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ABSTRACT

Poly (lactic acid) (PLA) has long been advocated as one of the best candidates for bio-based food packaging, but low thermal stability, slow crystallization, high oxygen and water permeability are drawbacks that still limits the use of PLA in a broader range of applications.
The goal of this research project has been to improve the permeability of PLA by use of nanocellulose or by combination of nanocellulose and nanoclay in PLA composites. The cellulose nanofibers (CNF) were extracted from sisal fibers using an optimized up-scalable three-step chemical protocol. Composites with both CNF and nanoclay resulted in highly transparent films with good termomechanical properties. Furthermore, the combination of nanocellulose and nanoclay led to a faster crystallization (80% reduced half crystallization time). In addition, hybrid composites was identified as an effective way to improve the barrier properties of PLA. In particular 1 wt% of CNF and NC resulted in a 63% of reduction on the oxygen transmission rate and a 57% on the water vapor transmission rate, while a 5 wt% PLA/CNF/NC resulted in a 89% and a 75% of decrease respectively.

Anders Egede Daugaard is an Associate Professor of Polymer Chemistry at the Technical University of Denmark (DTU). His main research interests are synthesis of polymers and modification of particle and polymer surfaces. During recent years he has worked with composite materials, specifically with the optimization of particle matrix interactions through modification of particle surfaces of nanomaterials such as MWCNT, nanoclays and nanocellulose for both thermoset and thermoplastic matrices.