

Optimization of softwood and hardwood mixture for the manufacture of OSB panels

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Introduction



Oriented strand boards (OSB) are widely used in construction and other industries due to their excellent physical and mechanical properties. Developed in the 1960s, OSB is also environmentally friendly and can be produced from fast-growing trees.



Historically, Eastern Canada has relied on hardwoods for OSB production, but with growing demand each year [1], softwoods are now seen as a promising alternative raw material. Initial research suggests that mixing hardwoods and softwoods can result in panels with good properties [2], but more work is needed to fulfill its potential.



This research seeks to address the gap by optimizing the hardwood-softwood mixture for OSB panels and identifying the best hot-pressing parameters. The goal is to ensure resource efficiency while meeting Canadian standards and to gain a deeper understanding of how these mixtures behave during the hot-pressing process.



Fig 1. Pieces of OSB panels

Objectives

Determine the best mixture of softwoods and hardwoods and the optimal hot-pressing parameters for producing OSB panels that comply with technical standards

Understand PF behavior in the presence of softwood and hardwood species to optimize hot-pressing conditions for manufacturing OSB panels

Evaluate the effect of combining softwood and hardwoods on the physical and mechanical properties of OSB panels

Determine the effect of pressing strategies on porosity and its relationship with the physical and mechanical properties of OSB panels

Methodology

Part 1. Curing Process of PF Adhesive with Softwood and Hardwood Species for OSB: A Differential Scanning Calorimetry Analysis

- Aspen, balsam fir, spruce, and birch samples will be grounded, dried, mixed with PF resin, and sealed in stainless steel capsules
- Differential Scanning Calorimeter DSC 2500 will be used to obtain the exothermic curing reaction curves by heating the samples from 50 to 200°C at 5 and 10°C/min heating rates

Part 2. Optimization of the proportion of hardwood-softwood mixtures for OSB production using aspen, spruce, and balsam fir

- Softwood mixtures of 50% spruce and 50% balsam fir are commonly used in small proportions in Eastern Canada's OSB mills
- Objective:** To increase the proportion of softwood mixture on aspen OSB panels and evaluate the physical and mechanical properties according to CSA O325:21

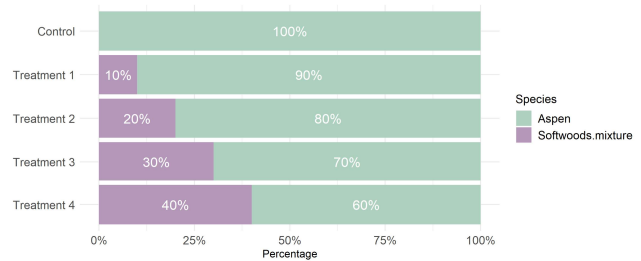


Fig 2. Proportions of aspen and softwood for each treatment

Part 3. Optimizing the blend of birch and poplar for manufacturing OSB

- In Eastern Canada, paper birch is mixed with poplar in proportions up to 1:3 to produce OSB panels
- Objective:** To increase the proportion of birch on aspen OSB panels and evaluate the impact on the physical and mechanical properties according to CSA O325:21

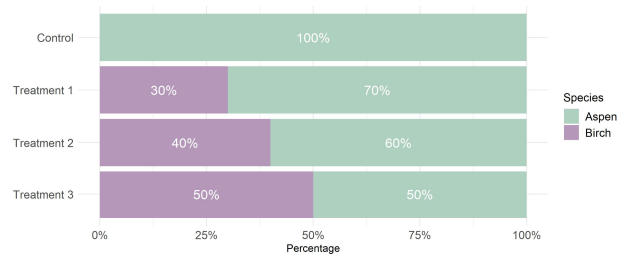


Fig 3. Proportions of birch and aspen for each treatment

Part 4. Effect of the pressing strategy and porosity on mechanical properties of OSB

- Objective:** To evaluate the effect of pressing parameters on physical and mechanical properties, porosity, and their relationship
- New panels of the best mixture from the previous parts will be produced with three different press closing times and temperatures
- Porosity will be assessed with a high-resolution X-ray scanner based on micro-tomography (micro-CT)

Expected results

Suggest the best softwoods-hardwoods mixture considering the physical and mechanical properties as well as the cost of production of OSB

DSC will identify the curing behavior of PF with conifers and hardwoods, helping predict optimal pressing parameters and resin compatibility with different wood species

Describe the behavior of different pressing strategies on porosity and physical and mechanical properties of softwoods-hardwoods mixed OSB

References

- [1] FAO. (2024, March 17). Forest Production and Trade – OSB production quantity in Canada, 1993-2020.
- [2] Zhuang, B., Cloutier, A., & Koubaa, A. (2022). Physical and Mechanical Properties of Oriented Strand Board Made from Eastern Canadian Softwood Species. Forests, 13(4).

