

# EFFECT OF BARK PARTICLE SIZE AND USED RESIN ON THE MECHANICAL PROPERTIES OF BARK BOARDS

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## GOAL

The aim of the project was to produce boards from bark particles of different sizes 2-5 mm, 5-8 mm and 8-15 mm adhesive together urea-formaldehyde (UF) and melamine-urea-formaldehyde (MUF) resin. The manufactured experimental boards were tested for bending (MOR and MOE) and internal bonding (IB) to determine their mechanical properties.

## MATERIAL & METHODS

The bark chips were plastificized for three days at a temperature of 50°C. Subsequently, it desintegrated into leaf particles used a DIEFFENBACHER knife ring flaker MRZ/MSF 1400. The particles were dried in a conventional chamber oven at a temperature of 70°C to a moisture content of 6% and sieved on a screen sorter for the required fractions.



Fig. 1: plastification



Fig. 2: desintegration flaker MRZ/MSF 1400



Fig. 3: drying



Fig. 4: screening

Particle boards were manufactured in the laboratory. The UF and MUF resins were applied by nozzle in a rotary blander. Bark particle mats were formed by hand into a mold with dimensions of 600 × 450 mm and pressed to a thickness of 12 mm at a temperature 180 °C. The pressing process has been 240 seconds at a pressure of 3.5 MPa, and then the pressure was reduced by 0.5 MPa in four steps of 20 seconds.



Fig. 5: rotary blender



Fig. 6: particles inside mold



Fig. 7: formed particles



Fig. 8: press

NAME	DESCRIPTION OF EXPERIMENTAL PARTICLEBOARD
RUF5	reference particlesboard bonded with UF resin of 5% volume
RUF7	reference particlesboard bonded with UF resin of 7% volume
RMUF5	reference particlesboard bonded with MUF resin of 5% volume
RMUF7	reference particlesboard bonded with MUF resin of 7% volume
P25UF5	pine bark particles with size 2-5 mm and bonded with UF resin of 5% volume
P58UF5	pine bark particles with size 5-8 mm and bonded with UF resin of 5% volume
P815UF5	pine bark particles with size 8-15 mm and bonded with UF resin of 5% volume
P25UF7	pine bark particles with size 2-5 mm and bonded with UF resin of 7% volume
P25MUF5	pine bark particles with size 2-5 mm and bonded with MUF resin of 5% volume
P58MUF5	pine bark particles with size 5-8 mm and bonded with MUF resin of 5% volume
P815MUF5	pine bark particles with size 8-15 mm and bonded with MUF resin of 5% volume
P25MUF7	pine bark particles with size 2-5 mm and bonded with MUF resin of 7% volume
S25UF5	spruce bark particles with size 2-5 mm and bonded with UF resin of 5% volume
S58UF5	spruce bark particles with size 5-8 mm and bonded with UF resin of 5% volume
S815UF5	spruce bark particles with size 8-15 mm and bonded with UF resin of 5% volume
S25UF7	spruce bark particles with size 2-5 mm and bonded with UF resin of 7% volume
S25MUF5	spruce bark particles with size 2-5 mm and bonded with MUF resin of 5% volume
S58MUF5	spruce bark particles with size 5-8 mm and bonded with MUF resin of 5% volume
S815MUF5	spruce bark particles with size 8-15 mm and bonded with MUF resin of 5% volume
S25MUF7	spruce bark particles with size 2-5 mm and bonded with MUF resin of 7% volume

Fig. 9: list of abbreviations of pressed experimental boards with explanations

The pressed experimental boards were cut into test specimens according to the European standards for bending EN 310 and EN 319 for internal bonding tests. The samples were placed in an air-conditioned chamber and conditioned at 20 °C and 65% RH. Mechanical testing was carried out on a Zwick®Z050 universal testing machine.

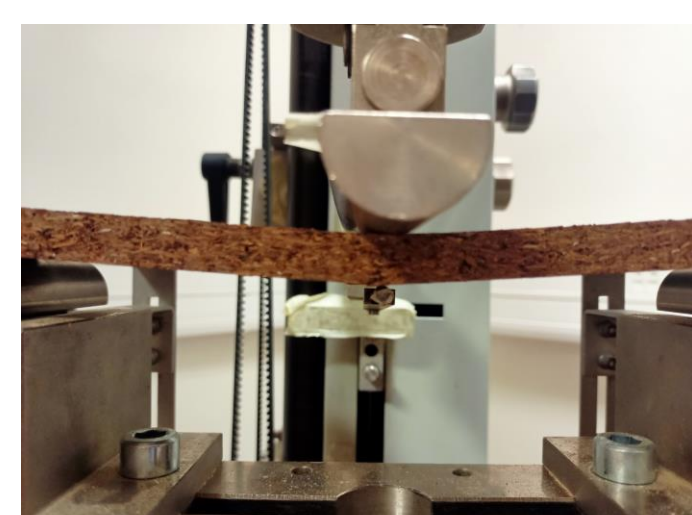


Fig. 10: bending

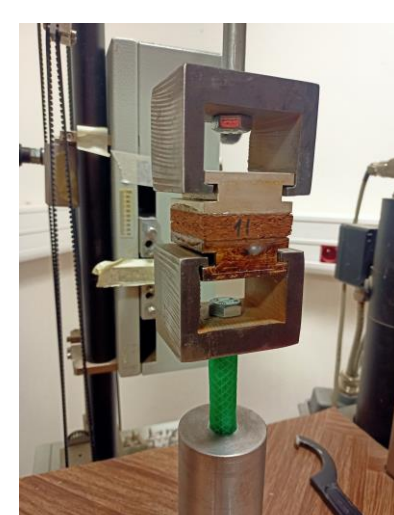


Fig. 11: internal bonding

## RESULTS

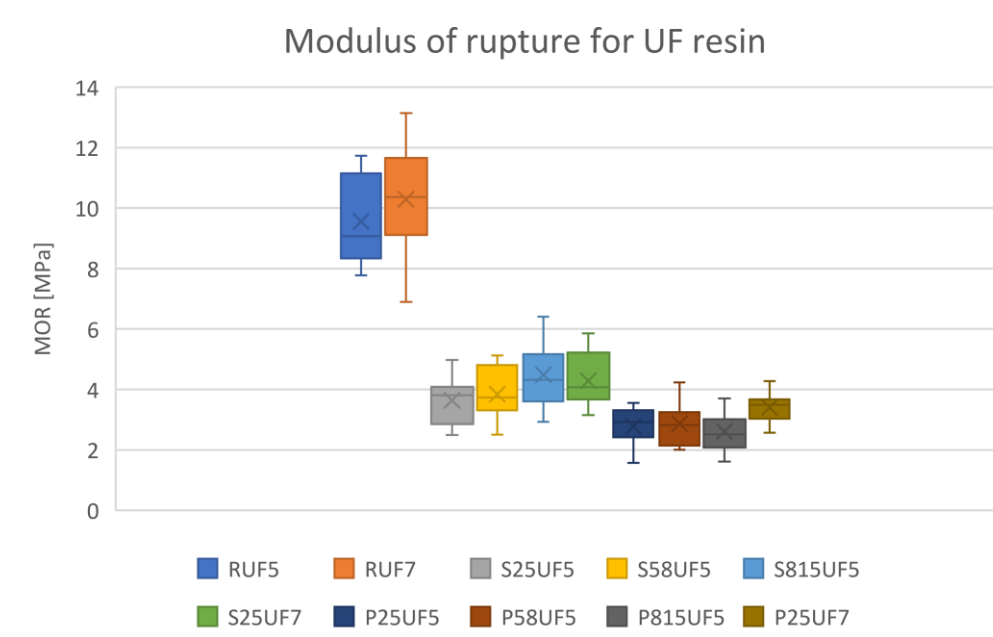


Fig. 12: comparison of modulus of rupture spruce and pine bark testing samples with particle sizes from 2 to 15 mm and reference samples bonded with UF resin.

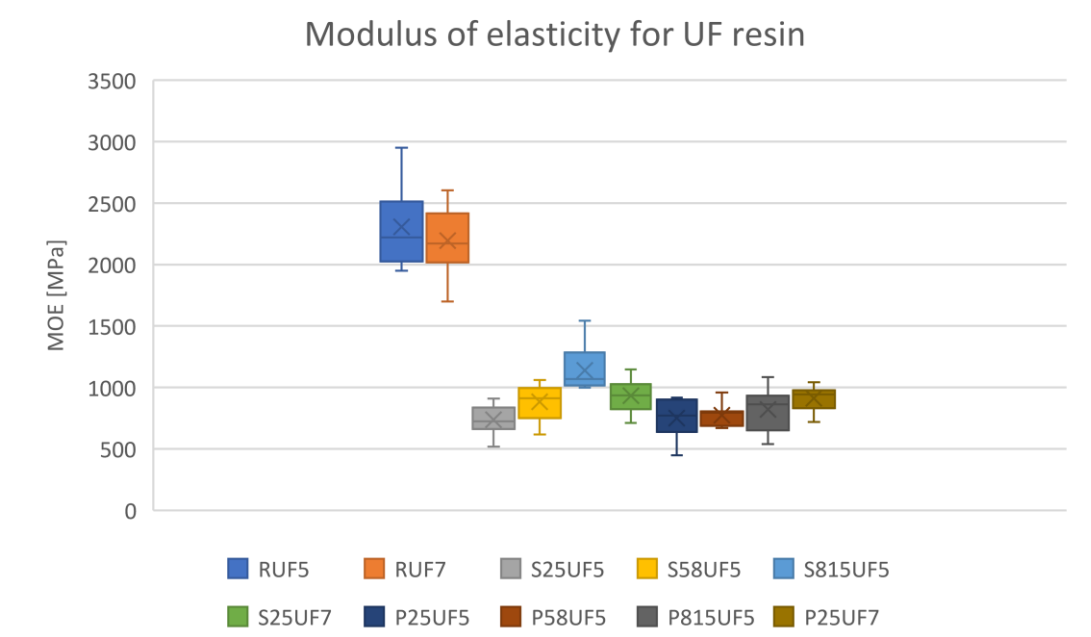


Fig. 13: comparison of modulus of elasticity spruce and pine bark testing samples with particle sizes from 2 to 15 mm and reference samples bonded with UF resin.

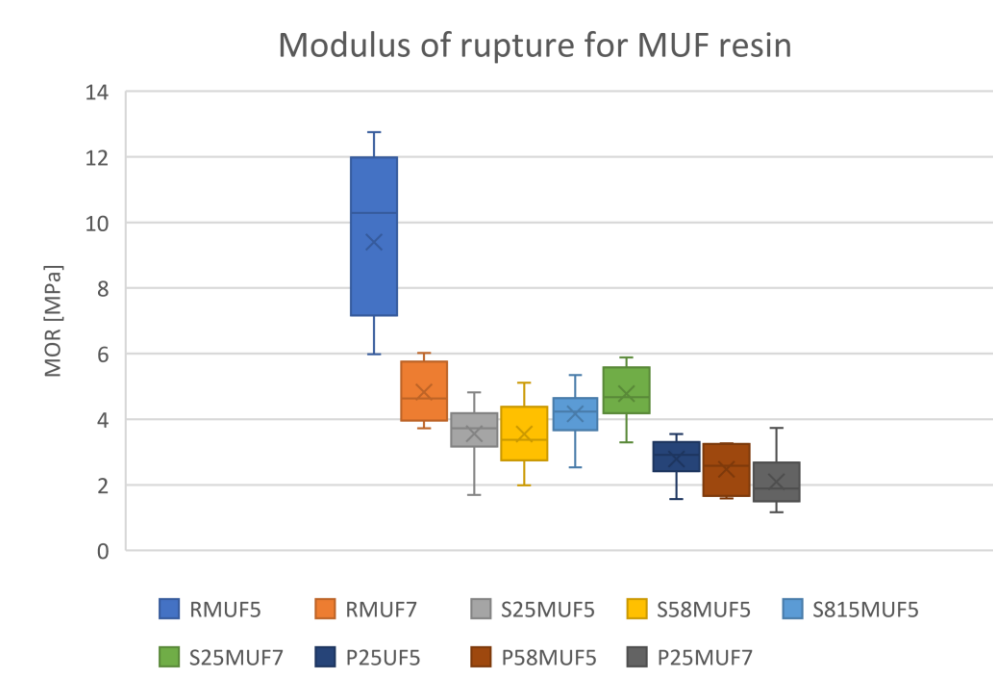


Fig. 14: comparison of modulus of rupture spruce and pine bark testing samples with particle sizes from 2 to 15 mm and reference samples bonded with MUF resin.

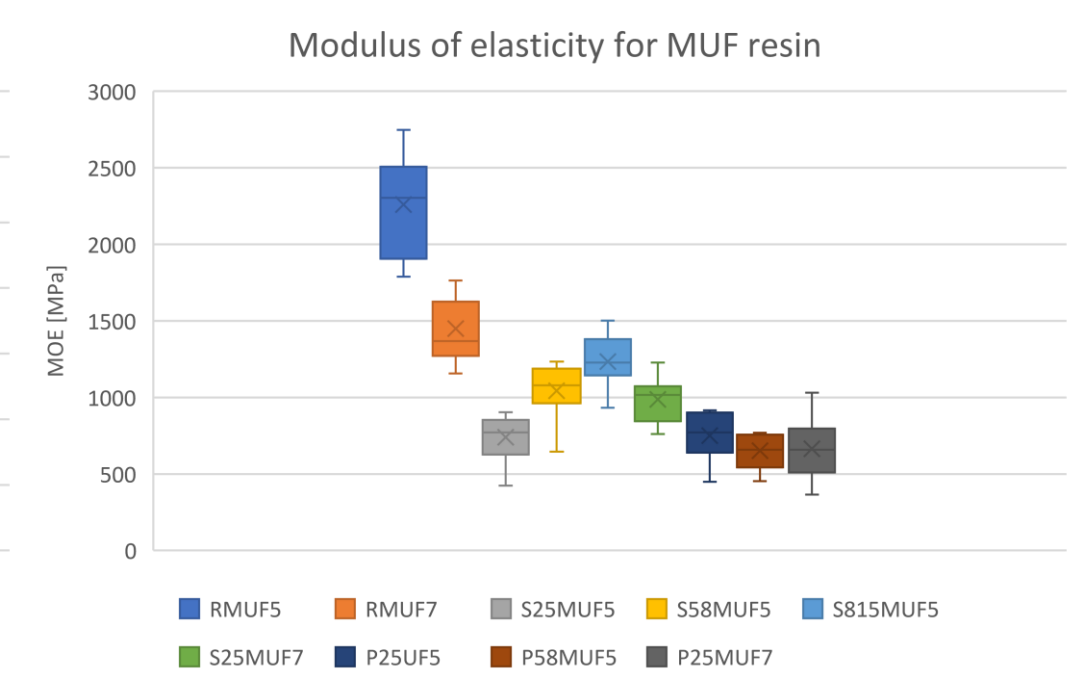


Fig. 15: comparison of modulus of elasticity spruce and pine bark testing samples with particle sizes from 2 to 15 mm and reference samples bonded with MUF resin.

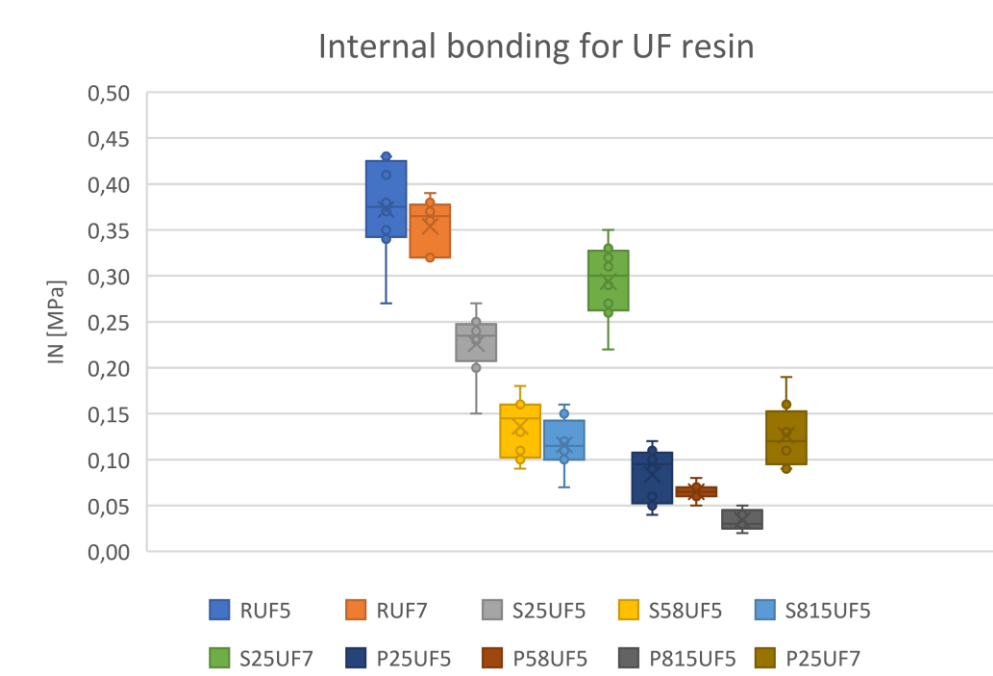


Fig. 16: comparison of internal bonding for spruce and pine bark testing samples with particle sizes from 2 to 15 mm and reference samples bonded with UF resin.

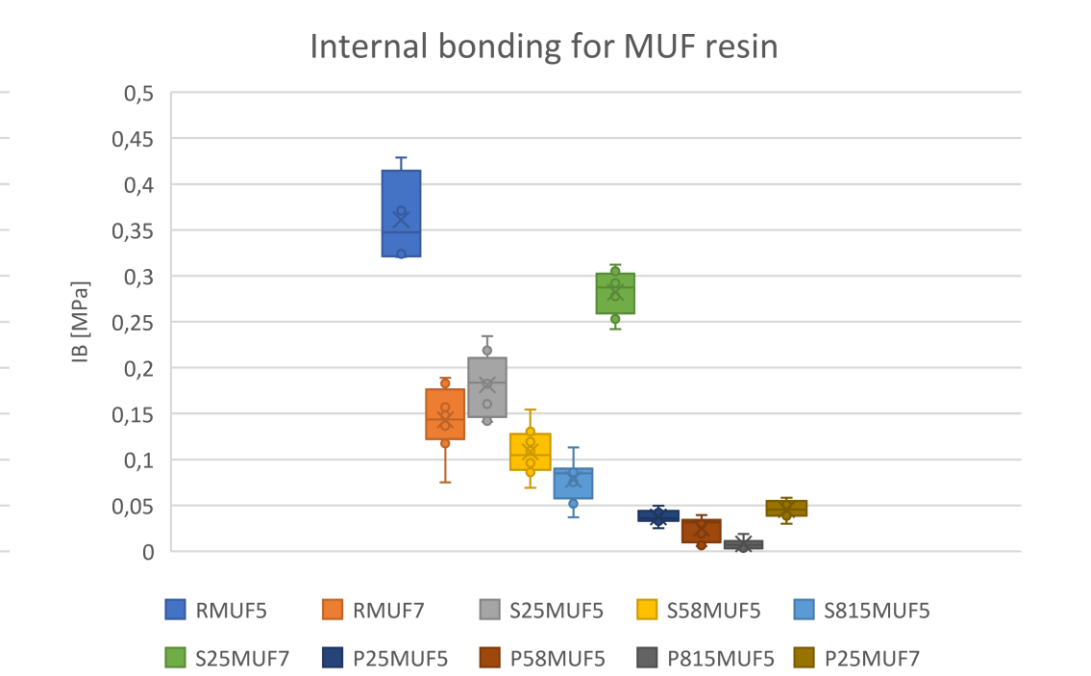


Fig. 17: comparison of internal bonding for spruce and pine bark testing samples with particle sizes from 2 to 15 mm and reference samples bonded with MUF resin.



Fig. 18: failure reference samples bonded with 5% and 7% UF resin after IB testing.



Fig. 19: failure samples from spruce bark bonded with 5% UF resin after IB testing.



Fig. 20: failure samples from pine bark bonded with 5% UF resin after IB testing.

## CONCLUSION

Reference samples bonded with UF resin showed, as expected, many times better bending properties than samples from spruce and pine bark. A slight increase in strength with increasing particle size was observed for spruce bark samples. For pine bark samples, the trend was unchanged or slightly decreasing with increasing particle size. With the percentage increase in the adhesive content, there was a slight increase in the bending properties. For bark samples bonded with MUF resin, the same trend was observed as for samples bonded with UF resin, except for reference samples bonded with 7% MUF resin - it is necessary to repeat the production and testing of the variant. As expected, IB testing produced the best reference samples. The strength of the bark particle samples decreased with increasing particle size, however, samples made from spruce bark particles showed multiple times higher strength than pine bark samples. Increasing the resin content increased the strength of the bark samples. When comparing the results according to the resin used, it emerged that the type of UF and MUF resin had no effect on the mechanical properties.