20 th World Congress on Material Chemistry & Nano Materials

Lignocellulose Application as Sustainable High-value materials

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The challenge in biomass conversion is that the products produced are of low quality and therefore of low value and only utilizable in commodity areas like energy (i.e. replacing coal) and/or at best in transportation fuels (i.e. ethanol). In this paper a new low-cost technology is presented which is capable to fractionate the valuable constituents of biomass, being polymeric Cellulose and polyaromatic Lignin, without destroying or damaging these components. This is very unique and up to now has only been possible making use of enzymes or of high cost organic ionic liquid technology. The Nano cellulose and Lignin produced are suitable candidates and/or precursors to produce high performance fibers like super nano-cellulosic fibers and Carbon-fibers.

Materials and Methods

Based on the unique ionic-liquid like" properties of $ZnCl_2$ solvents a novel cost-effective technology has been developed to convert cellulosic wastes into high quality materials such as tailored micro and Nano cellulosic materials. The original intention of this technology was to convert cellulosic wastes into sugars which could serve as base materials for the production of renewable fuels. During the development of such a route it was found that the cellulose produced from raw materials was quite unique and exhibited special properties and based on this insight the technology was adapted with the aim of producing valuable bio-based materials.

The advantages of this technology versus alternative routes as for instance the conversion of cellulose by enzymes, acids, organic ionic liquids and/or in combination with high energy mechanical milling are discussed. Biomass conversion with acids is fast but produces a lot of degraded side products. The use of ionic liquids and/or enzymes is expensive and slow (10-40 hours).

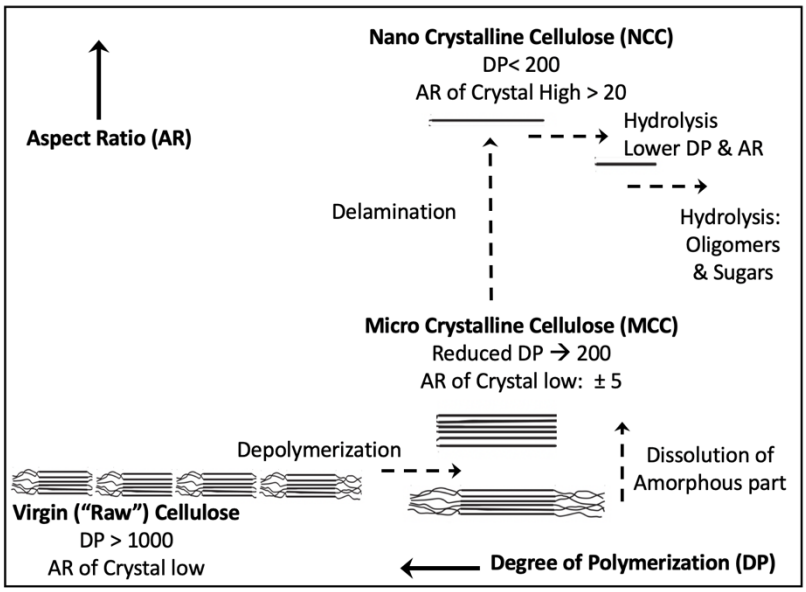
With this improved $ZnCl_2$ hydrate technology the opportunity arises to economically produce various high value products such as:

- Micro and Nano-Cellulose applied as bio-coatings & materials.
- Cellulose oligomers in food applications (non-digestible fibers).
- Lignin and Nano-Cellulose as construction materials (High Tech Wood)
- Lignin for Bio-Aromatics (precursors for Surfactants and Carbon Fibers)
- Lignin as bio-component in polymeric materials.

The Nano cellulose and Lignin produced are suitable candidates and/or precursors to produce high performance fibers like super nano-cellulosic fibers and Carbon-fibers.

The economic value of these materials is at least 5-10 x higher than the commodities produced with other biomass conversion technologies.

Based on these characteristics it is possible to establish a very attractive business case for the utilization of biomass and biomass waste components as high value materials.



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