multilayer structures.



PAPER LIFE CYCLE



Recycling

Process through which we aim at the recovery of materials, reinserting the recovered materials in the production cycles.

Paper recyclability

Process through which the aim is to recover the fibers contained in the mainly cellulosic materials or products, which can be reused for the production of new paper.



TOOLS TO HELP INCREASING RECYCLABILITY



1. Design guidelines
2. Methods for verifying the results achieved
3. Voluntary evaluation and branding
4. Indications to the consumer

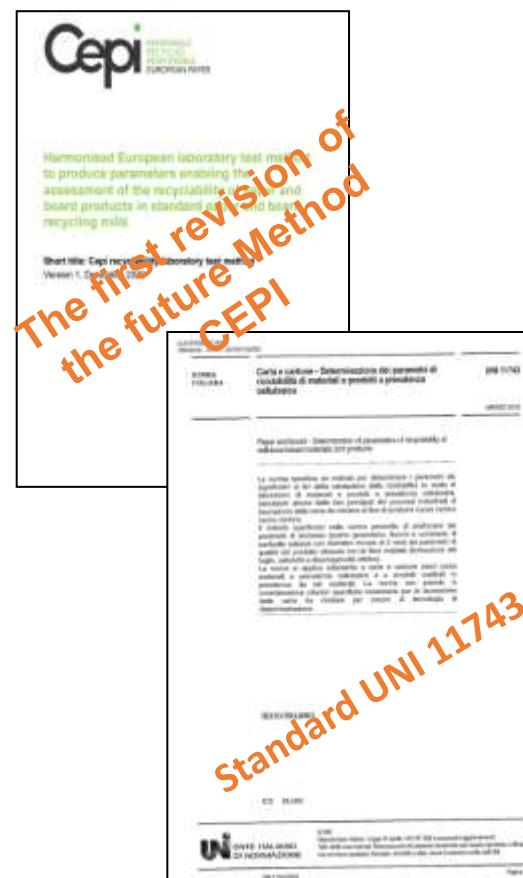


TOOLS TO HELP INCREASING RECYCLABILITY

1) Guidelines



2) Standards, Tests

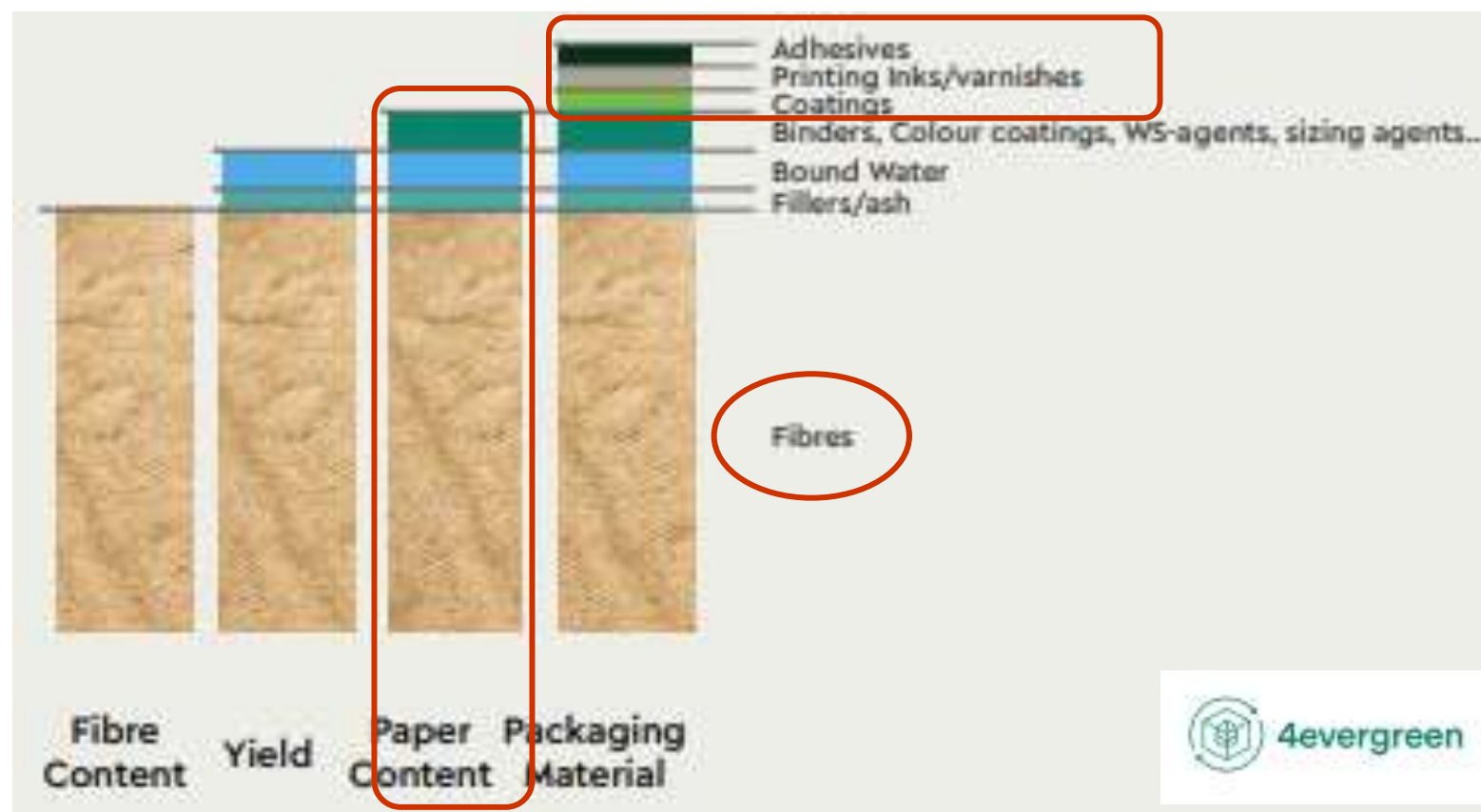


3) Evaluation protocols



SCOPE OF APPLICATION

They apply
to:
‘Paper content’ > 50%



RECYCLABILITY GUIDELINES

The current guidelines, according to the constituent materials, indicate the possibility of recycling by dividing them into 4 different categories. The design must aim at achieving compatibility with standard recyclability processes (first column).

Fully compatible with standard recycling process	Conditionally compatible with standard recycling process	Not compatible with standard recycling process	Compatibility with recycling process unknown
<ul style="list-style-type: none"> > compatible with sorting according to standard paper grades > no disturbing parts within the recycling process > expected positive output quality after recycling for target product > existing test results show good compatibility with standard recycling process 	<ul style="list-style-type: none"> > sorting not guaranteed in all cases > the efficiency of the recycling process is affected > compromised output quality after recycling with standard recycling process 	<ul style="list-style-type: none"> > major issues during sorting and/or recycling > non-feasible output quality for further treatment after recycling > existing test results show low compatibility with standard recycling process 	<ul style="list-style-type: none"> > based on current knowledge no clear guidance is possible > testing is required to examine the recyclability of the packaging with standard recycling process

FOCUS ON PAPER PRODUCTION PROCESS

The analytical steps of the methods examine the production steps in a standard paper mill

	Parameters	UNI-11743	CEPI ver.1
1	Pulpability	X	X
2	Coarse waste	X	X
3	Fibre flakes	X	X
4	Adhesiveness	X	X
5	Sheet formation	X	X
6	Macrostickies	X	X
7	Soluble substances	--	X

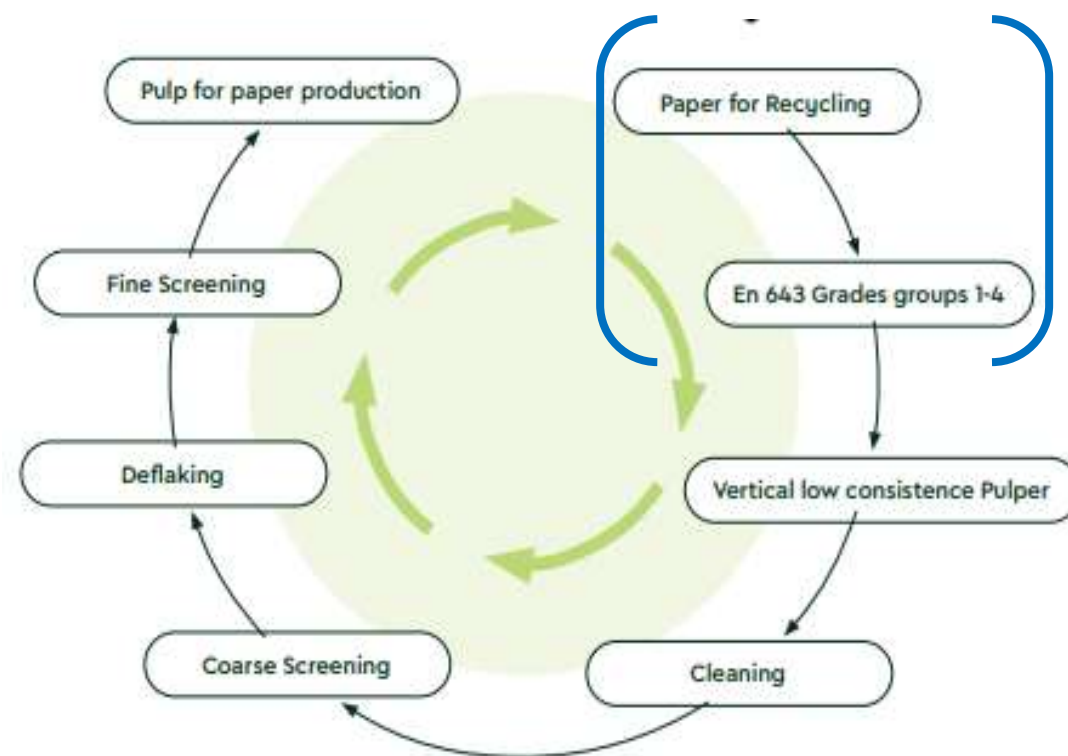


Figure 1. Recycling in standard paper mills

RECYCLABILITY OF THE FINISHED PRODUCT

For the evaluation of the results **Aticelca** published the «**Sistema di Valutazione 501:2019**»

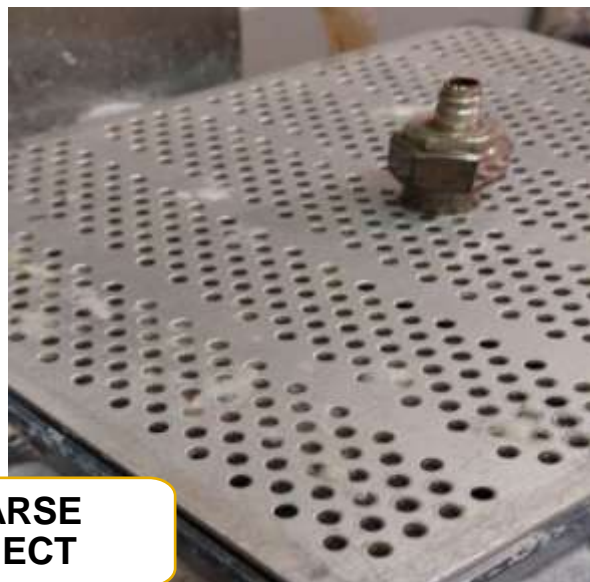
it is valid **only in Italy** and classifies the product in 4 different classes.



Evaluation Criteria	Recyclable with paper				Non Recyclable with paper
	Level A+	Level A	Level B	Level C	
Coarse reject (%)*	< 1.5	1.5 - 10	10.1 - 20	20.1 - 40	> 40
Macrostickies Area $\Phi < 2000\mu\text{m}^{**}$ (mm ² /kg)	< 2.500	2.500 - 10.000	10.001 - 20.000	20.001 - 50.000	> 50.000
Fibre flakes (%)***	< 5.0	5.0 - 15.0	15.1 - 40.0	> 40.0	
Adhesiveness	absent	absent	absent	absent	presence
Optical Inhomogeneities	level 1	level 2	level 3	level 3	



5 MEASURED PARAMETERS



**COARSE
REJECT**



**OPTICAL
INHOMOGENEITY**



**FIBRE
FLAKES**



MACROSTICKIES

ECOFUNCO CASE STUDY

Disposable products for food and beverage

- Paperboard 230 g/m², clay coated on one side
- Cutin coating for water barrier properties
- Film press application with semiautomatic coating unit



Cutin **25%** in EtOH
without glue



Cutin **50%** in EtOH
without glue

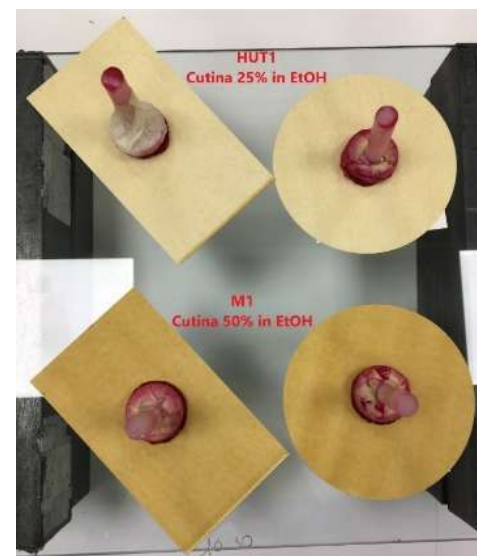


Cutin **25%** in EtOH
with glue

ECOFUNCO CASE STUDY

EXCELLENT WATER BARRIER and GREASE BARRIER

COBB 60sec (g/m ²)	COBB 30min (g/m ²)
< 4	< 10



Reference



Cutin 50% in EtOH



Centro Qualità Carta – GREEN LAB

The laboratory-scale paper mill



RECYCLABILITY EVALUATION

Evaluation parameter (according to ATICELCA – UNI 11743)	Cutin 25% in EtOH without glue	Cutin 50% in EtOH without glue	Cutin 25% in EtOH with glue
Coarse waste	0,0%	0,0%	15%
Fiber Flakes	5,9%	8,4%	7,2%
Adhesiveness	Absent	Absent*	Absent
Optical inhomogeneity	Level 2	Level 3	Level 2
Macrostickies (mm²/kg) Total Area	2.373	472.970	63.270
Area < 2000 um	2.373	452.706	30.775
Recyclability assessment	Level A	N.R.	Level C



Cutin **25%** in EtOH
with glue

Coarse reject
15%

Cutin **25%** in EtOH
without glue

Flakes
5,9%



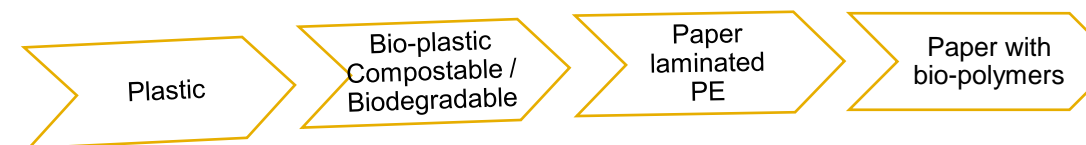
Cutin **50%** in EtOH
without glue

Macrostickies
452.706 mm²/kg

RECYCLABILITY EVALUATION

Comparison with reference (conventional) products

Evaluation parameter (according to ATICELCA – UNI 11743)	Cups and Trays PE laminated	Cutin 25% in EtOH without glue
Coarse waste	8-12-14 %	0,0%
Fiber Flakes	6-10-17 %	5,9%
Adhesiveness	Absent	Absent
Macrostickies (mm ² /kg) Area < 2000 um	1.000-40.000	2.373
Recyclability assessment	typically Level B	Level A



CONCLUSIONS

- Paper has potential to strongly increase its market share in food packaging sector
- Paper needs to be combined in multimaterial packaging for barrier properties, creating challenges for its recyclability with paper
- Standard methods are now available for recyclability assessment
- Promising results were achieved in ECOFUNCO project with cutin coating on paper for food and beverage disposable products
- Biobased materials are excellent candidates for sustainable and recyclable functional packaging in combination with paper



ECOFUNCO PARTNERS

ARCHA



Huhtamaki



LUCENSE



THANKS FOR YOUR ATTENTION

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