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# Upcycling of recycled fibres by oxidative processes

Amélioration des fibres recyclées par procédés d'oxydation

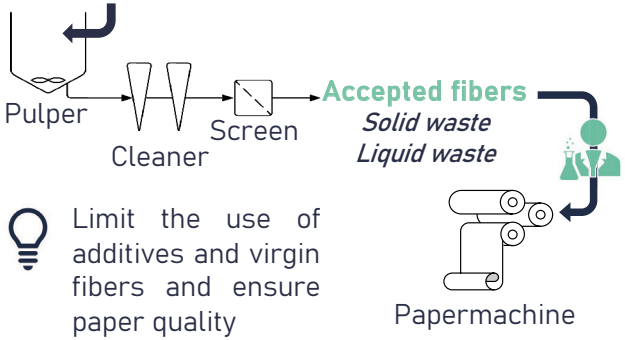
**BioChip**

## Context / Objectives

PEPR **PAC3R** « Recycling, Recyclability, Re-use of Paper and cardboards »

- Add more value to paper and board recycling products
- Recycle all types of paper and board
- Valorize recycling waste

**Recycled papers and boards**




Limit the use of additives and virgin fibers and ensure paper quality

To develop new sustainable chemical process to upcycle recycled fibers for packaging applications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## Methods

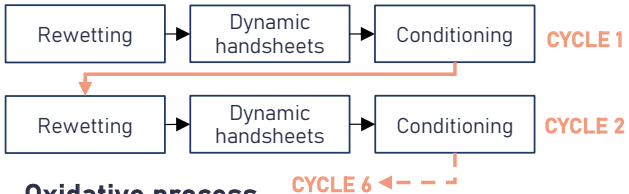
Enhance the fiber's bonding potential to improve paper's mechanical properties and resistance to water

### Raw materials

**Test Liner**
Recycled fibers
Contaminants
Fillers

**Refined UKP**
Softwood Kraft pulp, high kappa
Contaminant-free

### Recycling at laboratory scale




### Oxidative process

CHO or COOH groups creation on lignin to increase its hydrophilicity and increase fiber bonds

**Ozone treatment**
High fibrous consistency, acidic conditions

### Grafting process

### Chemical and mechanical characterizations

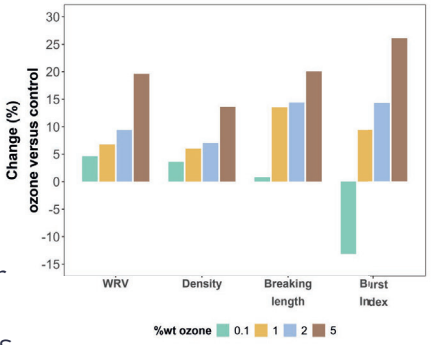
$DP_v$, Kappa number, COOH content
Water Retention Value (WRV), Tensile, Burst

## Results

### Test Liner

**Improvement**
5% - 20% of mechanical properties

**Presence of contaminants**
⇨ difficulties for chemical characterizations




### Cycle 3 refined UKP

**Recover** 20 to 45% of mechanical properties lost through 3 successive recycling operations while **preserving lignin and cellulose**

| Property | Recovery percentage |
|---|---|
| WRV | 36 |
| Density | 46 |
| Breaking length | 22 |
| Burst index | 31 |

$$= \frac{\textit{Property gain on cycle 3 due to ozone}}{\textit{Property loss due to 3 times recycling}}$$

| | Control | Ozone |
|---|---|---|
| $DP_v$ | 1763 | 1438 |
| Kappa number | 87 | 55 |