



Short Communication

Effect of curing pressure on Glue shear strength of 7 & 9-ply combination from *Melia composita* and *Populus deltoides*

Ismita N.

Forest Research Institute, P.O. New Forest, Dehradun-248006, India
manishranjan509@gmail.com

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Abstract

The study was carried out on preparation of combination plywood from *Populus deltoides* (P) and *Melia composita* (M). Four combinations with alternate arrangement of veneers for 7 ply and 9 ply (two each) were tried. Effect of two pressure levels viz. 14.0 kg/cm² and 17.5 kg/cm² and four combinations of veneers (PMPMPMP, MPMPMPM, PMPMPMPMP and MPMPMPMPM) were studied. The dry and wet glue shear strength at all four combinations passed Indian standard IS: 303(1983).

Keywords: Combination Plywood, Glue shear strength, Poplar (P), Melia (M).

Introduction

Plywood industry has been experiencing dearth of timber for past few decades. Utilization of plantation timbers and other lesser known timbers for making plywood has become need of the hour. Presently plywood is manufactured mainly from plantation timbers like poplar and eucalyptus. Their large scale plantations are being raised in different parts of the country. The suitability of poplar for plywood is well established^{1,2}.

Apart from the problem of raw material shortage, it has been found that plywood made of a single wood species has some drawbacks too. Combi-ply is plywood which is made up of combination of two or more wood species. Combi-plywood possess lot of advantages and can meet requirements for construction, joinery, furniture and transport industries where high strength throughout plywood is not required. Combi-ply using poplar and eucalyptus has already been reported^{3,4}.

The suitability of poplar for combination plywood is well established⁵. *Melia composita* has been identified as an important fast growing secondary species suitable for the manufacture of plywood⁶. An earlier work on 3 & 5 ply from *M. composita* and polar combination was reported to be successful⁷. The present study was carried out to investigate the suitability of *M. composita* for manufacture plywood in combination with poplar for 7 & 9 ply combinations.

Materials and Methods

Veneers of 2.00 mm thickness were obtained from logs of Polar and *Melia composita*. They were air dried to 8- 10 % moisture content. The dried veneers were utilized for making 7-ply and 9-ply boards, using Phenol Formaldehyde as the binding agent.

The amount of glue applied was about 110 gm/m² in single glue spread on solid basis. Veneers of both the species were laid in alternate combination to form 7 & 9 Ply combination (PMPMPMP, MPMPMPM, PMPMPMPMP and MPMPMPMPM). They were then pressed in hot press at 150^o C at two different pressure levels viz. 14.0 kg/cm² and 17.5 kg/cm². The duration of pressing was kept constant for 11 minutes. The prepared boards were conditioned at room temperature. Test samples were prepared from these boards for glue shear strength test as per IS: 1734 (Anon., 1983). The glue adhesion test was conducted under two different conditions viz. glue shear strength test in Dry state and water resistance test.

Six samples were prepared from each board for each test. The dimensions of all the test samples were in accordance with IS: 1734 (Part-4). In the glue Shear strength test in Dry state the tenacity of the bonding material is estimated. The samples were conditioned at room temperature (27± 5^o C). The maximum load at the time of complete failure of each specimen along with the extent of glue shear failure (percentage) was recorded. For BWR (Boiling Water Resistance) grade, the samples were submerged in boiling water for a period of 8 hours. The wet sample pieces were then subjected to glue shear strength test. (IS:-1734 Part-6 Anon, 1983). One-way Analysis of variance (ANOVA) was carried out to find out the effect of the two pressure levels used in the study on all combinations.

Results and Discussion

The study was carried out for Glue shear strength of two combinations of 7-ply (PMPMPMP and MPMPMPM) and two combinations of 9-ply (PMPMPMPMP and MPMPMPMP) in dry and wet state samples. For general purpose plywood (BWR grade), the glue shear strength average minimum values for dry

test and water resistance test should be 135 kg and 100 kg respectively as per IS: 303⁹. Density of plywood for all four combinations ranged from 0.5 to 0.57 kg/m³.

Glue Shear Strength of dry and wet samples at the two pressure levels: - All four combinations of plywood prepared at both the pressure levels met IS: 303(1989) except PMPMPMPMP combination pressed at 17.5 kg/cm² for wet samples (Table-1).

Effect of Pressure levels on dry and wet Glue shear Strength: - The two pressures used in the study did not exhibit significant differences in the Dry glue shear strength (DGSS) and wet glue shear strength (WGSS) for PMPMPMP and MPMPMPM and MPMPMPMPM combinations except for DGSS and WGSS of PMPMPMPMP combination (Table-2). Thus it may be inferred that pressures of 14.0 kg/cm² and 17.5 kg/cm² are equally good for DGSS and WGSS in all combinations. Similar results were observed for all four combinations of 3-ply & 5 ply as reports by Ismita and Gautum (2016)⁷.

Table-1
Glue shear strength of wet and dry samples at two pressure levels

S. No	combination	Ply Size Inches	Resin	Pressure (Kg/cm ²)	Average glue shear strength	
					Dry condition FL (Kg)	Wet condition FL (Kg)
1.	PMPMPMP	15x15	PF	14.0	159	138
2.	PMPMPMP			17.5	179	132
3.	MPMPMPM			14.0	168	125
4.	MPMPMPM			17.5	168	129
5.	PMPMPMPMP			14.0	184	138
6.	PMPMPMPMP			17.5	117	88
7.	MPMPMPMPM			14.0	176	159
8.	MPMPMPMPM			17.5	141	121

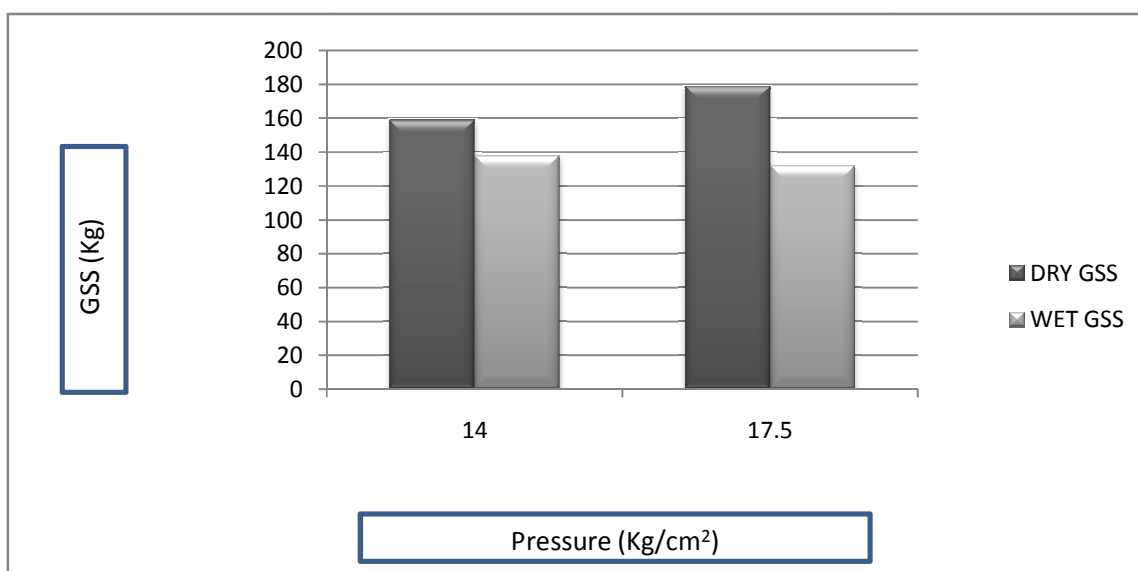


Figure-1
Glue shear strength for PMPMPMP combination

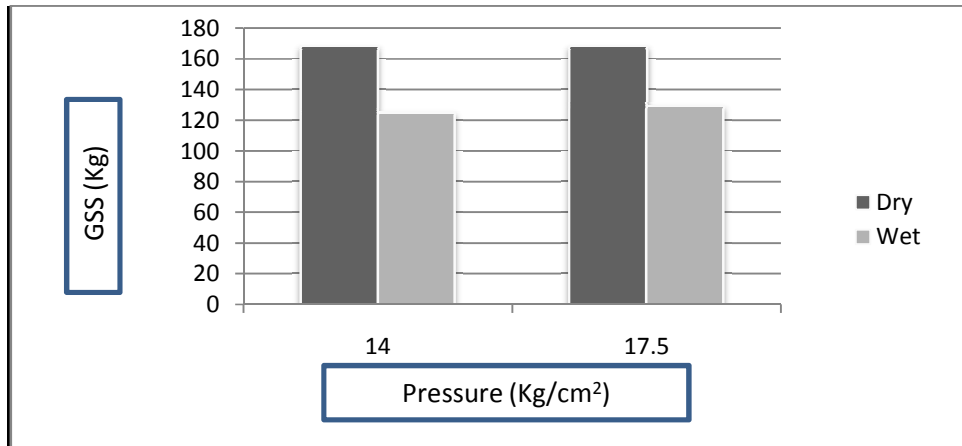


Figure-2
Glue shear strength for MPMPMPM combination

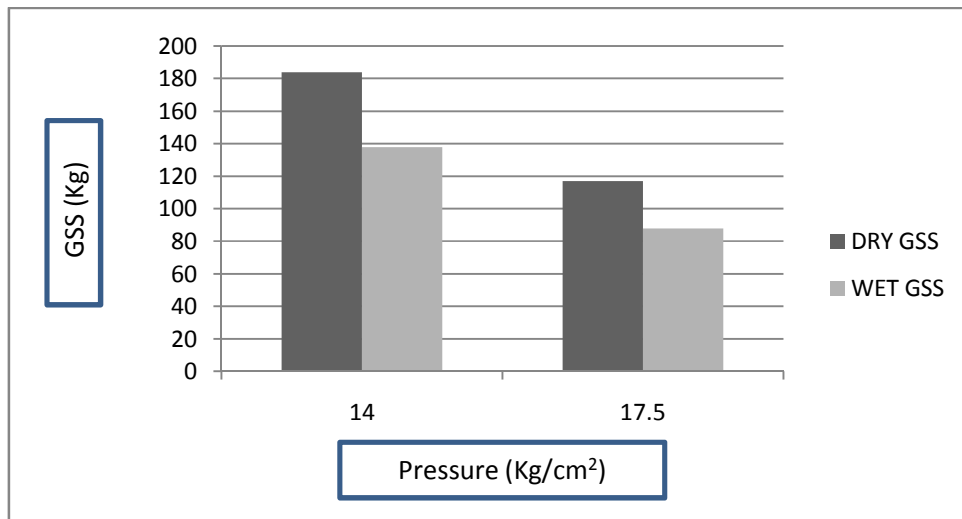


Figure-3
Glue shear strength for PMPMPMPMP combination

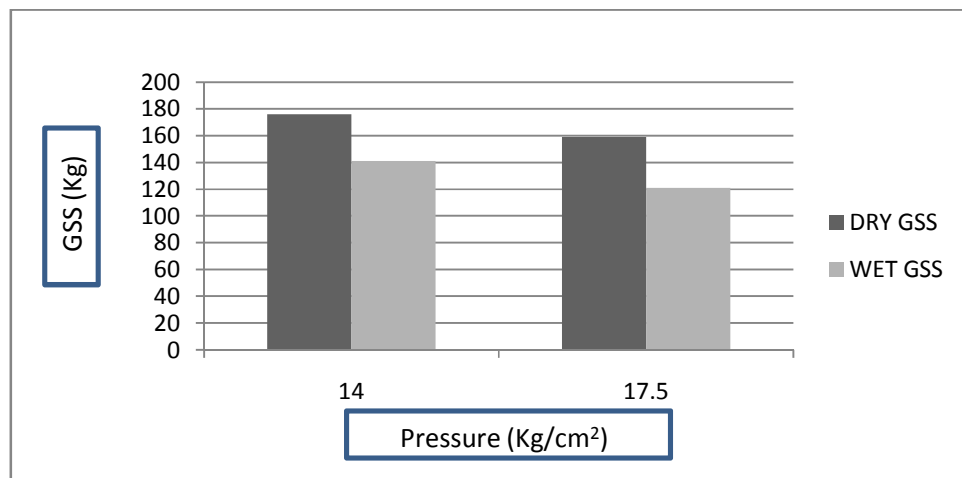


Figure-4
Glue shear strength for MPMPMPMPM combination

Table-2
ANOVA

Combination	Source of variation	df	Mean Square	F	Sig.
PMPMPMP (DGSS)	Pressure levels	1	2223.375	3.127	.091
	Error	22	710.981		
PMPMPMP (WGSS)	Pressure levels	1	210.042	.455	.507
	Error	22	461.254		
MPMPMPM (DGSS)	Pressure level	1	4.167	.003	.957
	Error	22	1402.530		
MPMPMPM (WGSS)	Pressure level	1	88.167	.093	.763
	Error	22	945.652		
PMPMPMPMP (DGSS)	Pressure levels	1	26934.000	25.219	.000
	Error	22	1068.023		
PMPMPMPMP (WGSS)	Pressure levels	1	14850.375	41.041	.000
	Error	22	361.845		
MPMPMPMPM (DGSS)	Pressure levels	1	1768.167	1.383	.252
	Error	22	1278.106		
MPMPMPMPM(WGSS)	Pressure levels	1	2501.042	2.234	.149
	Error	22	1119.527		

*significant at level 0.05

Conclusion

The suitability of 7 & 9 ply combination (BWR grade) of *Melia composita* and *Populus deltoides* was studied. Glue shear strength of all combinations met requirement of IS: 303 (1989) except the 9-ply (PMPMPMPM) combination wet test samples at 17.5 kg/cm². The findings of the study indicate that pressure was not significantly affecting GSS for dry and wet samples in given combinations. These findings are in accordance with previous for 3 & 5 ply combinations of *Melia* and poplar (Ismita and Gautum 2016). Pressure has shown significant effect on GSS for PMPMPMPMP combination. This requires further investigation.

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