



WOOD CEMENT COMPOSITES MANUFACTURED FROM FAST GROWING SPECIES IN TURKEY

**MUSTAFA ASLAN
DEPARTMENT OF FOREST PRODUCTS
KARADENİZ TECHNICAL UNIVERSITY
TRABZON, TURKEY**

**IUFRO All Division 5 Conference
Forest Product and Environment: A Productive Symbiosis
Taipei - TAIWAN
2007**

Wood Cement Composites

Construction material produced mixing wood, cement, and water

According to Wood Particle Size ;

- | | | | |
|----------------------------|------|----------------------|-----------|
| ▪ Cement Particleboards | WPCB | (kg/m ³) | 1240-1450 |
| ▪ Wood Fiber cement boards | WFCB | (kg/m ³) | 1000-1800 |
| ▪ Wood Wool Cement Boards | WWCB | (kg/m ³) | 350-500 |



Raw Materials

- **Wood ; Filler material**
 - Pine, Spruce etc. Softwoods species
 - Eucalyptus, Acacia etc. hardwoods species
 - Non wood species (Bamboo)
 - Wood industrial wastes and agricultural residues
 - **Cement; Matrix material**
 - Portland Cement
 - **Additives ; Accelerate of reaction**
 - CaCl_2 , Al_2SO_4 , SnCl_2 , AlCl_3 , NaSiO_2
 - **Water; Initiative of Reaction**
- 

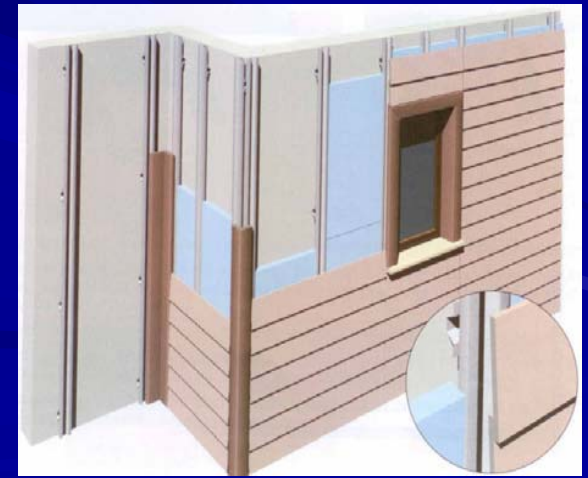
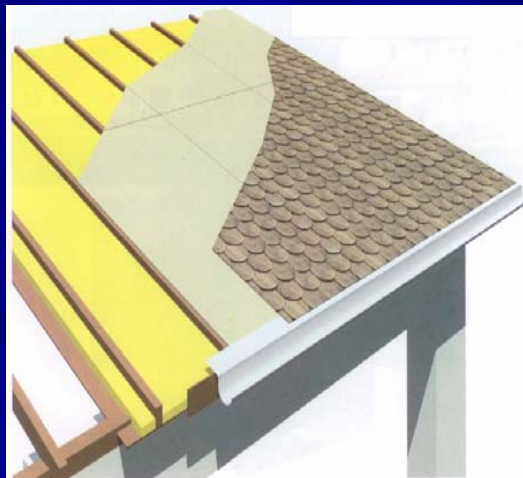
Properties of Material and Usage



- basements
- floor units
- sound insulation in walls, ceilings and floors and mainroad
- roofs
- thermal insulation
- important properties such as fire, water, termite and fungi resistance
- relative low price of products



Applications



Objectives

- Experimental manufacturing of wood cement composite panels from species of eucalyptus, spruce and alder
- To establish initial data about the properties of the panels.
- To determine physical and mechanical properties of the samples and compare them to those of commercially produced panels.

Raw Materials

■ Wood

- Eucalyptus (*Eucalyptus camaldulensis*)
- Alder (*Alnus Glitunosa*)
- Spruce (*Picea orientalis*)

■ Cement: PC 42.5 Portland Cement

■ Accelerators : $\text{Al}(\text{SO}_4)_3$, NaSiO_2

■ Catalyzer: Water

Spreading area and quantity

EASTERN SPRUCE (*Picea orientalis*)



The area of Spruce (*P. Orientalis*) trees is about 146,300 hectares

The area of Alder (*A. Glutinosa* var. *Orientalis*) trees is about 66,654 hectares

The area of eucalyptus trees is about 20000 hectares



Preparing Wood Material

Wood Chipper



Wood Hammer Mill



Circular screen



Particles are differentiated to their dimensions in circular sieve



Coarse and Fine particles

Panel Production

- Spreading chemicals and water, Mixture and Forming



Raw Material Ratios

(56 cm-56cm-1,8cm - 1,2 g/cm³)

Raw Material	Ratio
Wood / Cement	1:2,75
Water / Cement	1:1,64
Al ₂ SO _{4(s)} (% based on cement)	1,5
Na ₂ SiO _{2(l)} (% based on cement)	3,5
Surface layer/ Core Layer (%)	40 / 60

- **Press parameters:**

Pressure: 5,5 MPa

Press time : 24 hours

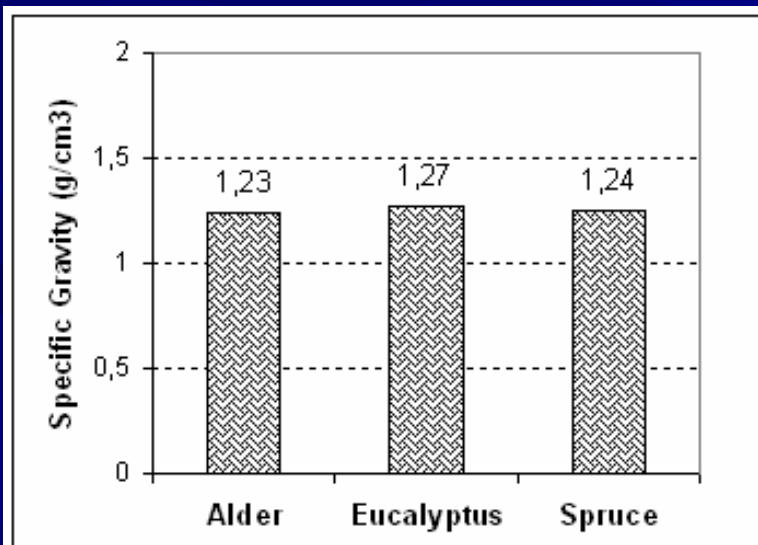
Press temp.: 60 C (first 8 hours)



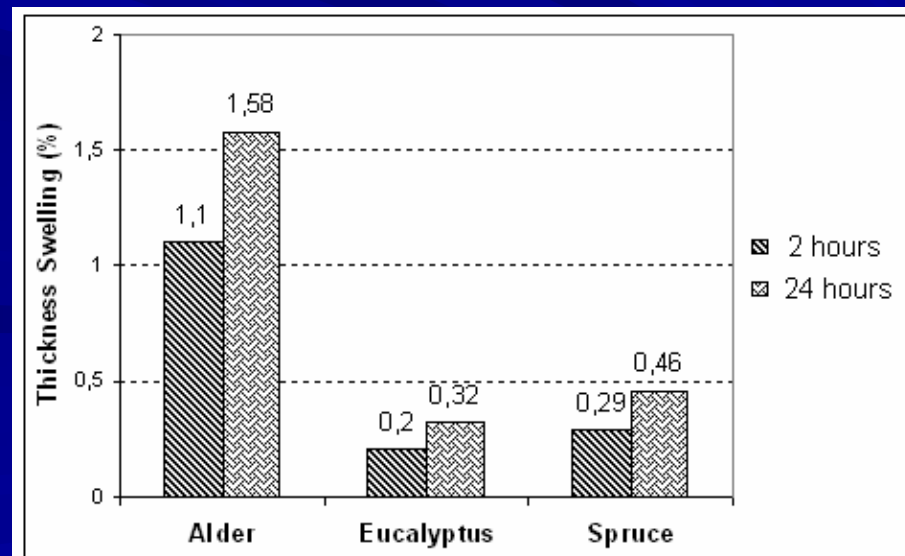
Physical Properties



Specific Gravity



Thickness Swelling



Mechanical Properties:

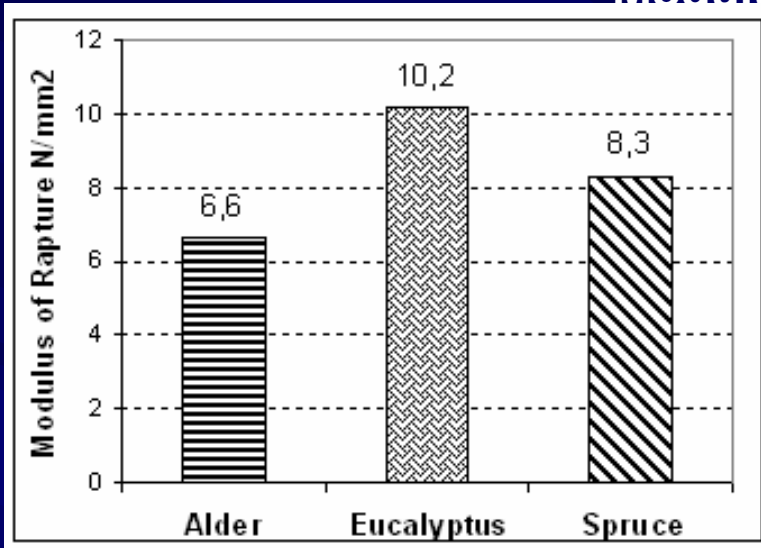
- Modulus of Raprure and Modulus of Elasticity (EN 310)



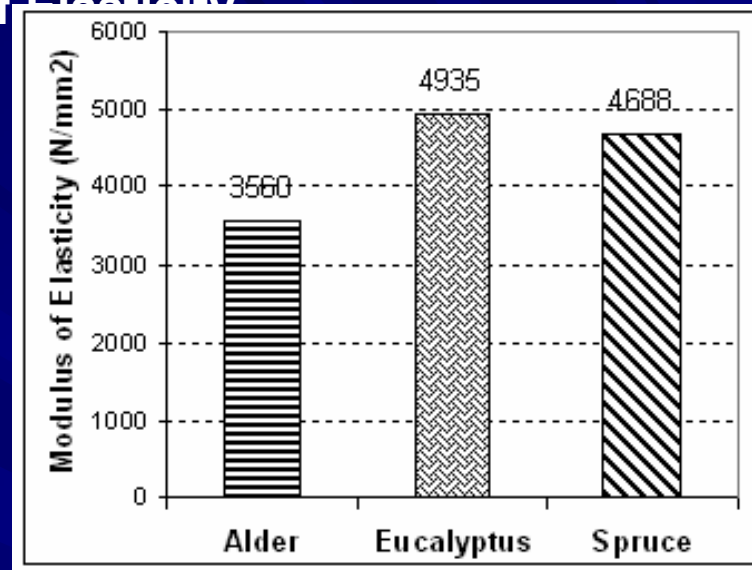
- Internal Bond (EN 319)



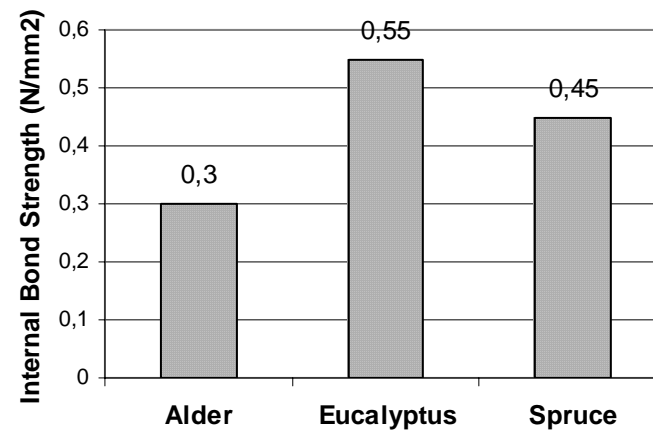
Modulus of Rapture



Modulus of Elasticity



Internal Bond Strength



Conclutions

- Sypruce and Eucalyptus are convenient for wood cement composites as mechanical properties that those are comparable to typical commercial WCPB
- Although WCPB panels made from 100%Eucalyptus gave reasonable results according to EN Standards %100 Alder WCPB panels gave unsuitable properties for commercial production as fast growing species in Turkey
- Three-layer of mixed particle of raw material at different ratio would give a better understanding of the panel properties.
- It appears that particleboard panels made from mixing Eucalyptus and Spruce may give better results than other groups.



Karadeniz Technical University

QUESTIONS & COMMENTS

THANK YOU

