



Master thesis project in organic chemistry/ cellulose chemistry (15/30 hp)

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Welcome with your application

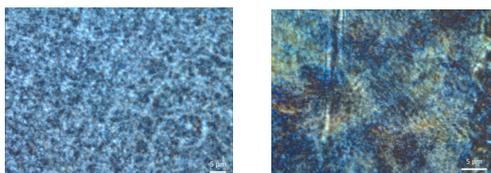
Keywords: Synthesis, material characterization bio-composite

ABSTRACT: Cellulose is the most abundant polymer in nature and is beneficial due to its biodegradability, high strength and durability, high thermal stability, good biocompatibility, relatively low cost and low density yet good mechanical properties. Cellulose can be used in many application areas such as textiles, paper and packagings, medical products, composites and construction materials. There is an increasing interest in the use of biodegradable and renewable materials in consumer products but due to some lack in properties this needs to be considered. By chemical modification of cellulose, its properties can be changed or improved and new application areas for cellulose could be found.

Composite materials are one area where cellulose can be implemented to decrease the need of fossil based material and increase the amount of renewable materials into the composite. The addition of cellulose to the plastic matrix can also be used as reinforcement and change the bulk mechanical-properties of a bio-composite.

However, the mixing of cellulose fibers with a polymer matrix has disadvantages as poor mixing, the fiber act more as a filler than as a reinforcement. Luckily, during the 21st century nanocellulose has been developed. The small size of the particles makes them easier to mix with a matrix. Due to their small size, they have an extremely high surface to size and weight ratio which give them a large contact area with the matrix. Since the nanocellulose are hydrophilic and commodity polymers like polypropylene and polyethylene are hydrophobic a challenge to overcome is to achieve an efficient and strong interaction between the nanocellulose and the polymer matrix.

Thus, to find a combination of nanocellulose, or chemical modified nanocellulose and a matrix, with or without additives that gives a strong material is both challenging and may be found by different approaches.



Figur 1 Polarized light microscopy of nanocellulose films, showing how surface modification affect their aggregation properties.

The thesis project

Initial phase of the project is to prepare and characterize nanocellulose. Most probably the surface of the nanocellulose must be chemically modified. Thereafter, there are possibilities to direct the project towards more detailed surface modification and/or to focus more on finding polymer matrix with or without additives that forms a bio-composite with good mechanical properties. There are also, as for almost all projects, the need for a literature study, report writing, communicate the results and your curiosity and skills to relate chemical details with material properties and envisage applications.

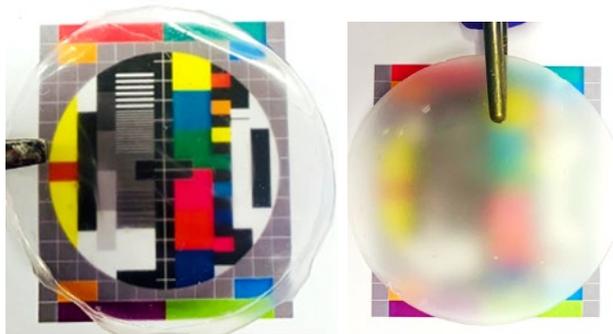


Figure 2 Examples on how surface modification of the nanocellulose affect the properties.

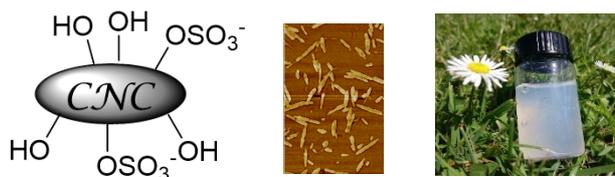


Figure 3 Examples on how we communicate nanocellulose. I) as cartoon, ii) as AFM image or iii) as a suspension.