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Recently, there has been a dramatic increase in developing novel bio-based polymers which can be good candidates for the replacement of synthetic polymers with comparable material properties and can therefore be used to reduce the use of fossil resources and protect the environment by producing biodegradable materials. Cellulose, the most abundant biodegradable organic compound, is becoming increasingly potential raw material for the chemical industry.

The main purpose of this work is efficient modification of cellulose and different types of pulps. Cellulose reactions can be either homogeneous in which the reaction are starting from the dissolved polymer or heterogeneous where cellulose stays in a solid or more or less swollen state during the chemical modifications. However, the most efficient cellulose modification processes such as acylation and carbamation can start from solid cellulose and end up with a soluble product. These type of reactions are rare and can currently be applied to synthesis of very few cellulose derivatives. This work deals with the homogenous and mostly heterogeneous acylation and carbamation of cellulose with different aromatic and aliphatic acid chlorides and isocyanates.

In recent work, acylation and carbamation of cellulose and pulp including birch kraft pulp, dissolving pulp and hemicelluloses-poor birch kraft pulp has been done in a reactive dissolution media, meaning that the synthesis is solvent- free and reaction start without pre-dissolution of cellulose and end up with a clear and homogenous solution. Purity and the properties of the products were analyzed using ^{1}H-, ^{13}C-NMR and FTIR spectroscopic techniques. The degree of substitution (DS) of the final products was studied using novel ^{31}P-NMR method. The thermal properties of cellulose esters were also investigated using differential scanning calorimetry (DSC) and thermo-gravimetry (TGA).