

Novel nanocellulose films and coatings

Background

The majority of engineered plastic materials used today are made from synthetic polymers. The use of conventional petroleum-based polymer products creates many potential problems due to their non-renewable nature and ultimate disposal. Wood-based polymers, when used in such applications, offers advantages with respect to sustainability and limited environmental impact. Of growing interest is the use of nanocellulose as an alternative to petro-based materials such as polyethylene (PE) and polyethylene terephthalate (PET). The term "nanocellulose" refers to cellulosic nanofibrils disintegrated from the plant cell walls. New methods for the manufacture of very small and homogeneous nanocellulose have recently been developed at Innventia AB. The nanocellulose fibers are 5 - 20 nm thick and have a length of up to several μm .

Nanocellulose films have been shown to have excellent gas barrier properties. Nevertheless, a limitation of these materials is their water sensitivity, producing a loss of barrier properties when the degree of hydration increases. If such films will receive a larger commercial interest, it will be necessary to alleviate their sensitivity towards moisture and decrease their water vapor permeability.

Project description

The influence of the nanocellulose surface chemistry on the barrier properties of the prepared films will be studied. The nanocellulose films will be cross-linked; ionically with calcium/aluminum ions or through covalent linkage with poly vinyl alcohol, citric acid, polyacrylic acid or polyethylene glycol. Thermal cross-linking of the films will also be addressed. In order to decrease the moisture sensitivity of the films, fatty acids or nanoclay will be added to the nanocellulose prior or after film formation. The biobased nanocomposite films will be characterized in terms of their oxygen and water vapor permeability and their mechanical properties; tensile strength, fracture toughness and strain at break, will be evaluated.

Prerequisites

The candidate should preferably be a last-year student in a suitable M.Sc. program in chemistry, biotechnology, chemical engineering, mechanical engineering etc.

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