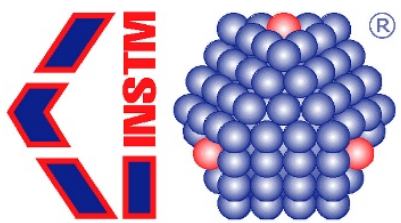
POLY-PAPER

AN INNOVATIVE COMPOSITE MATERIAL FOR PACKAGING, RECYCLABLE WITH PAPER AND CARDBOARD



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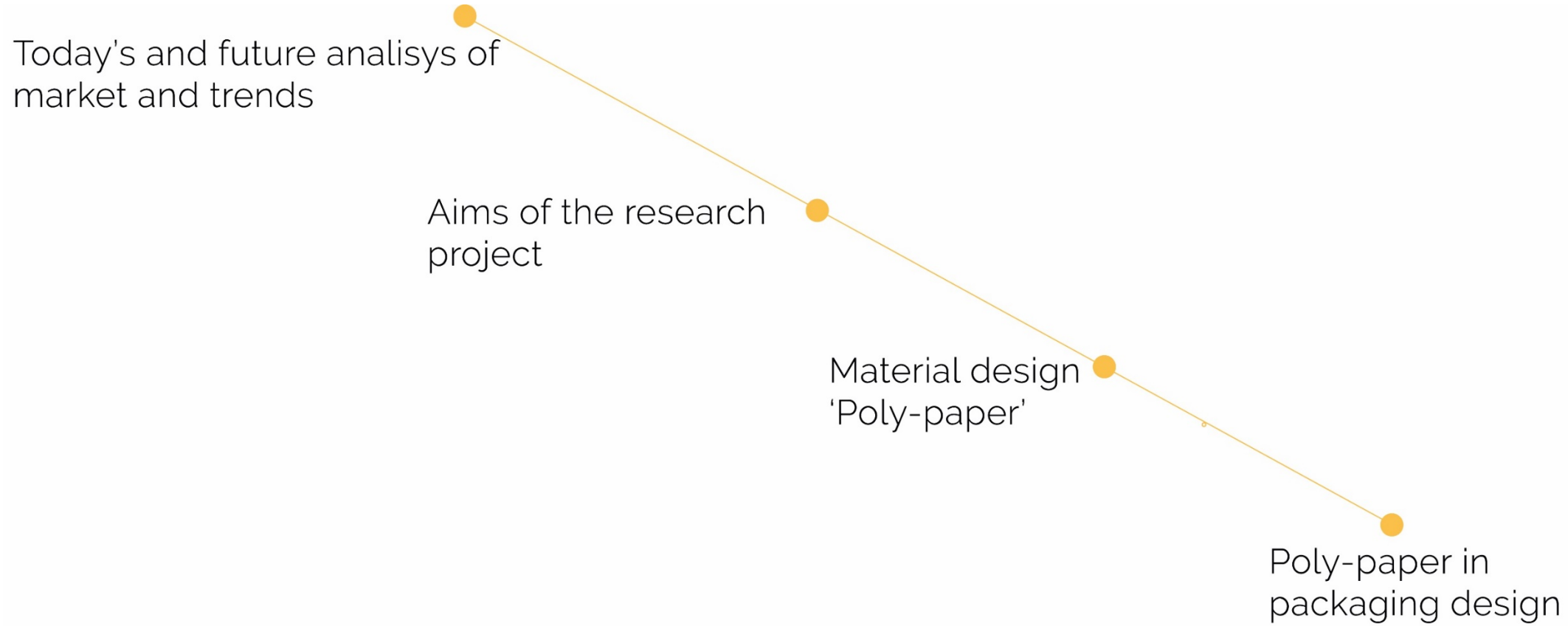
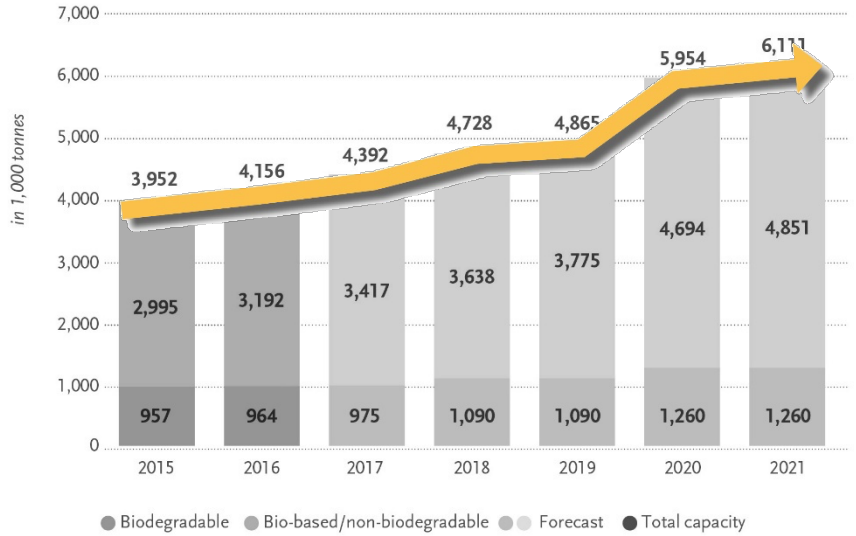
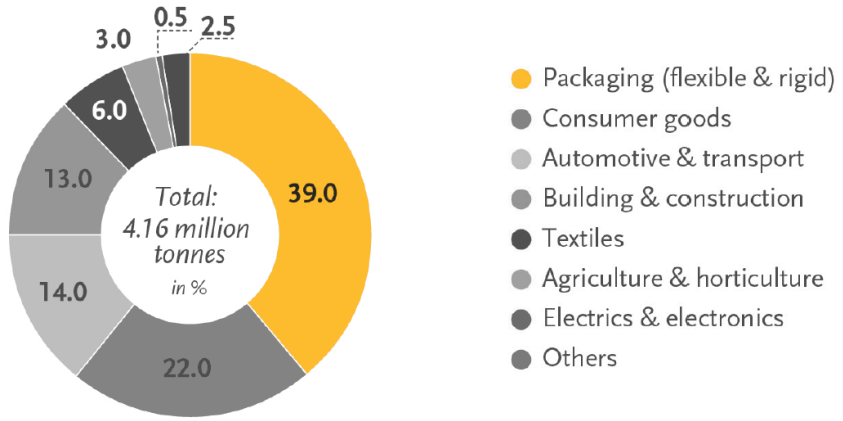


Circular plastics trend

- Technical feasability
- Waste-related issues
- Favored or mandatory use
- Significant increase in the prices of petroleum products
- Eco-sustainability of raw materials and/or of their recovery at the end of life
- Biodegradability / composting



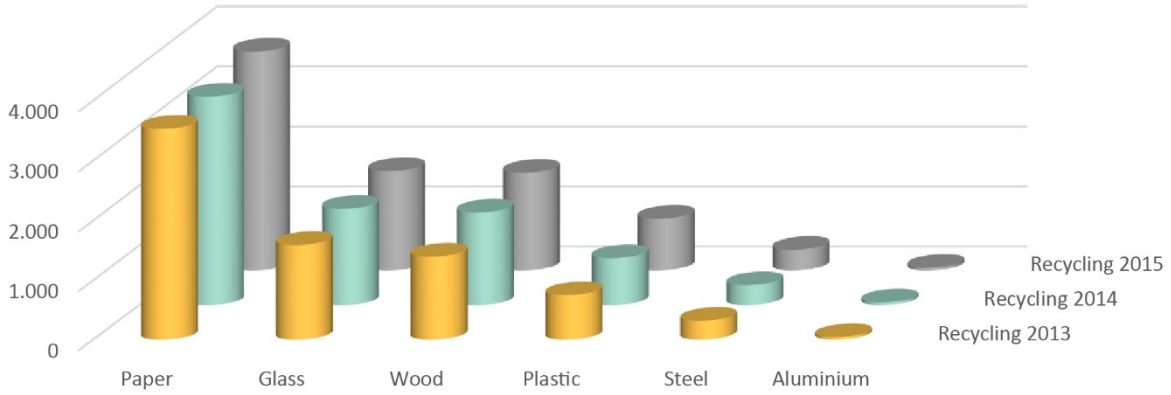


Source: European Bioplastics, nova-Institute (2016)

Paper and Cardboard Advantages for Recyclability

- Cellulosic recycling channel is the most working and constantly growing
- 80% recycling rate
- Perfect example of circular economy

Quantity of recycled packaging waste from public and private areas (1,000 * tons), 2013-2015



Source: ISPRA, Rapporto rifiuti urbani (2016)

Plastic
Technical feasibility

Paper Recyclability

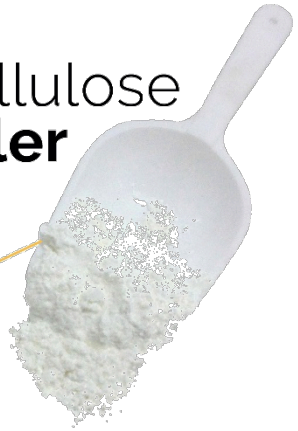
new material
for

mono material, recycled,
recyclable **packaging**


Polymer
Matrix
Cellulose
Filler
Poly-paper

Polymer
Matrix

Cellulose
Filler



Poly-paper

Poly(vinyl alcohol) (PVA)

Water solubility
biocompatibility
biodegradable
low tm (180°C)

Processable through:

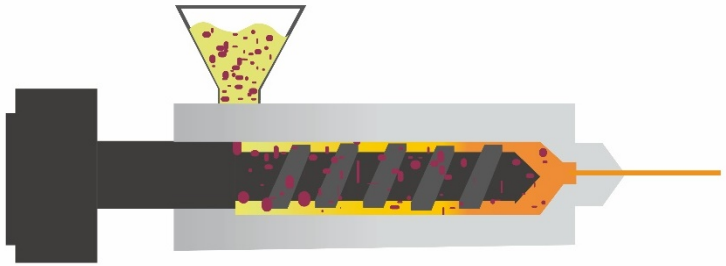
- Injection Moulding
- Extrusion
- Fiber spinning
- Thermoforming

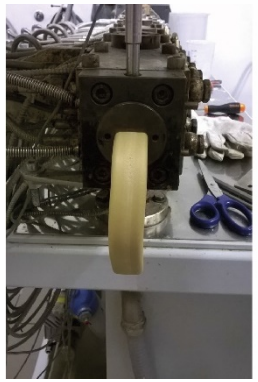
Cellulose fibers

Renewable
Biodegradable
Insoluble
Strenght
Structural organization
Lightness
Sensitive to moisture

Process temperatures:
160 ° C for a few days
180 ° C for one day
200 ° C exposure limit

Extrusion



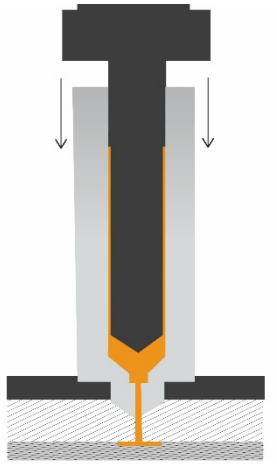


Dry blend

Extrusion
≈ 180°C

Compression moulding

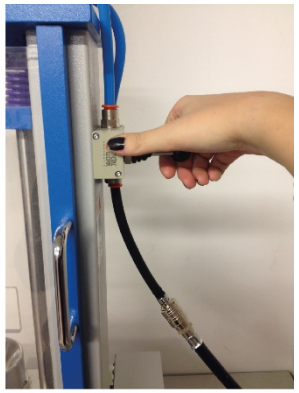
Pellets

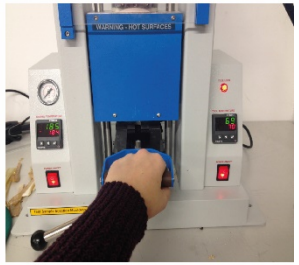


barrel
≈ 180°C
mould
≈ 70°C

PVA matrix/

- 0% cellulose fibres
- 10% cellulose fibres
- 20% cellulose fibres
- 30% cellulose fibres

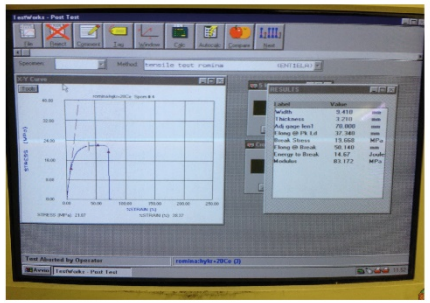




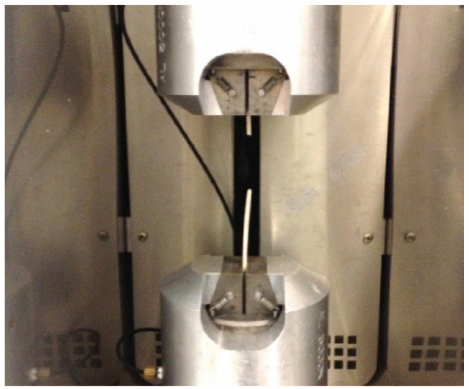
compression moulding of test samples

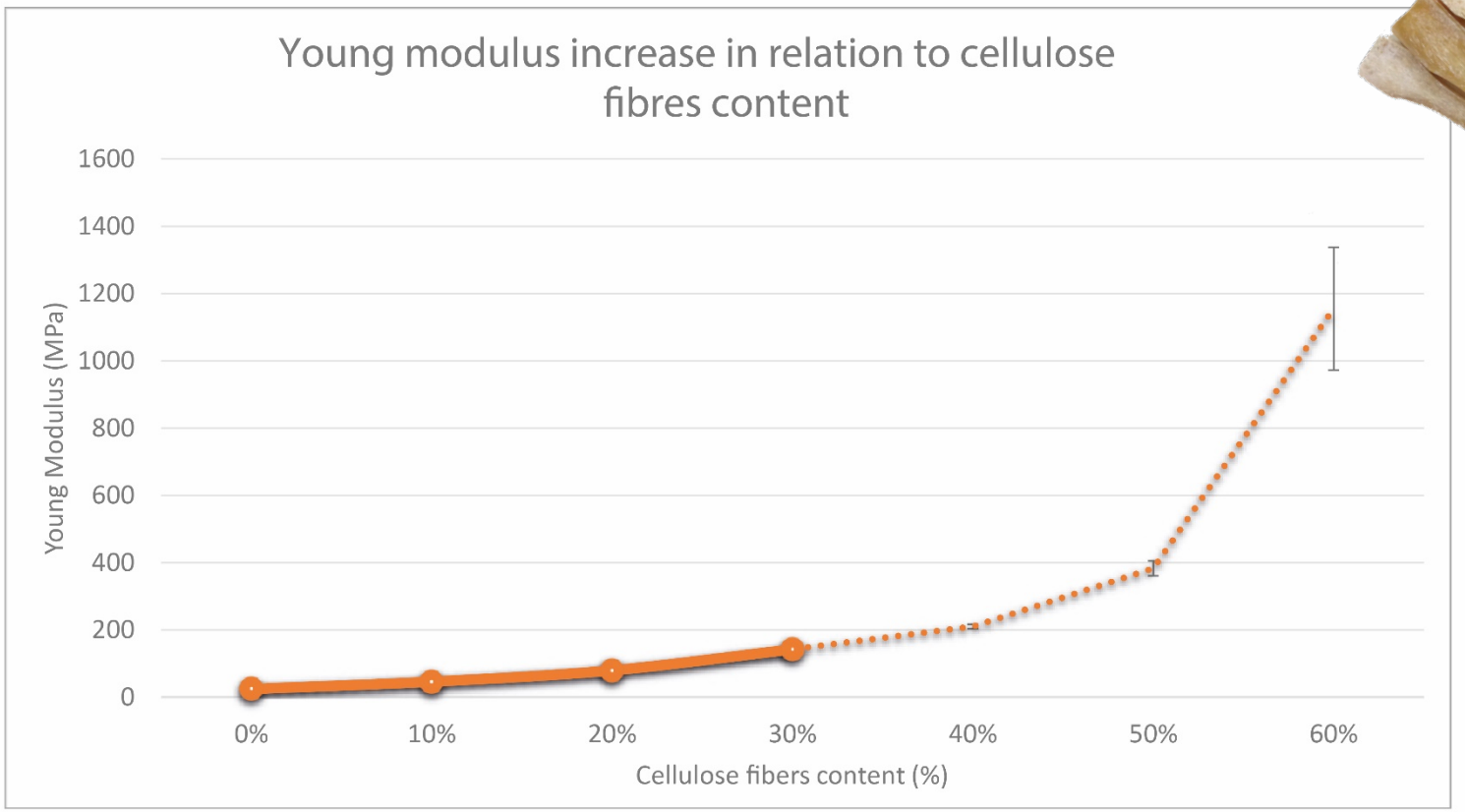
↓

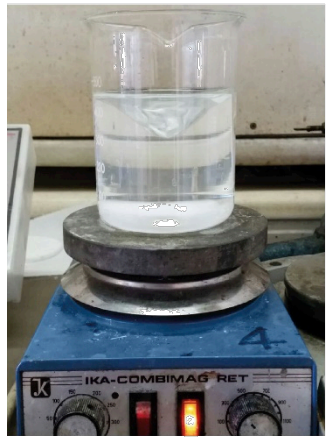
tensile tests

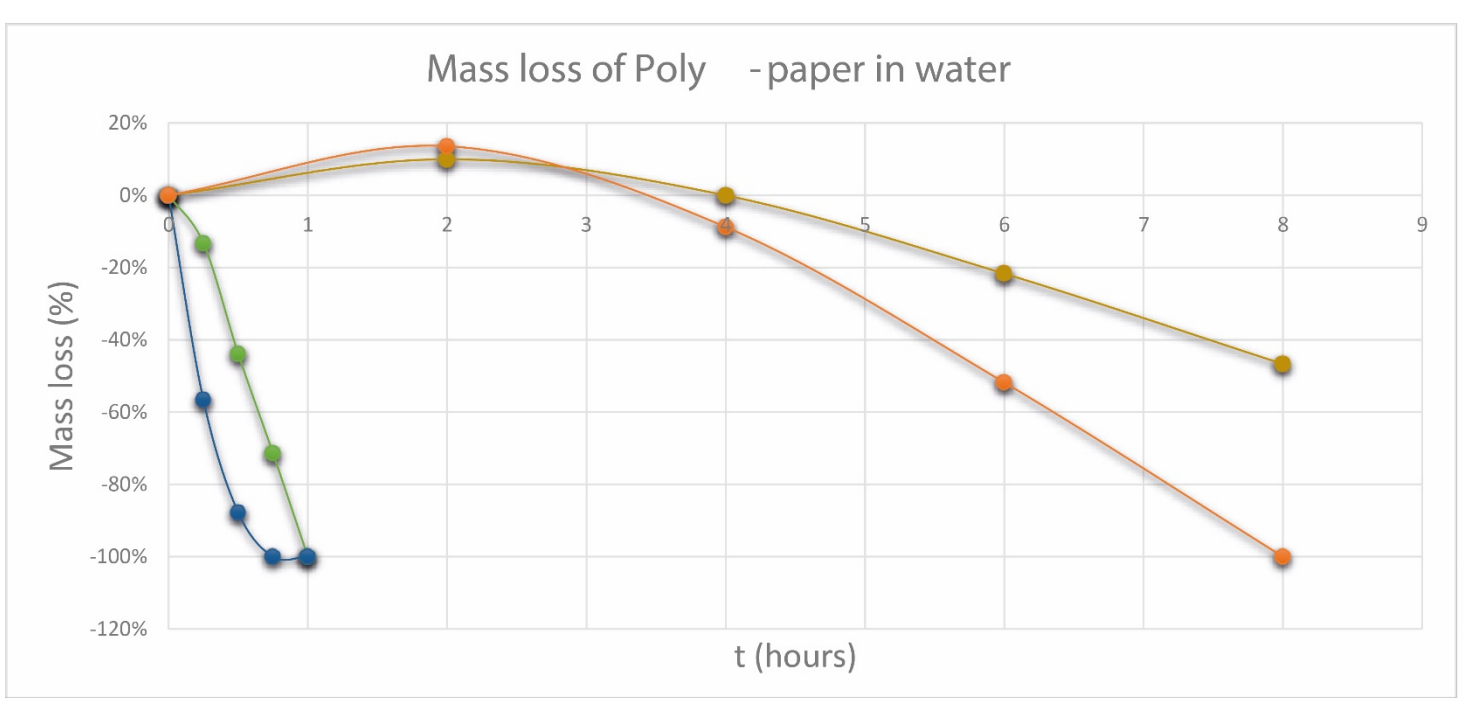


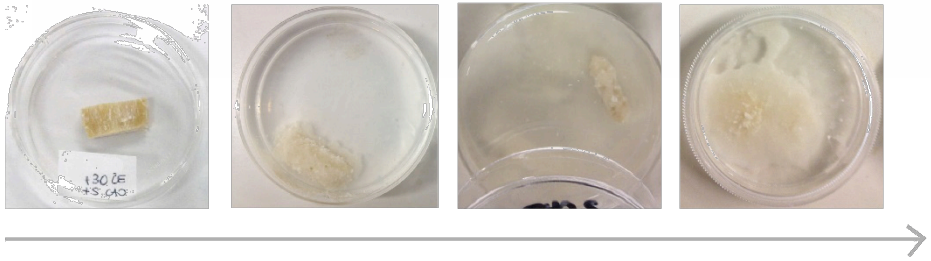
10 / Results and discussion











water		
	21˚C	40˚ C
static water	− −	−
water in turbulence	+	++

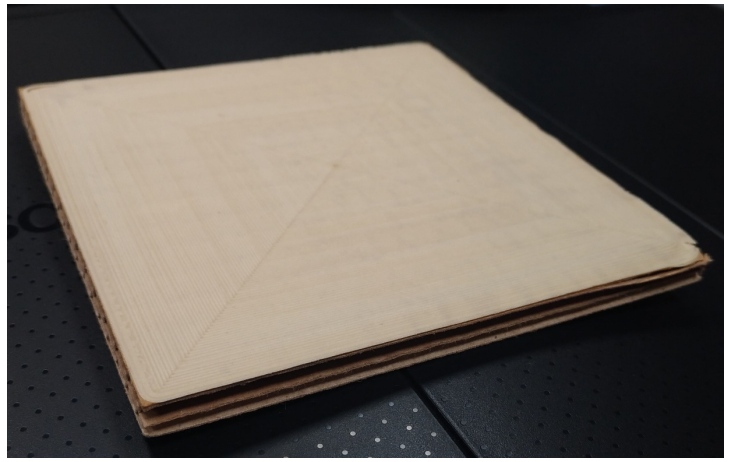
Italian patent No. 102015000028276 “Materiale composito ad alta sostenibilità ambientale” - 30/11/201
World PCT IB2016/053777 - 24/06/2016

Recyclability in paper industry

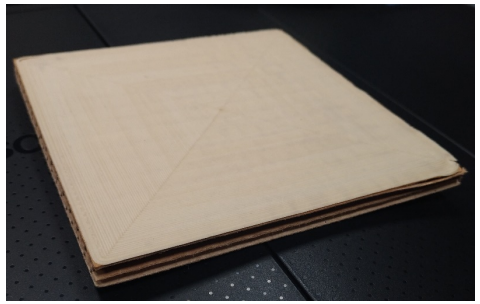
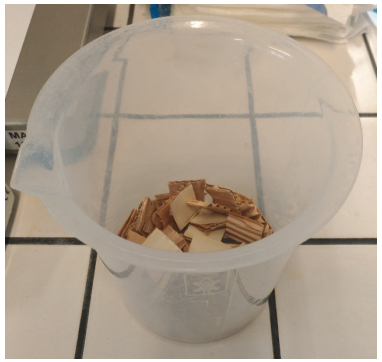
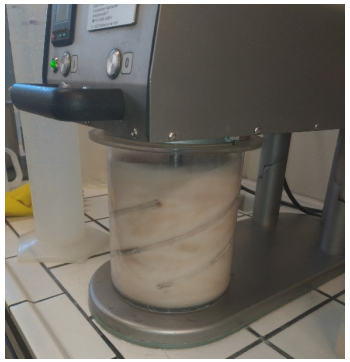
- Test method **Aticelca MC 501:2017**
- European Standard EN 13430:2004

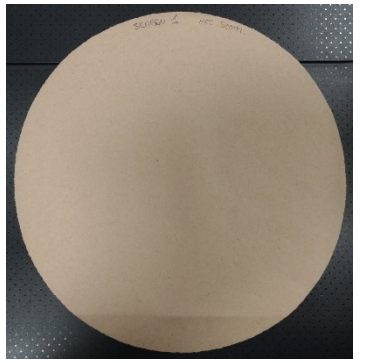
Criteria:

- Almost 50% of cellulose content
- Recyclable products are those who concur through their recycling to obtain a new paper product
- Cellulosic material plus 50% of external materials maximum



Cardboard with a layer of Polypaper
In 25% by weight

Starting specimen

Output sheet

Evaluation criteria

	Recyclable with paper				Not recyclable with paper
	Level A+	Level A	Level B	Level C	Not recyclable with paper
Coarse scrap (%)	< 1.5	1.5 - 10.0	10.1 - 20.0	20.1 - 40.0	> 40.0
Area of adhesive particles Ø < 2000 µm (mm^2/Kg)	< 2.500	2.500 - 10000	10.001 - 20.000	20.001 - 50.000	> 50.000
fiber flakes (%)	< 5.0	5.0 - 15.0	15.1 - 40.0	> 40.0	-
tackiness	none	none	none	none	present
Optical heterogeneity	Level 1	Level 2	Level 3	Level 3	-

Material	Composition	Functions	Processes	Dismission
 **ecovio®** the bio-based paper coating BASF	ecoflex® and polylactic acid (PLA)	• Barriers against fat and grease • Barriers against aroma • Barriers against mineral oil	Extrusion coating technology for flexible or rigid packaging	Compostable Complete biodegradation into: • Water • CO2 • Biomass
 **LNP™ THERMOCOMP™ MX07442** سابك sabic	polypropylene (PP) reinforced with 30 percent wood flour	• Replacing wood • Resistant to fungi better • Dimensional stability	Extrusion and injection molding	Renewable, biodegradable
 **MATER-BI** NOVAMONT	Blend of modified corn-starch (polysaccharide), synthetic biodegradable polyester, plasticizer	Properties and characteristics of use very similar to those of traditional plastics	Blowing, casting, extrusion/ thermoforming and injection moulding	Biodegradable and compostable

Poly-paper

Material	Composition	Functions	Processes	Dismission
Poly-Paper Politecnico di Milano	PVA (modified polyvinyl alcohol), Cellulose fibers	Replacing plastics Contribute to the circularity of packaging Similar appearance to paper Water weldability Shape memory forming	Extrusion, injection molding, 3D printing, traditional thermoplastic processes at lower temperatures.	Renwable with paper industry

Making today's packaging allocable to a single recycling chain: structures, closures, adhesive

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