Prepregs of nanofibrillated carrot juice waste

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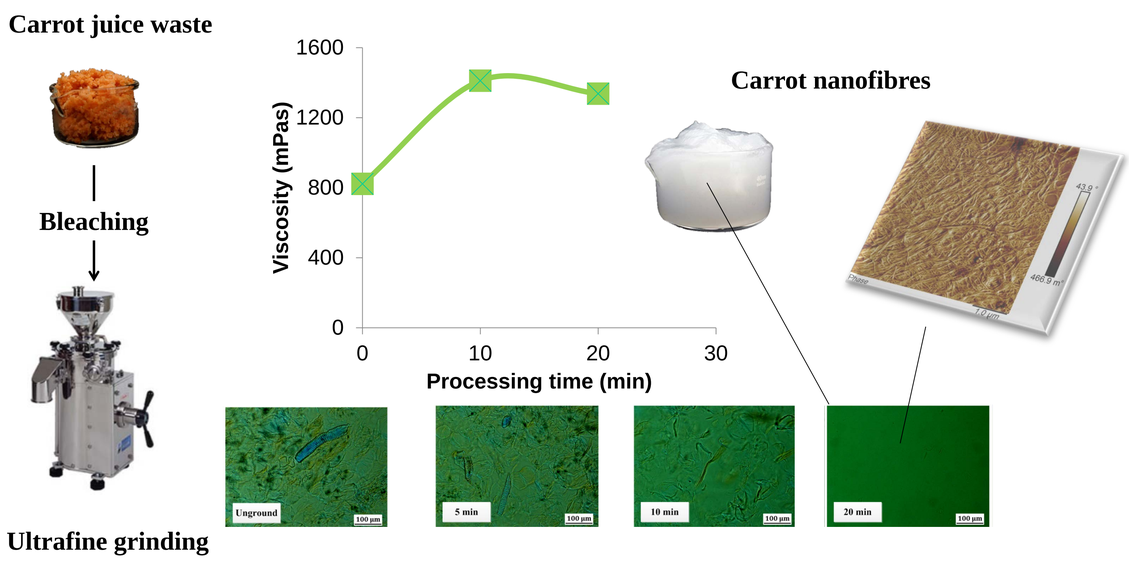
Materials

Material

Residue from carrot juice residue, kindly supplied by Brämhults Juice AB , Sweden was bleached and nanofibrillated using ultrafine grinding

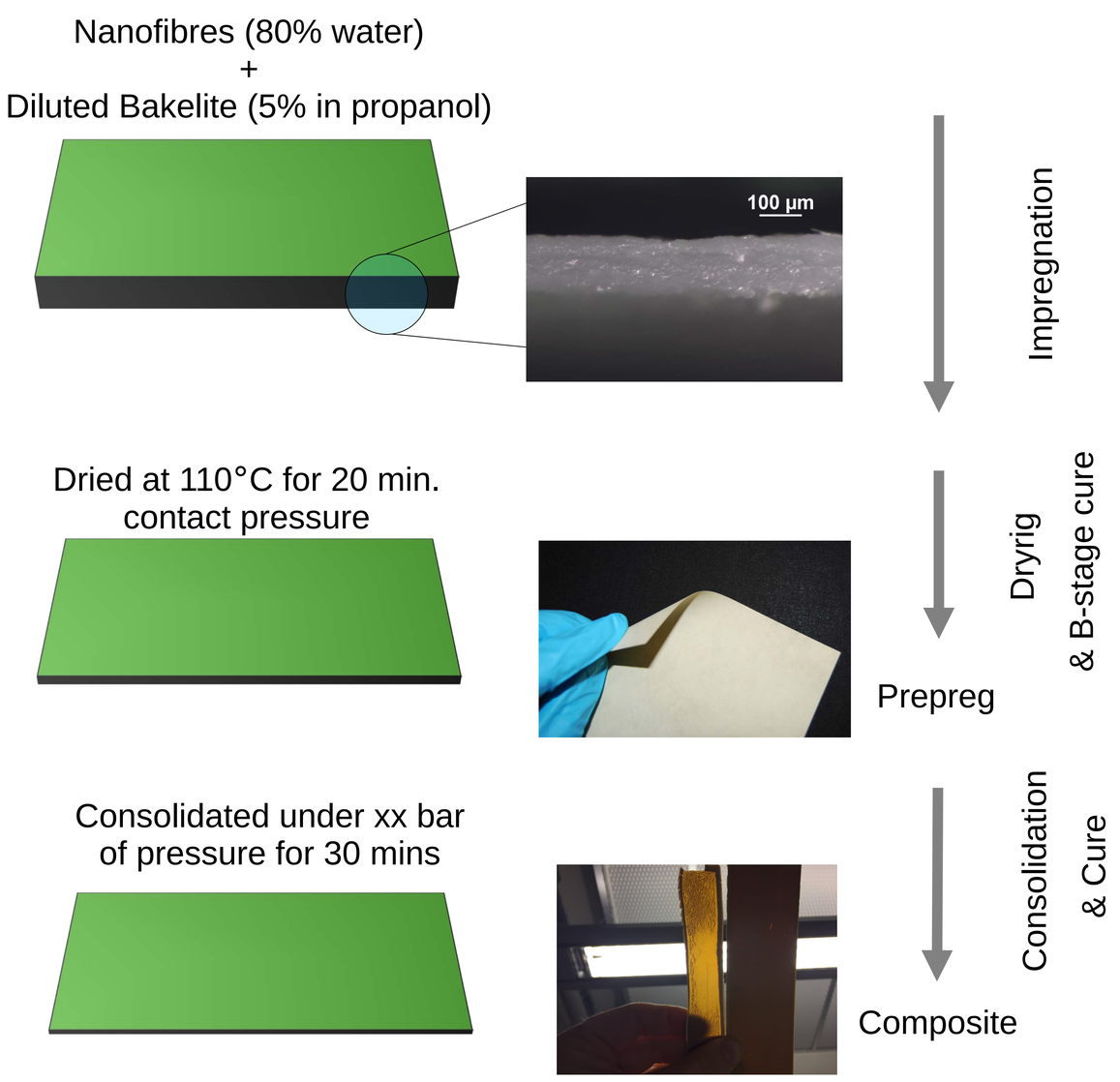


20 minutes processing = 0.9 kWh/kg [1]

(equivalent to paper pulp processing [2])

Prepreg manufacture

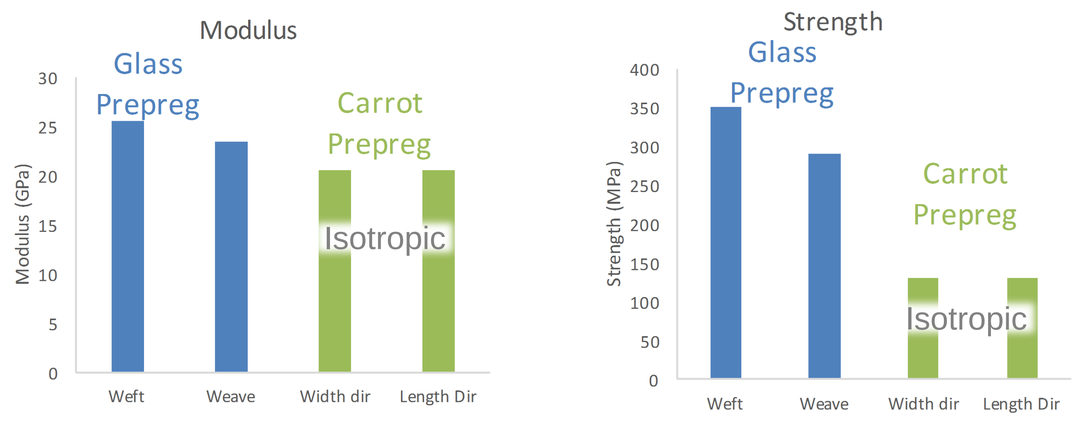
Aqueous suspensions of carrot nanofibres were filtered then impregnated with dilute Bakelite (Phenol formaldehyde PF1143 V60, Hexion) whilst in a hydrogel state.



Properties

Mechanical properties

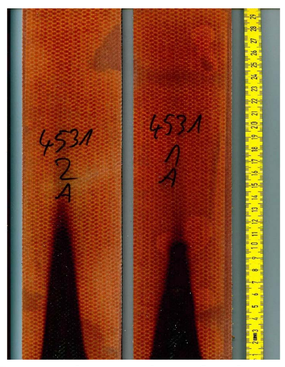
The mechanical properties of the carrot waste/Bakelite nanocomposites were measured and compared to the glass-fibre/Bakelite composites by tensile testing.



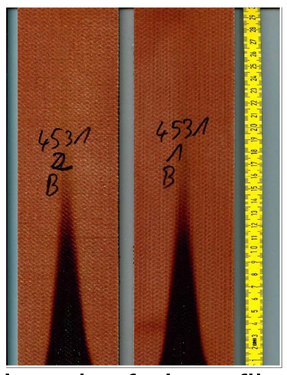
Fire behaviour

The fire behaviour of the carrot waste/Bakelite material was tested by adding a sheet to a glass-fibre/Bakelite composite and measuring the effect on the heat release, heat release rate and burn length.

Materials	HRR (kW/m²)	HR (kW*min/m²)	Burn length (mm)
With carrot nanocomposite	40,34	33,13	73
Without carrot nanocomposite	41.83	54.74	43



Burn length of glass-fibre composite with carrot prepreg



Burn length of glass-fibre composite only

Conclusions

- Impregnation method allows carrot juice waste to be made into prepregs that can be used in sandwich constructions
- The carrot based composites have a Young's modulus similar to that of glass fibre composites, though lower strength.
- The addition of a prepreg of the carrot cellulose network to a glass fibre sandwich construction, lowers heat release and heat release rate and the burn length is acceptable

References

1. Berglund, Linn, et al. "Production potential of cellulose nanofibers from industrial residues: Efficiency and nanofiber characteristics." *Industrial Crops and Products* 92 (2016): 84-92.
2. Singh, R., Bhardwaj, N. K., & Choudhury, B. (2015). Cellulase-assisted refining optimization for saving electrical energy demand and pulp quality evaluation.

Industrial Production Processes for Nanoreinforced Composite Structures (INCOM) project

The work was done as part of the INCOM project. The aim of the INCOM project is to develop techno-economically viable solutions and production methods for lightweight structures based on advanced sustainable materials for use in sporting goods, vehicles and aeronautical applications.

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