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IUFRO Division 5 Conference
**5.05A Using Plantation and small-diameter
timber in composites**



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**The use of waste Banknote paper in
Particleboard Manufacturing**

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Aim of work and methods

To evaluate the potential for producing three layer composite panels from old waste banknote paper by using:

- Industrial wood particles and old banknote wastes
- Determining the sieve analysis of wood and old banknote particles and their pH
- Producing Three-layer laboratory panels from mix wood and banknote particles in core layer and wood particle in face layers using urea-formaldehyde with specification of pH=7.3 , viscosity=200cp , density=1.3g/cm³ , Solid content=59.8 %.
- Measuring physical and mechanical properties of panels



Conditions of treatments

Press time min	Press temp. °C	Banknote particle / Wood particle %
5	160 180	0/100
		10/90
		20/80
		30/70
7	160 180	0/100
		10/90
		20/80
		30/70



Results

Table 1 Physical and mechanical properties of panels in various treatment

Press time min	Press Te mp. °C	Banknote Particl e content %	MOR Mpa	MOE Mpa	IB Mpa	Thickness Swelling %	Water Adsorp tion %
		0	18.4	1993	1.32	31.4	76.0
		10	19.3	2098	1.54	32.2	78.3
	160	20	19.3	2150	1.57	29.9	74.9
		30	20.0	1531	1.58	34.4	70.6
5							
		0	15.5	2024	0.80	34.4	71.8
		10	16.3	1972	1.01	29.8	75.8
	180	20	17.6	2070	0.93	28.1	71.6
		30	17.8	2077	1.02	28.9	67.9

Results

Continue Table 1 Physical and mechanical properties of panels in various treatment

Press time min	Press Temp. °C	Banknote Particle content %	MOR Mpa	MOE Mpa	IB Mpa	Thickness Swelling %	Water Adsorption %
		0	15.3	1932	0.66	34.8	70.7
	160	10	16.1	1916	0.76	33.6	72.4
		20	15.5	1971	0.75	32.4	69.6
		30	17.6	1379	0.84	29.1	70.8
7							
		0	14.1	1767	0.59	33.3	75.1
	180	10	14.6	1762	0.56	30.4	72.6
		20	14.7	1852	0.62	30.5	73.6
		30	15.5	1818	0.75	27.6	68.1

Results

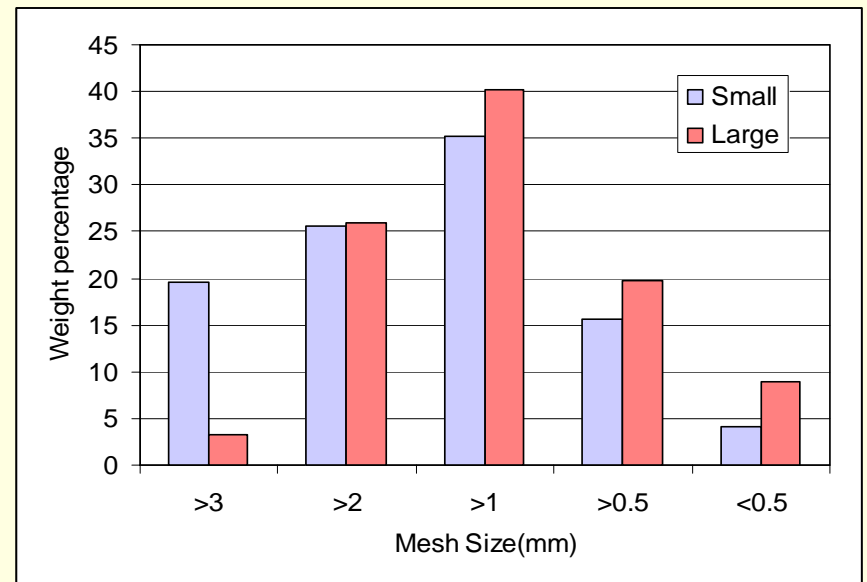
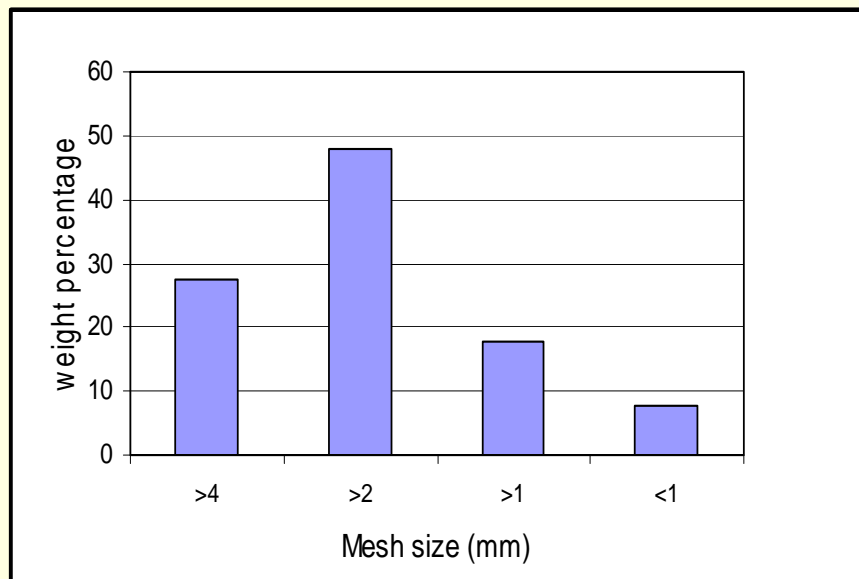


Figure 1 Banknote Particle weight distribution by sieve analysis **Figure 2** Wood Particle weight distribution by sieve analysis

Results

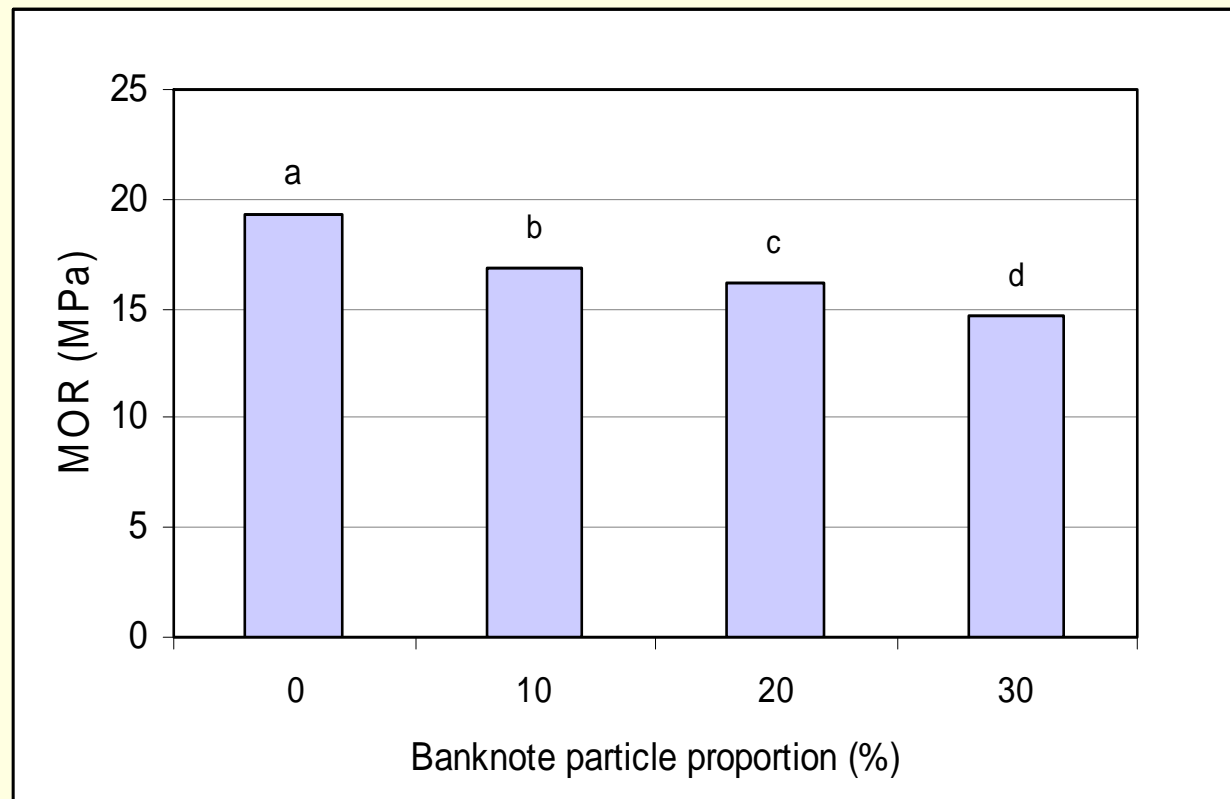


Figure 3 Influence of banknote particle proportion on MOR

Results

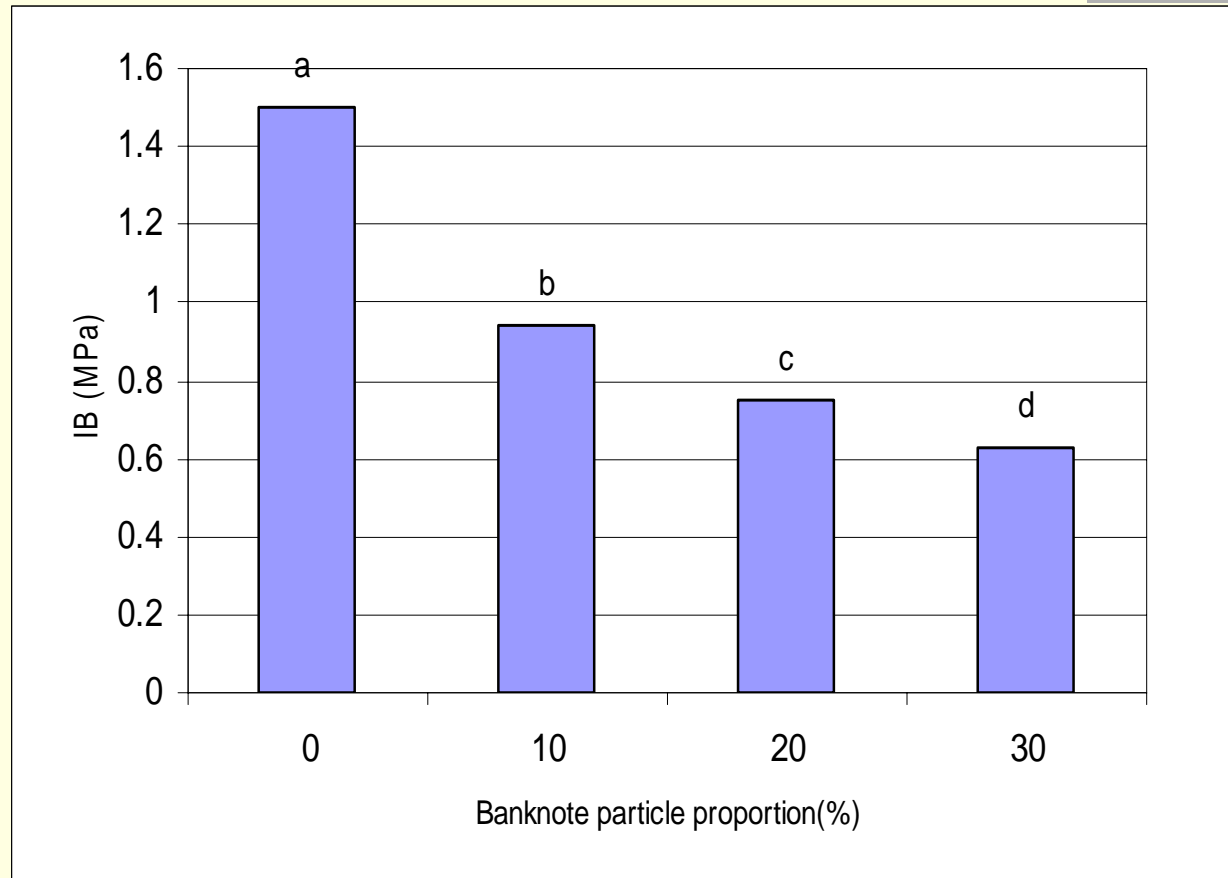


Figure 4 Influence of banknote particle proportion on internal bond

Results

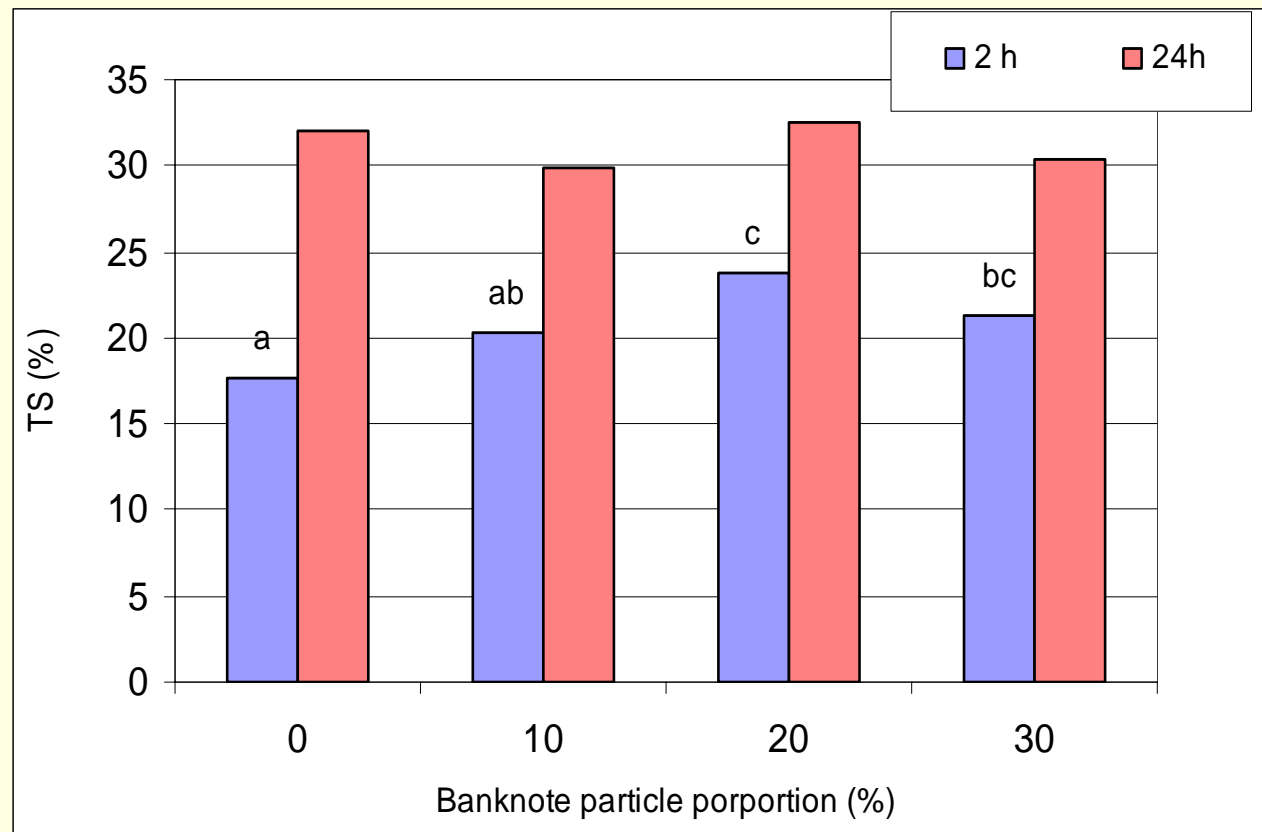


Figure 5 Influence of banknote particle proportion on thickness swelling

Conclusion

- ✓ physical and mechanical properties of panels produced using 30 percent banknote particle in combination with wood particles in the core layer, 5 minutes and 160°C upon press time-and temperature, had comparable value with EN standard for this type of panels, could be recommended as the best combination for the particleboard application .

