Trends in paper based food packaging and products with increased recyclability

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LUCENSE

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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
Technology transfer and innovation consultancy to local SMEs and Industries
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 Cepi 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
  - 57% because it is easier to recycle

\(^1\) CEPI – Confederation of European Paper Industry
\(^2\) Survey commissioned by Twosides
\(^3\) 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

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.

* EU Waste framework directive
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).
FOCUS ON PAPER PRODUCTION PROCESS

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

<table>
<thead>
<tr>
<th>Parameters</th>
<th>UNI-11743</th>
<th>CEPI ver.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pulpability</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2 Coarse waste</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3 Fibre flakes</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4 Adhesiveness</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5 Sheet formation</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6 Macrostickies</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7 Soluble substances</td>
<td>--</td>
<td>X</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Recyclable with paper</th>
<th>Non Recyclable with paper</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level A+</td>
<td>Level A</td>
</tr>
<tr>
<td>Coarse reject (%)*</td>
<td>&lt; 1.5</td>
<td>1.5 - 10</td>
</tr>
<tr>
<td>Macrostickies Area Φ &lt;2000μm.**</td>
<td>&lt; 2.500</td>
<td>2.500 - 10.000</td>
</tr>
<tr>
<td>(mm²/kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fibre flakes (%)***</td>
<td>&lt; 5.0</td>
<td>5.0 – 15.0</td>
</tr>
<tr>
<td>Adhesiveness</td>
<td>absent</td>
<td>absent</td>
</tr>
<tr>
<td>Optical Inhomogeneities</td>
<td>level 1</td>
<td>level 2</td>
</tr>
</tbody>
</table>
5 MEASURED PARAMETERS

- Coarse Reject
- Adhesiveness
- 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
ECOFUNCO CASE STUDY

EXCELLENT WATER BARRIER and GREASE BARRIER

<table>
<thead>
<tr>
<th>COBB 60sec (g/m²)</th>
<th>COBB 30min (g/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4</td>
<td>&lt; 10</td>
</tr>
</tbody>
</table>

Reference

Cutin 50% in EtOH
Centro Qualità Carta – GREEN LAB

The laboratory-scale paper mill
### RECYCLABILITY EVALUATION

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

- **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

<table>
<thead>
<tr>
<th>Evaluation parameter (according to ATICELCA – UNI 11743)</th>
<th>Cups and Trays PE laminated</th>
<th>Cutin 25% in EtOH without glue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse waste</td>
<td>8-12-14 %</td>
<td>0,0%</td>
</tr>
<tr>
<td>Fiber Flakes</td>
<td>6-10-17 %</td>
<td>5,9%</td>
</tr>
<tr>
<td>Adhesiveness</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Macrostickies (mm²/kg)</td>
<td>1.000-40.000</td>
<td>2.373</td>
</tr>
<tr>
<td>Area &lt; 2000 um</td>
<td>typically Level B</td>
<td>Level A</td>
</tr>
</tbody>
</table>

Recyclability assessment typically Level B

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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
THANKS FOR YOUR ATTENTION

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