FUNCTIONALIZATION OF SOFTWOOD SAWDUST GENERATED FROM PINE WOOD HONEYCOMB PRODUCTION FOR OBTAINING ENVIRONMENTALLY FRIENDLY COMPOSITE MATERIALS BASED ON RECYCLED POLYPROPYLENE

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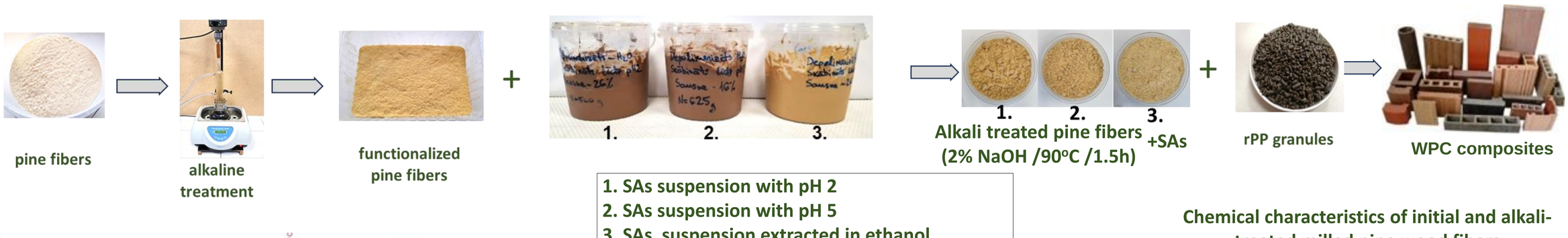
The main disadvantage of softwood sawdust as a filler in wood-plastic composites (WPC) is the presence of resins in its chemical composition and its poor compatibility with synthetic polymers due to their different polarities. Due to these factors, the obtained composites have unsatisfactory exploitation properties. Targeted and scientifically based improved physicochemical functionalization of pine fibers by alkaline hydrolysis under the optimal conditions allows regulating the interaction between the pine fibers and the recycled polymer matrix and controlling the compatibility in the composite material. The replacement of organic solvents for removing the wood resins with the alkaline treatment responds to “Green“ technology.

In this study, suberinic acids was used as a biolubricant for improving the processing parameters of the WPC proceeded by extrusion with the following injection moulding. The composite samples filled with the functionalized pine fibers were characterized by increased mechanical properties and decreased wettability compared with the samples containing raw pine fibers. The incorporation of suberinic acids in the composite system led to a decrease in the minimal torque values of the co-rotating screws in the extruder in comparison with the torque indexes for the composite samples filled with the untreated pine residue.

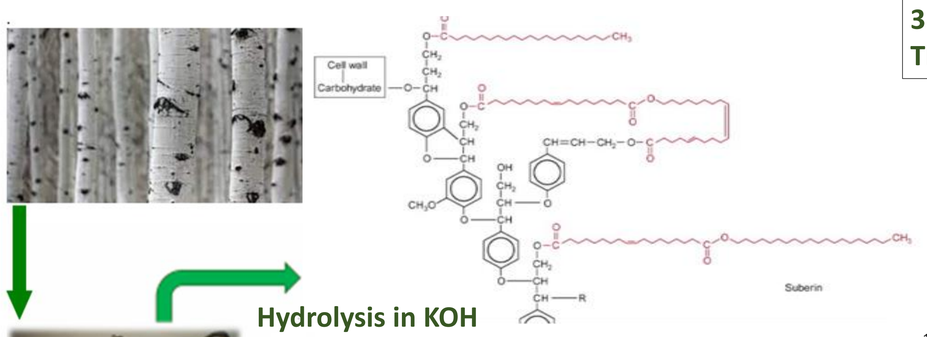
The content of the modified wood filler in the WPC was 30 wt%. The WPC samples for tensile and bending tests were prepared using HAAKE MiniLab II and MiniJet II.

The improvement of the processing parameters from the point of view of energy consumption by decreasing the torque of the extruder screws and the injection pressure for moulding the rPP based composite samples as a result of the decrease of the apparent viscosity of the melt in the presence of suberinic acids was shown. The optimal content of the biolubricant in the WPC was found. At this content, the presence of suberinic acids positively affected the mechanical properties of the biocomposite.

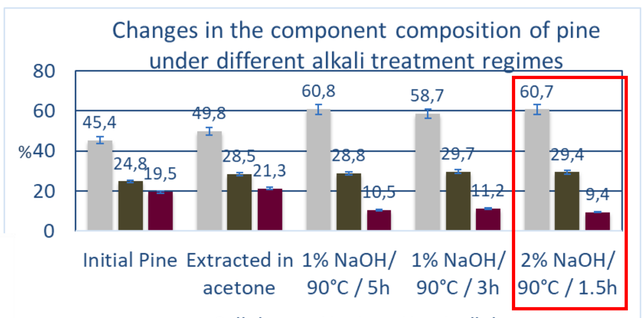


1. SAs suspension with pH 2
2. SAs suspension with pH 5
3. SAs suspension extracted in ethanol

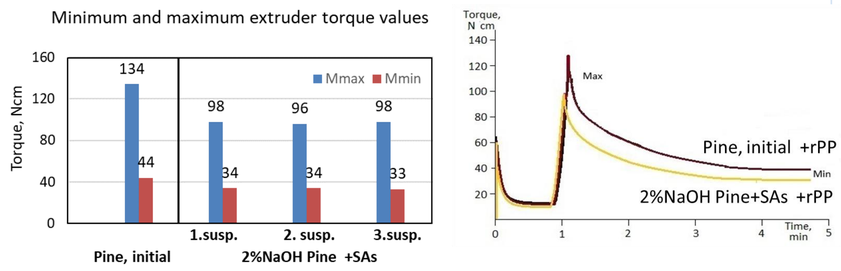
The content of SAs – 3,75 %



Chemical characteristics of initial and alkali-treated milled pine wood fibers



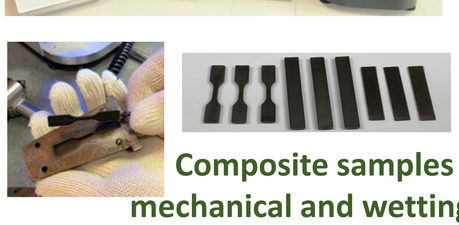
Torque *vs* time curves for the composite with Suberinic acids at different rotor speed



Pendulum Impact Testing Machine “Instron CEAST 9050”

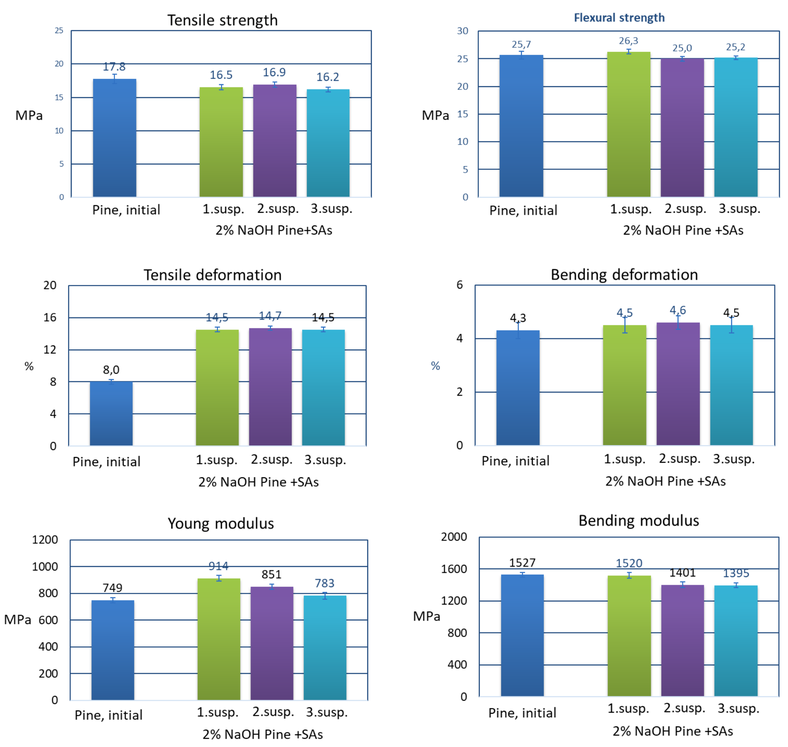
Laboratory equipment for wood-plastic composite processing HAAKE MiniLab II and MiniJet II, (Thermo Scientific)

Co- and counter-rotating twin screws

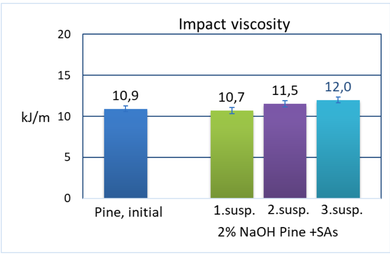


Composite samples for mechanical and wetting tests

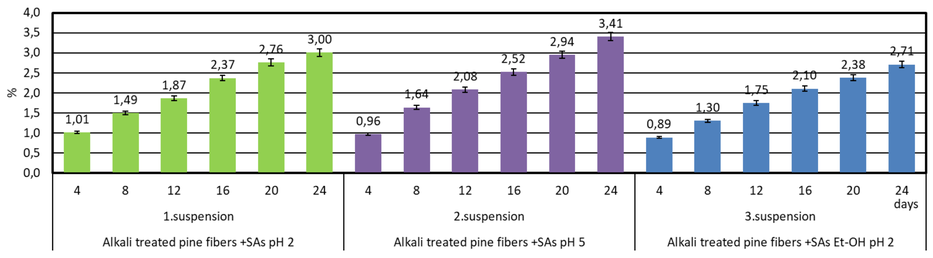
Mechanical properties of modified pine wood fibers and SAs composite samples with 30% filling



Impact viscosity



Water sorption of composite samples with different content of Suberinic acids after 24 days according to the ASTM D1037-12 standard



Conclusions

It was found that the treatment of modified pine fibers with suberic acids contributes to a decrease in the minimum and maximum torque values of the extruder, compared to the torque of composite samples filled with untreated pine fibers.

Acknowledgement

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