

The tensile shear strength comparison of the unprotected exterior conditions plywood produced from fir, alnus, pine and poplar wood

Mustafa Öncel^{1,*}, Alperen Kaymakçı¹, Hakan Aydoğan¹, Osman Emre Özkan¹, Emine Gülmez¹

¹ Kastamonu University, Forest Faculty, Forest Industry Engineering, Kastamonu, Turkey

* Corresponding author: moncel@kastamonu.edu.tr

Abstract: Forest products are at the forefront of services provided by nature. Forests are natural resources that meet the needs of human. Moreover, because of its superior properties, it still maintains its importance in many applications today. One of these applications of wood is plywood production. With the production of plywood, wood material can be used more efficiently also, it is possible to obtain large surface materials with high strength properties, less dimensional changes, free from various defects. In this study, plywood samples were obtained from fir, alder, pine and poplar rotary cut veneers with combinations of poplar-pine, poplar-fir, poplar-alder and simple poplar. It is aimed to determine the tensile-shear strength values of these unprotected outdoor plywood's produced by using phenol formaldehyde resin and to determine the effect of wood species on adhesion quality. Generally, Phenol formaldehyde (PF) resins are preferred as adhesives for water resistant plywoods to be used in outdoor environments. For this purpose, test samples were provided by TKS Tosya Veneer and Particle Board Company. In accordance with the instructions of adhesion class 3 and according to TS EN 314-1 and TS EN 314-2, the test specimens were firstly allowed to cool in water for at least 1 hour at $(20 \pm 3) ^\circ \text{C}$. Secondly they were immersed in boiling water for 4 hours, then dried at $60 \pm 3 ^\circ \text{C}$ for 16-20 hours in an air-circulating drying oven. Thirdly, they were immersed in boiling water for 4 hours. After this process, samples were allowed to cool down in water for at least 1 hour at $(20 \pm 3) ^\circ \text{C}$, and the excess water on them was gently wiped off and then tested for adhesion quality in a Shimadzu™ brand universal tester. The test speed was adjusted so that the sample was separated in 1 minute. The obtained data were analyzed statistically by using SPSS 22 statistical program. As a result of the study, the plywood produced from the poplar wood had the lowest tensile-shear strength. The highest tensile-shear strength was determined in poplar-alder and poplar-fir plywoods. Statistically, no difference was found between these plywoods in terms of tensile-shear strength value. In order of the test results, the second highest degree of tensile-shear strength was determined in poplar-pine plywood. The obtained tensile-shear strength values were determined to be higher than the minimum value of 1N/mm^2 determined for the unprotected exterior conditions plywoods specified in TS EN 314-2. These plywoods are thought to be used in outdoor conditions.

Keywords: Plywood, Tensile-shear strength, Adhesion quality, Wood veneers, Unprotected exterior conditions plywood