

Current projects, success stories, and possible future research activities in recycling/deinking at CTP

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CTP, a Unique Centre for Cellulose based Applied Research and Technology Transfer

- Promote the **development**, boost competitiveness...
Of pulp, paper and board, printing & converting industry
- Advance **scientific and technological knowledge** by
 - innovating and transferring know-how to industry
 - meeting the markets' needs and expectations

HOW?

- Cutting-edge research
 - ✓ Integrating innovative technologies,
 - ✓ Developing new products
 - ✓ In line with legislation monitoring, standardisation
- Technological transfer of research results, through
 - ✓ Consultancy & expertise, training and publications
- Individual services
 - ✓ Analysis, testing, confidential studies, product certification



Grenoble & Douai



Grenoble & Douai

Grenoble: 8 R&D teams

- InTechFibres. Plant Chemistry
- Recycling – Deinking
- Water. Energy. Environment
- Materials structuring
- Functional products & surfaces
- Hygiene, Food contact
- Materials performances
- Electronics, Instrumentation

Douai: 1 R&D team

- Interactive Graphic Printing team
- ImprimLab'



Team **R**ecycling-**D**einking
Who are we?

Context



Circular Economy: «we close the loop»

- **Paper for Recycling (PfR) is the major fibrous source for the production of paper and board:**
 - 240 Mt collected in the world (2015)
 - In Europe (2015): 56 Mt collected (~48 Mt used, the rest exported)
 - Trend in an increasing volume (306 Mt) and share of PfR (60%) for 2025
- **Recycling rate increases (72.5% in 2016 in Europe) leading to more and more increase in unwanted material**
- **Demand for better quality for lower cost production and lower waste generation**

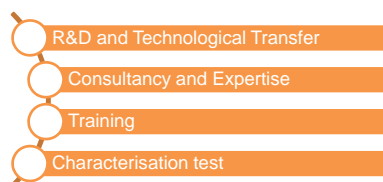


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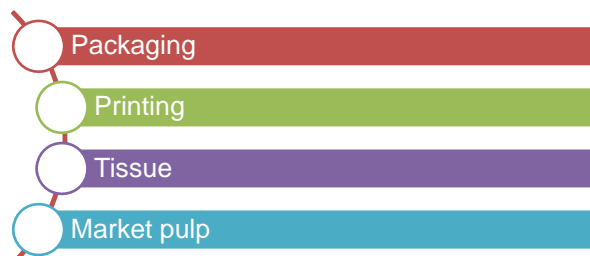
Markets addressed



Main CTP activities



Specific markets or applications



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Our objectives... for you !



- **To maintain and improve the use of recycled fibres**
 - Decrease in production **costs** (paper for recycling, chemical and energy savings, reduction of waste/sludge amount)
 - Quality **improvement**
 - Create new **technologies** and new **concepts**
 - To help and support you...

Team Recycling-Deinking



Benjamin FABRY
Team Manager

Staff

4 Project leaders
7 Expert technicians in
collaboration with other teams

Fields of expertise

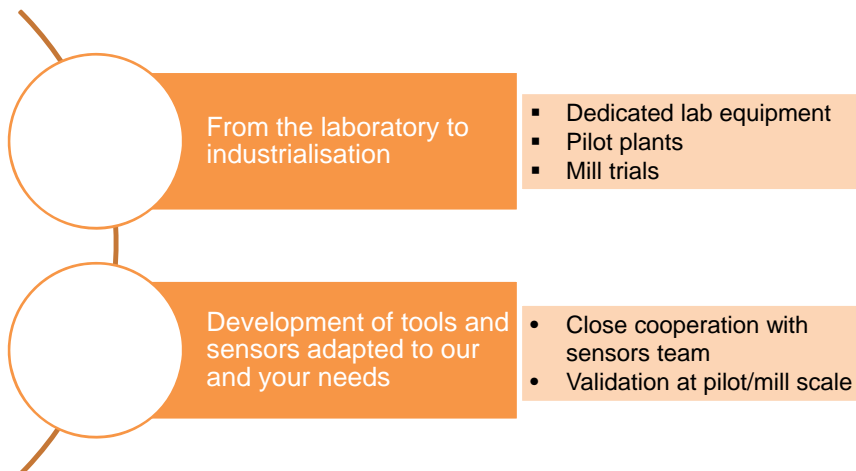
- **Process**
 - Production of recycled pulp for packaging
 - Production of deinked pulp for printing/writing
 - Production of deinked pulp for tissue
- **Characterization**
 - Stickies: Sources of deposits
 - Mass balances (particles, ink, stickies, ash...)
- **Before and after the production**
 - Test of recyclability/deinkability of products put on the market (eco-conception)
 - Sorting and control of paper for recycling

Means to Answer to our
Objectives

Testing Laboratories / Pilots



Key technologies



Recycling and Deinking Pilot



All type of recycling/deinking lines in a safe environment

- Beginning in 1978 and constantly upgraded
- Low production (20-50 kg/h)
- Unique and flexible tool
- Possibility to close the water loop
- All equipment available to simulate recycling and deinking



Fractionation and cleaning Pilot Plant



From investigation and feasibility to industrial applications

- 3 pressure screens equipped with
 - Different rotors (4)
 - More than 20 baskets (holes from 0.25 to 1.8mm and slots from 0.08 to 0.35mm) with different profiles
- More than 15 hydrocyclones for cleaning or fractionation
- And all the equipment for characterization



Characterization of PfR

- **Objectives: conformity to EN643, humidity, composition, optimisation of sorting centre**
- **Tools:**
 - Automatic sampling
 - Monitor@ sensor
 - Sorting table



Lab equipment

- **All the sample preparation chain to measure**
 - Optical properties on pads and handsheets
 - Mechanical properties
 - Stickies
 - Water characteristics



Lab Equipment



Among all the equipment...



Helico Pulper



Flotation cell



Continuous Flotation cell



Washer



Somerville and PulMac



Handsheets former

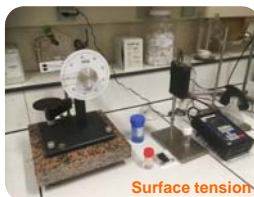
Measurements Tools



Among classical to more original measurement tools...



ColourTouch



Surface tension



FPIA



3DStick



FoamShear



NanoSizer

Success Stories: Examples Innovations



Fractionation



From PhD Thesis to Industrial Trials...

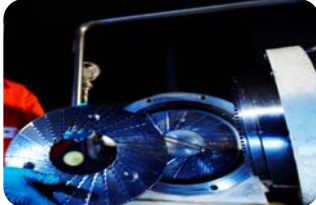


- **Best 3 of the EFPRO-CEPI early stage researchers – 2012**
- **Best poster IMPC – 2014** (*Carré et al.*)
- **Several research applications**
 - LWC and SC stratified paper (BoostEff)
 - Tissue (BoosTissue)
 - Packaging material (LightBrown, Fluco)
- **Mill trials (2016–2017)**
- **Open various possibilities for rethinking the process and pulp quality**

LightBrown



How to obtain the best from fine elements to face to decreasing mechanical properties?



- **By combination of fractionation/thickening and mechanical treatment:**
 - Mechanical property improvement from 10 to 40% at the same basis weight
- **Selling price of OCC**
 - October 2016: Test liner 3: 480 €/t
 - Added value: +20% strength gain (access to reinforced grade) → 5–10% selling price
 - Opportunity to sell at 500–530 €/t
 - Net increase of 20–50 €/t to be compared to max additional cost of 6 €/t (1000 t/d)

Process water flotation



Improve deinking process efficiency, PM runnability, and paper quality



- **Removal of surfactant/hydrophobic/VFA substances**
- **CTP solution: add air to solve your problem!**
- **Demonstrated**
 - 1st results at lab and pilot scale
 - 1st feasibility mill trials:
 - ✓ 1–2 pts yield gain for the same brightness
 - ✓ Chemical saving
 - Operating in mill since several years

3D Stick



On-line measurement of stickies in collaboration with Techpap



- **Palme d'or de l'innovation ATIP – 2014**
- **TAPPI Wayne Carr Award – 2016**
- **Laser triangulation associated with NIR: both qualitative and quantitative macrosticky contamination**
 - 3D dimension
 - Chemical nature
- **On-line measurement**
- **Prototype already tested in 3 mills**
- **Commercialisation by Techpap**

Monitor

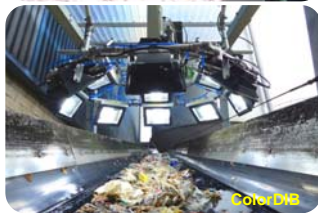


From lab to commercialisation for Paper for Recycling bale control



- **Information on moisture, plastic, ash, and lignin content**
- **2 versions**
 - Portable version with introduction of measurement probe (1m length) after drilling of the bale
 - Installed version: Monitor® on automatic core-drilling system
- **Total Monitor® installed: >20**

Other sensors



- **SIMPATIC (on-line) and SIMPALAB (lab) for dirt speck analysis**
- **MorFi (lab and on-line version) for fibre characteristics**
- **NewsMag to control ONP/OMG ratio in conveyor**
- **ColorDIB to measure on-line fibre rejects**

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Eco-conception Example of release paper



- **Development within Functional Products & Surface Team**
- **Hydrophobisation of paper and board through a new technology: chromatogeny**
 - Grafting green chemistry without solvent
 - To increase hydrophobicity of uncoated paper
 - To preserve barrier properties of coated papers during humid environment exposition
 - First pilot trials at CTP pilot in 2010
 - First industrial installation in 2015 in South Korea
 - Patents
 - ✓ Principle: 1
 - ✓ Products: 7
 - ✓ Process: 4

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Eco-conception

Example of release paper



Present situation

- Adhesive**: Tack/adhesion, Cost, Impact on recyclability
- Silicon**: Stable release, Cost, Impact on recyclability
- Backing**: Coverage / no inhibition, Cost, Recyclable
- Label**: Multiprint/printability, Wet-strength, Cost, Anti-dirt, Impact on recyclability

Future situation

- Silicon free**: Stable release, chromatogeny, Recyclable
- Backing**: Std paper, Recyclable
- Label**: Multiprint/printability, Wet-strength without wet-strength agent, Protection of water based inks without varnish protection, Recyclable

- **Development of release paper without silicon recyclable & biodegradable (already on the market)**

- **Other applications to come...**

R&D Projects

in the area of recycling/deinking

2017–2018: on going mutualised projects



CTP project – Team B

DigiPro - DiagnoStick - Fi/Ch - DreamDiP - FUSA - Optifine



CTP project with other teams

StiffBoard - OptiWhite - VariFill - Fluco II - AlteRaf



CTP project with other teams (recyclability)

Waregraft II



National or European projects with participation of Team B

Provides - MAceO

R&D Projects

Future research activities?

R&D projects



- **General trends**

- Decrease in graphic grades (more pronounced for newsprint compared to OMG) → *change in raw material composition, process to be adapted*
- Decrease in basis weight
 - ✓ Challenge for *mechanical properties* in packaging grade
 - ✓ Same printed surface for lower quantity of fibres (same trend for adhesives)
→ *more efficient recycling process will be requested*
- Looking for higher collection of PfR → presence of higher amount of non-paper components
- Apparition of new printing method (or increase of some of them)
 - ✓ Digital prints
 - ✓ Printed electronic
- Request for cleaner and cleaner pulp for the production of packaging material

R&D projects



- **Future reasearch activities?**

- More efficient sorting and/or better knowledge of the incoming material in the mill
- Decontamination of pulp (hazardous or non-hazardous substances)
- Use of fractionation for the right treatment to the right stream and/or for stratification application
- Eco-conception of new products/applications
- Digital prints
- Packaging and tissue

***A team of experts
for your specific needs...***



***Competences and facilities
at your service***