# NANOCRYSTALLINE CELLULOSE (NCC) FROM LIGNOCELLULOSIC BIOMASS: APPLICATIONS AND FUTURE PROSPECTS

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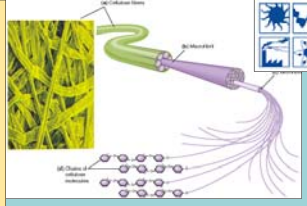
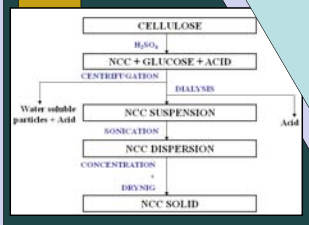


## AIM OF THE RESEARCH

**Nanocrystalline cellulose (NCC)** is here presented; it is a cellulose derived nanomaterial that is promising as new class of bio-based reinforcing material for the preparation of nanostructured composites due to impressive mechanical properties (in particular large tension modulus) associated with low density and high aspect ratio. Advantages in the use of NCC are related to its useful, unsurpassed, physical and chemical properties, but also to their renewability, low cost, sustainability. Residual biomasses represent a major promising source of extraction of such an interesting nanomaterial

## EXTRACTION PROCEDURE




## PROPERTIES

### 1.NCC REINFORCEMNET OF POLYMER NANOCOMPOSITES

PS (plasticized starch) with different amounts of NCC [4].

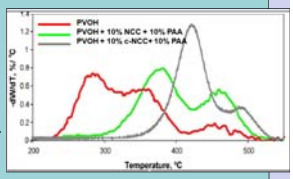
| Sample | σ , MPa | E, MPa | $\varepsilon_B$ % |
|---|---|---|---|
| PS | 3.9 | 31.9 | 68.2±3.1 |
| PS/NCC (5%) | 6.4 | 82.6 | 44.3 |
| PS/NCC (10%) | 7.6 | 180.4 | 35.9 |
| PS/NCC (15%) | 8.2 | 255.3 | 26.8 |
| PS/NCC (20%) | 8.9 | 311.9 | 14.1 |
| PS/NCC (25%) | 10.5 | 447.5 | 9.4 |
| PS/NCC (30%) | 11.9 | 498.2 | 7.2 |

σ = Tensile strength; E = Young's module; $\varepsilon_B$ = Elongation at break

### 2. NCC IMPROVEMENT OF THERMAL STABILITY OF NANOCOMPOSITES

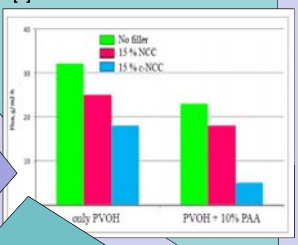
Thermal degradation is shown for:
- Films of pure polyvinyl alcohol (PVOH)
- Films of PVOH + polyacrilyc acid (PAA)

and NCC (or carboxylated NCC) [5].




### 3. NCC EFFECT ON BARRIER PROPERTIES

Nanocomposites often show barrier properties, due to increased tortuosity provided by nanoparticles. Barrier towards trichloroethylene, a toxic chemical, is shown for:
- Films of pure PVOH
- Films of PVOH + Polyacrylic acid, PAA
- Films of both polymers with NCC or carboxylated NCC as fillers [5].




## FIRST RESULTS

- ✓ REVIEW OF OTHER WORKS (COTANA ET AL. 2012)
- ✓ ARRANGEMENT OF THE EXPERIMENTAL FACILITY
- ✓ NCC FROM MFC
- ✓ NCC FROM CARDOON (ON GOING EXPERIENCE)

## APPLICATIONS


Coating
Packaging

Security paper
Films
Paints

PROTECTION

OPTICAL

NCC

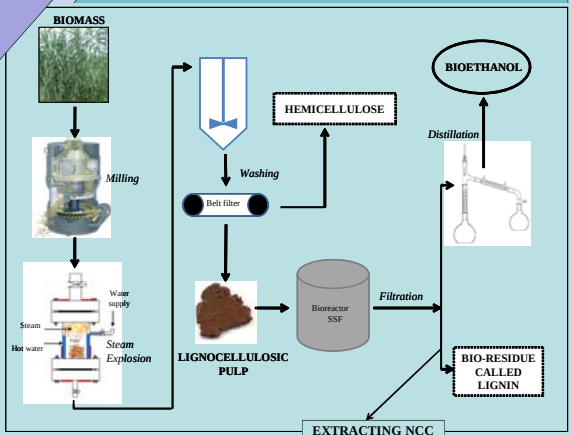
BIOMEDICAL

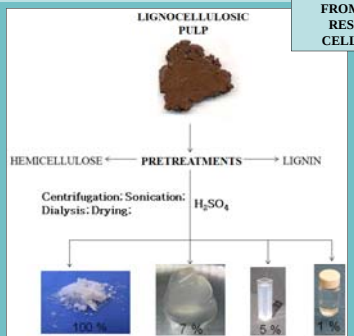
REINFORCEMENT

VOC barrier
Bioprothesis
Drug Delivery

Nanocomposites
Bio-nanocomposites

## ON GOING ACTIVITIES FUTURE PROSPECTS




## RELEVANT REFERENCES

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