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Plasticised cellulosic composites for packaging applications (COMPAC)

Vision and goal

The vision is to find green cellulose based solutions for packaging applications. This will be an alternative to materials made of fossil based resources that have a negative impact on the environment.

The goal of the project is to manufacture plasticised cellulosic materials in pilot scale and characterize those regarding mechanical properties, moisture response and water vapour transport.

Background

Cellulose from the forest is an abundant resource, renewable and degradable that makes it to a suitable pervasive material for a sustainable development. The advantages of using plasticised cellulose are that density, strain at break, tensile strength and elastic modulus increase both under dry and wet conditions compared to normal paper and board. This increase in properties makes the material formable and add barrier resistance for oxygen. The high stiffness makes it suitable for using as a matrix in composites together with strong fibres that are unaffected by the treatment.

The challenges to be overcome are the cost of the chemicals, need for extensive washing with recycling of chemicals and shrinkage during drying.

Experimental

Laboratory paper made from chemical pulps from birch and pine as well as dissolving pulp from softwood have been plasticised with phosphoric acid, AmimCl ionic liquid, sodium thiocyanate / urea DES, sodium hydroxide/urea, NMMO and zinc chloride for increased strength and strain at peak load. Linerboard has been treated with sodium hydroxide/urea at -12 °C. The sodium hydroxide/urea system has also been tested on-line at a pilot paper machine at slow speed in Markaryd, Sweden. A dissolving pulp with low viscosity from Domsjö Fabriker was used.

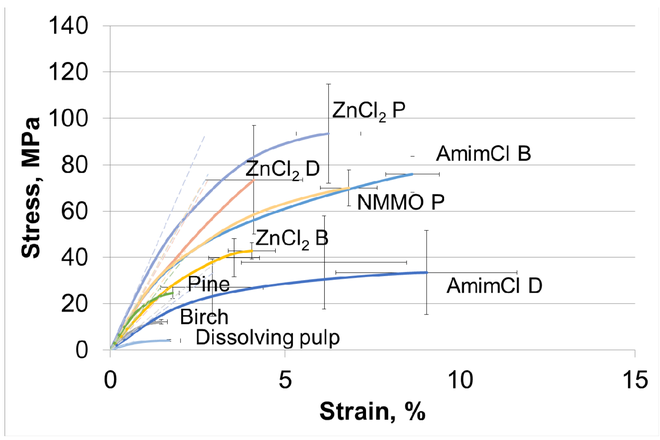
Compression properties

	Grammage, g/m^2	SCT-index, kNm/kg	Bending stiffness, Nm	
		CD	CD	MD
Untreated	153	15	75	134
Treated	206	24	134	217
Treat & washed	184	19	92	142

Short-span compression (SCT) and two-point bending stiffness of three different linerboard samples.

The compression index of single layer linerboard treated with sodium hydroxide/urea at -12 °C was almost twice as high in CD compared to the single linerboard only being soaked in water and dried, 24 kNm/kg and 15 kNm/kg, respectively.

Tensile properties



Examples on how plasticising agents, zinc chloride, AmimCl and NMMO improve tensile properties of isotropic paper made of chemical pulps from birch (B), pine (P) and dissolving pulp (D).

Conclusions

Solvents for cellulose plasticise paper and can improve tensile and compressive properties. They also densify the paper and the solvents affects paper made of various pulps differently. Some work better on hardwood while others work better on softwood pulp.

It is possible to plasticise paper in a pilot paper machine at slow speed using the pond size press and sodium hydroxide mixed with urea at -12 °C. A difficulty is to efficiently remove the chemicals from the paper by washing.

Financers and partners

COMPAC is a European project financed by Vinnova and EU within the program of WoodWisdom ERA-Net +. Participating universities are from Sweden, Germany and Finland. In total, 11 Companies participate and the Swedish part of the project involves three companies.

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