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Title of thesis EFFECT OF FIRE-RETARDANT TREATMENT ON COMMON ASPEN *(POPULUS TREMULA)* AND SILVER BIRCH (*BETULA PENDULA ROTH*) VENEER PROPERTIES

SUMMARY

Plywood is an important wood-based panel material used for constructional purposes, transportation sector and furniture industry. It is produced by bonding layers the wood veneers crosswise together to form a strong and rigid material by hot pressing. Due to its many applications, plywood is required to fulfil some performance criteria. Being a combustible material, plywood is treated with fire-retardant chemicals to incorporate fire protection. This can be done by either treating readymade plywood panels or impregnation of the veneer sheets with fire retardant chemicals and then bonding them as top layers or top and core layers of plywood. Impregnating veneer samples with fire retardant chemicals has an impact to the bonding properties of the veneers.

This master thesis was focused on preparation of 1.5 mm aspen and birch veneer samples for impregnation tests by different methods and different fire-retardant chemicals, to evaluate the effect of fire-retardant chemical to the fire resistance properties and to study the bonding properties of veneer samples after treatment with fire retardant. In this project, three types of fire retardants (Palonot, Ultra and Burnblock FR) were used to treat wood veneers and two common wood species, aspen (*Populus tremula*) and Silver birch (*Betula pendula Roth*) were used. Phenol formaldehyde and lignin phenol formaldehyde adhesives were used to bond the veneer samples for lap shear strength test.

Three methods of veneer treatments were used. These are, vacuum impregnation, roller coater and spray coating. The impregnation was carried under vacuum pressure of -0.65 bar, at room temperature; rubber roller coater was used to apply fire-retardant chemicals and gravity type spray gun was used to apply chemical on the sprayed samples. Percentage of the solid content of the fire retardants were determined by oven drying method. After treatment of the veneer samples, fire resistance and lap shear strength tests were carried out to determine the effect of the fire-retardants on fire resistance and bonding strength, respectively.

The solid content is the active content of the fire-retardant and higher percentage implied better fire protection. Results from the solid content determination showed that Palonot fire-retardant had the highest concentration of solids followed by Ultra and Burnblock. Generally, vacuum impregnated samples had the highest FR retention when compared to other methods of treatment. Samples treated with Palonot FR performed better during fire test, giving higher protection time. The performance of Palonot FR is directly linked to the solid content of the chemical. Also, samples treated with Palonot charred and remained

together while samples treated with Ultra and Burnblock FR charred and broke into pieces during fire test. It is recommended that if spraying or roller coater is to be used for treatment, fire-retardants with higher concentrating should be used.

Treatment of veneer with fire retardant impacted the bonding properties of the veneers. Treated birch samples gave impressive results compared with the aspen samples. However, the lap shear strength recorded was higher than the values found in literature. In comparison with other treatment methods the vacuum impregnation can be used for fire retardant treatment as the lap-shear tests gave sufficiently good bond strengths.

The aim of this master thesis was accomplished. The influence of different treatment methods and different fire-retardant chemicals to the fire resistance and bond strength properties of birch and aspen veneers were determined. The analysis of the obtained test results enabled to make recommendations for selecting the sufficient fire-retardant chemicals and treatment methods to increase the fire resistance properties of birch and aspen veneers by maintaining the sufficient bond strength.