

PELLETIZING OF SOFTWOOD AND HARDWOOD WITH SINGLE CHANNEL PELLET PRESSES

Mikko Havimo

Juha Rikala

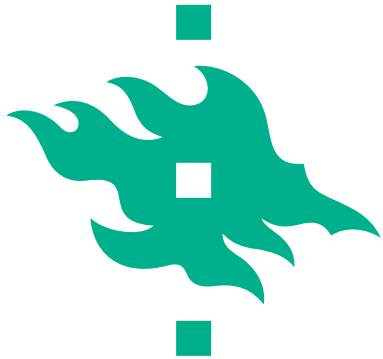
Antti Rissanen

Marketta Sipi

Department of Forest Science

University of Helsinki

Finland

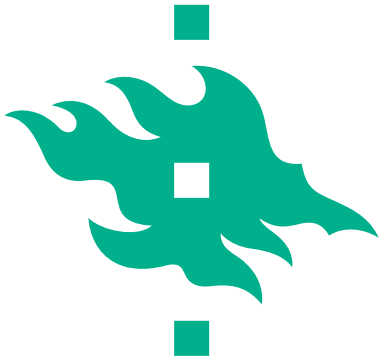


Fuel pellets - Introduction

- ❑ Pellets are a popular heating fuel in Nordic countries
 - ❑ Renewable, domestic and CO2 neutral

- ❑ Pellet quality is a problem for end users
 - ❑ Often pellets have low mechanical strength
 - ❑ Low strength causes problems in boiler feeding systems

- ❑ Differences in pelletizing between tree species
 - ❑ Hardwoods are considered as a difficult raw material



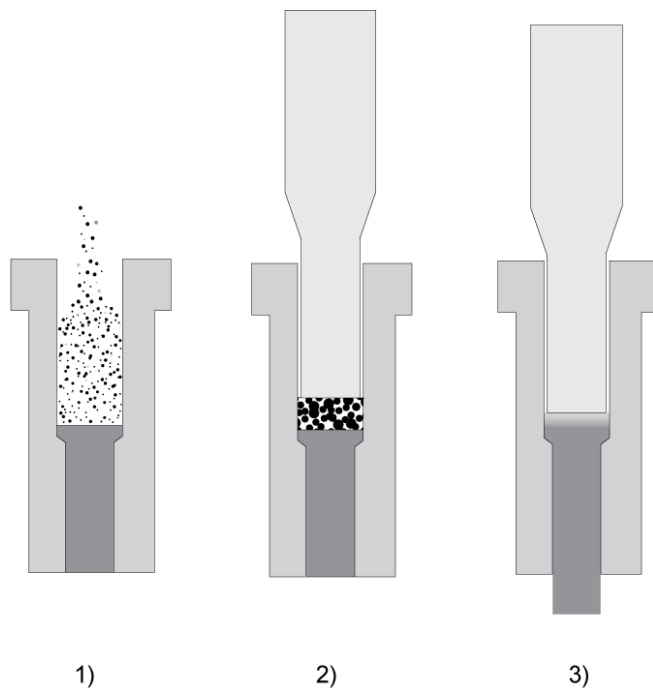
This study discusses:

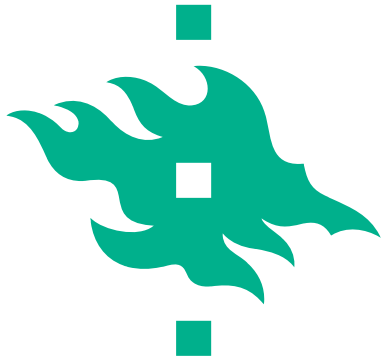
□ Aim of the study

- Test effect of compression load
- Test effect of temperature
- Test different tree species
- Mechanical strength is the studied variable

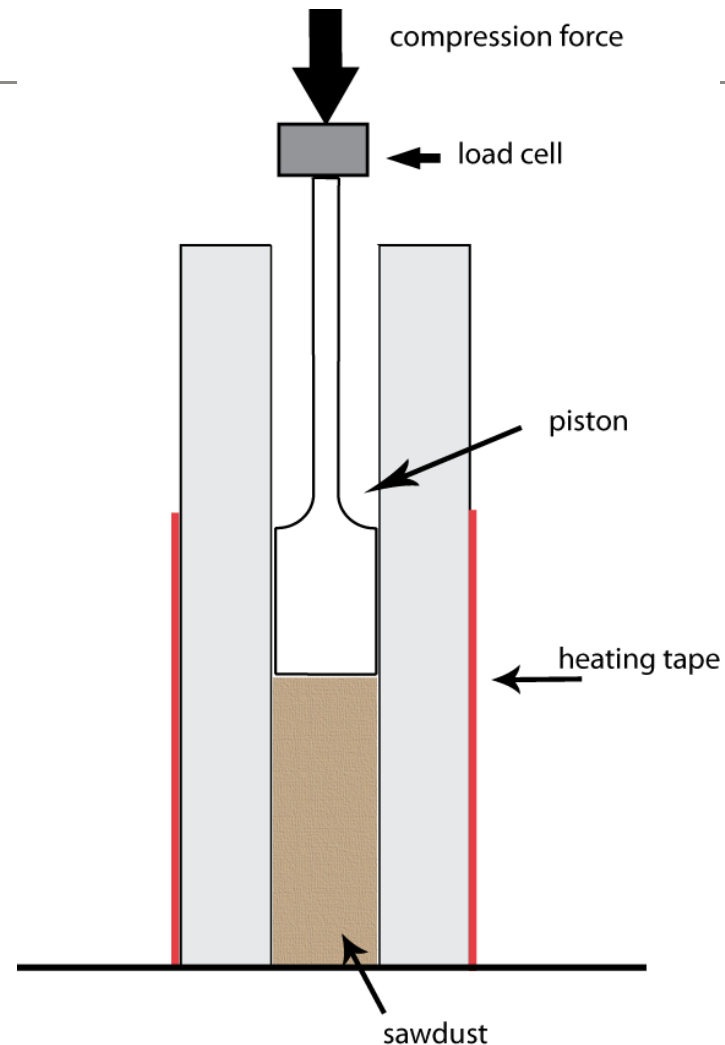
□ Method

- Two single channel pellet presses
- Laboratory scale
- Channel diameter 10 mm





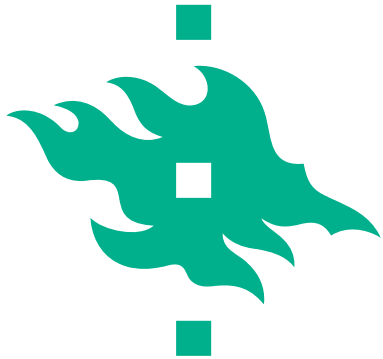
Pellet press – first version



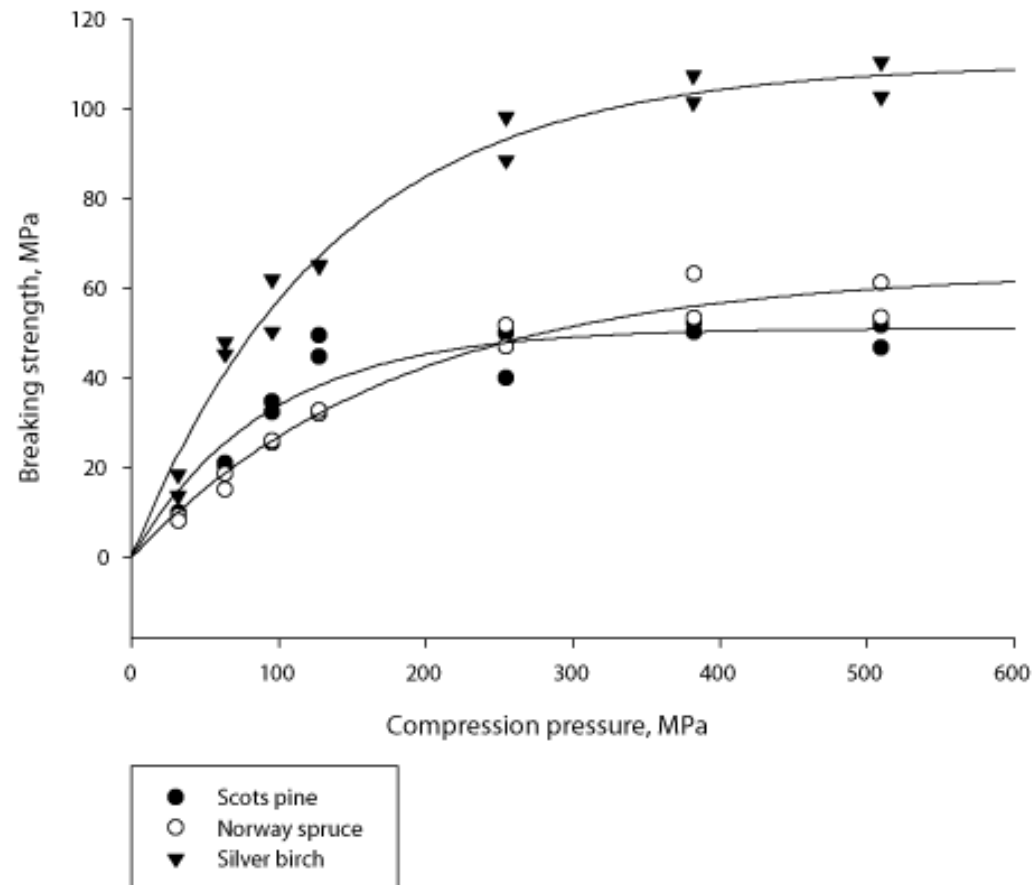
In this device temperature and compression pressure can be controlled

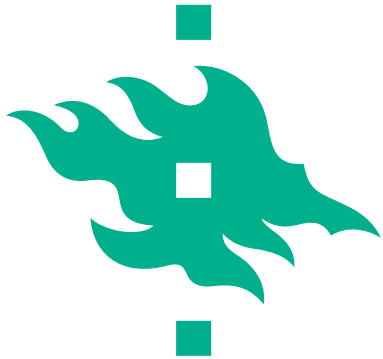
One pellet is made at a time

Norway spruce, Scots pine and Silver birch were tested

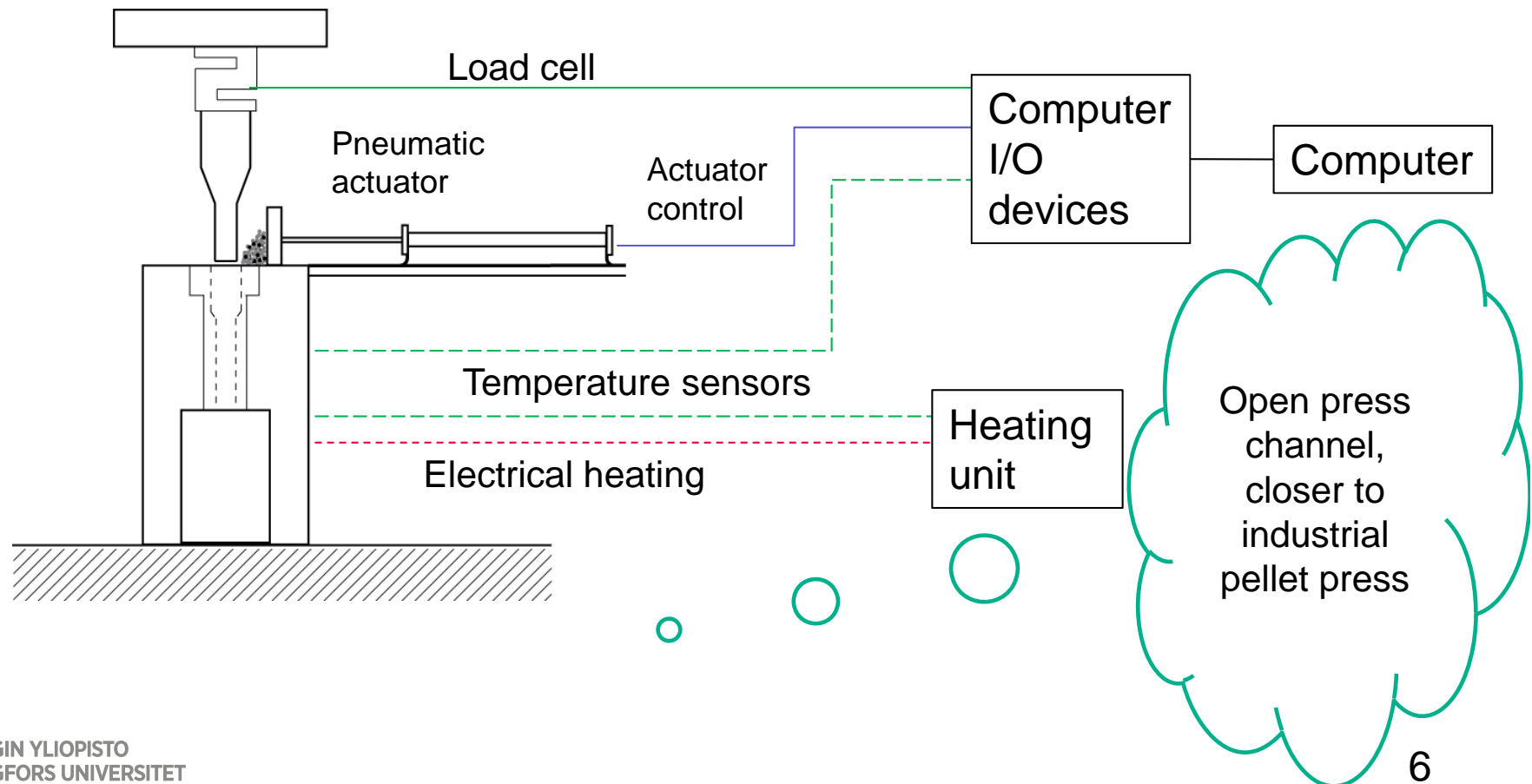


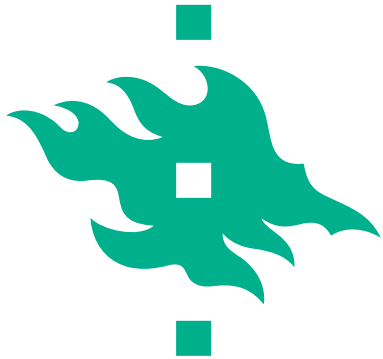
Effect of compression pressure on pellet breaking strength



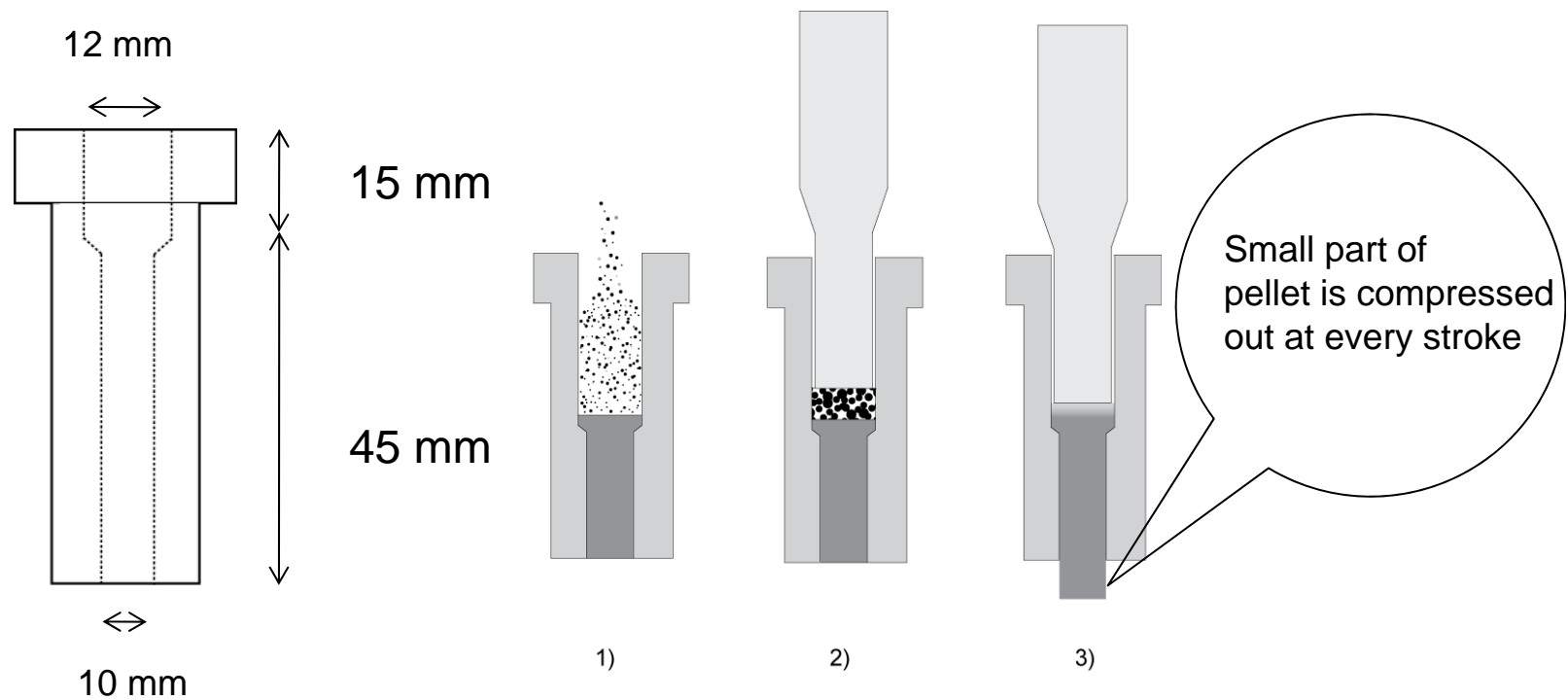


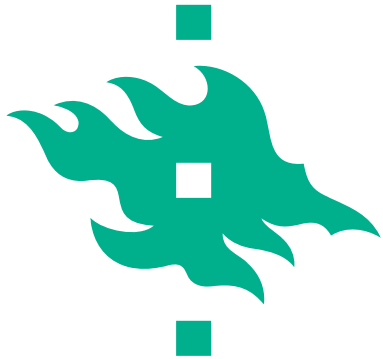
Pellet press – second version





Simulation of continuous pelletizing: Press channel

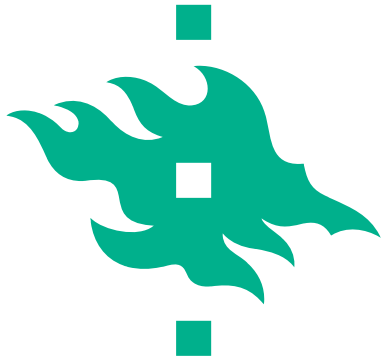




Experiments – raw material

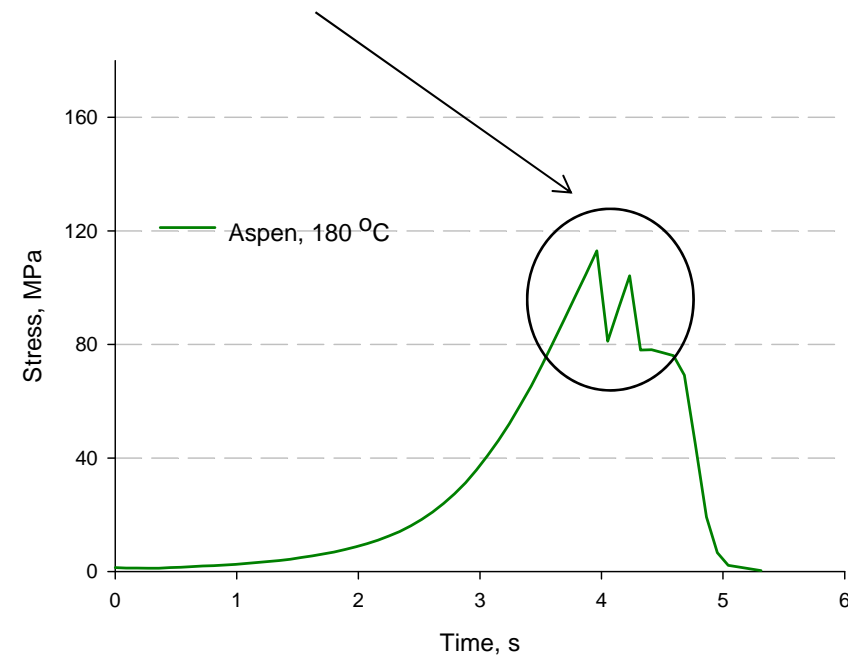
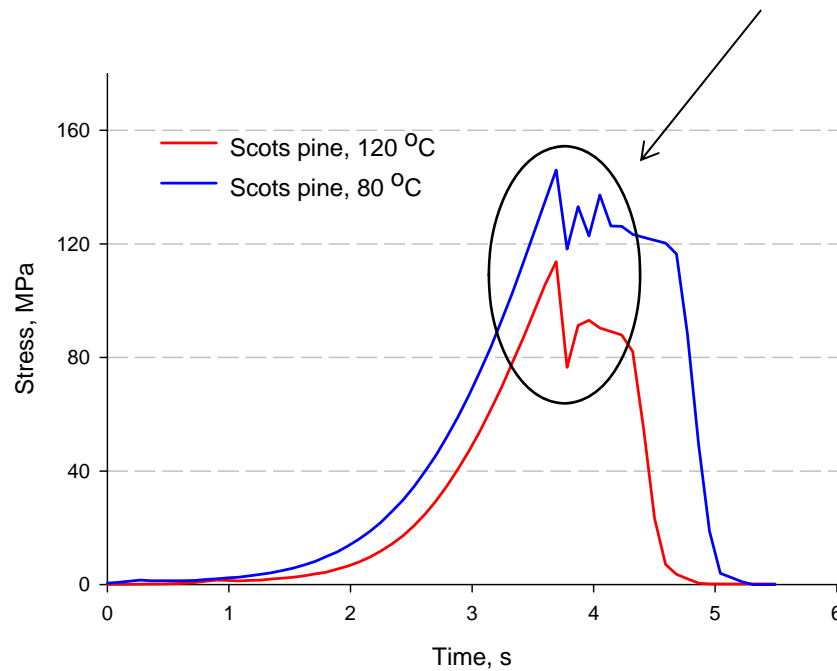
- ❑ Scots pine (*Pinus sylvestris*)
 - Density 418 kg/m³
 - Temperatures from 40 to 140 °C

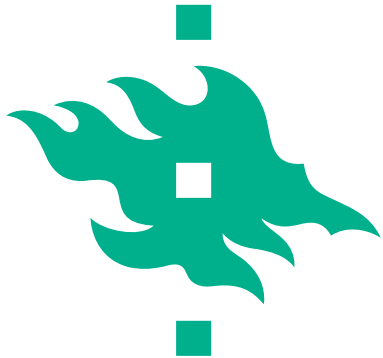
- ❑ Trembling aspen (*Populus tremula*)
 - Density 397 kg/m³
 - Temperatures from 120 to 180 °C



Experiments: Load in compression phase

This is called stick-slip friction.*





Pellet properties and temperature

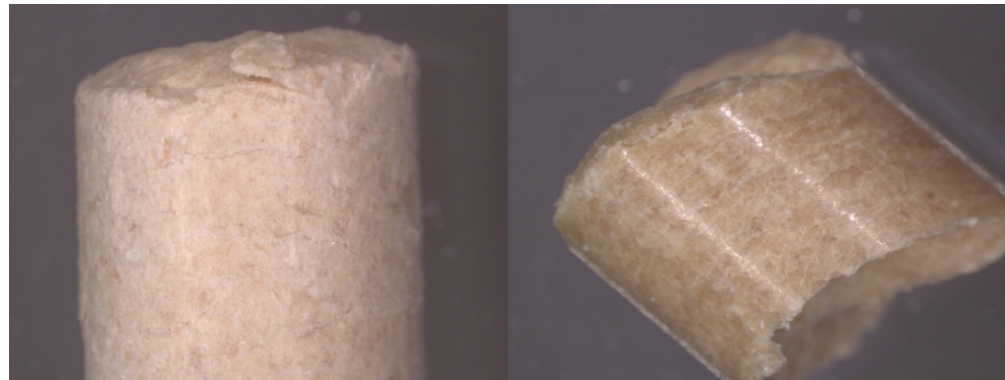


Aspen 140 °C

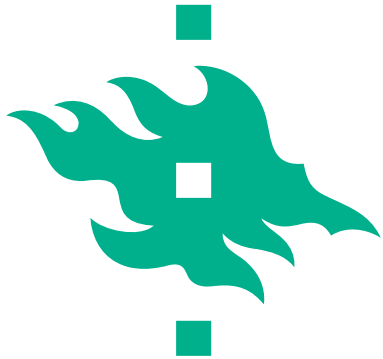
Aspen 160 °C

Aspen 180 °C

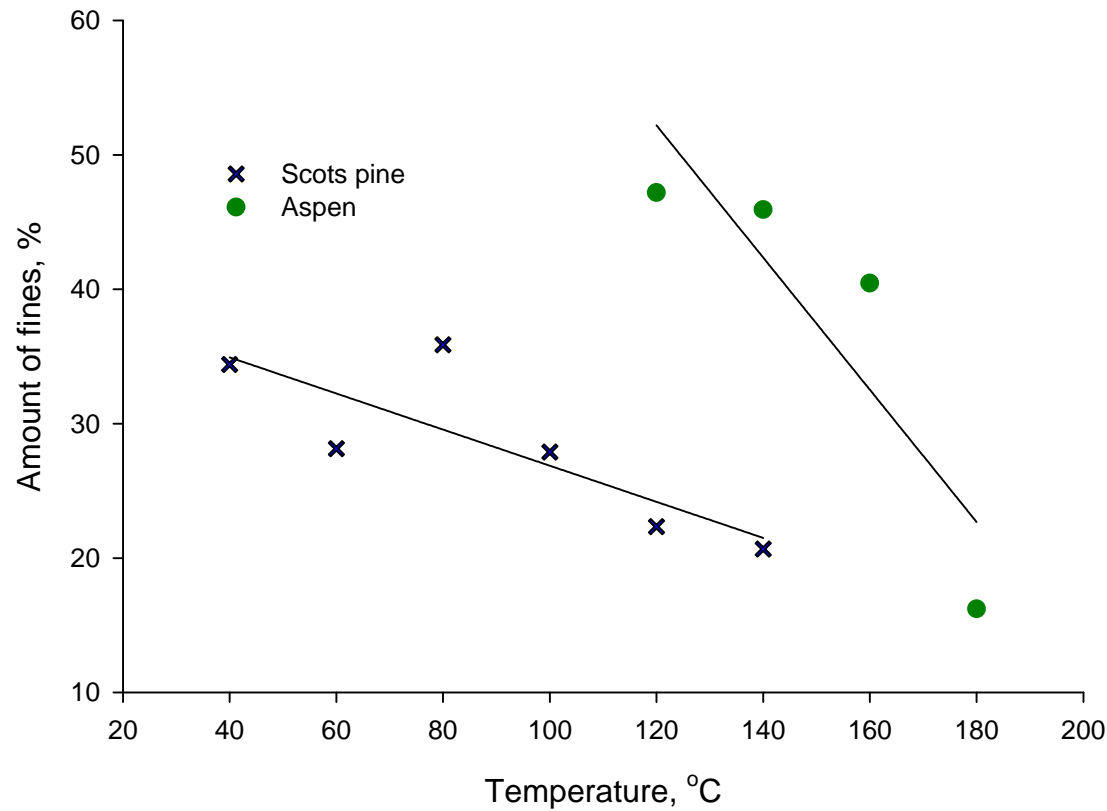
Scots pine
60 °C



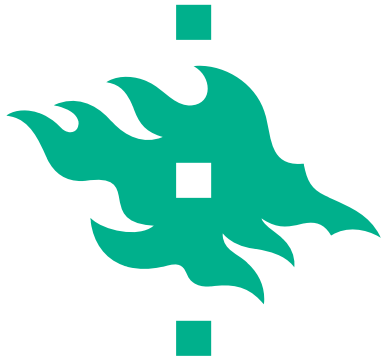
Scots pine
140 °C



Tumbling tests



- Pellets were shaken 20 minutes with 1500 rpm in Geno/Grinder shaker
- Amount of fines was measured



Conclusions

□ Temperature

- Increases mechanical durability and strength
- Causes oscillating loads and unsteady flow
- Operation of the pelleting device becomes unsteady and difficult

□ Tree species have differences

- For Scots pine 100 – 120 C is suitable temperature range
- For Aspen substantially higher temperatures: 140 – 160 C
- Silver birch requires significantly more compression force

A close-up photograph of a pine branch. The branch is covered in vibrant green, needle-like leaves that are densely packed. In the center of the branch, a small, developing brown cone is visible, partially obscured by the needles. The background is a soft, out-of-focus green, suggesting more of the same plant. The overall lighting is bright and natural, highlighting the texture of the needles.

**Thank you for your
attention!**