



EFFECTS OF ACETIC AND NITRIC ACID PRE-TREATMENT ON COPPER CONTENT OF SPRUCE WOOD TREATED WITH CBA-A AND CCA

Sibel Yıldız, Eylem Dizman, Ümit C. Yıldız

- **Karadeniz Technical University, Faculty of Forestry, 61080, Trabzon / TÜRKİYE**



Spruce is known to be refractory wood species.

This study investigates the effects of nitric and acetic acid pre-treatment on

- copper retention**
- compression strength and**
- decay resistance**

of spruce wood (*Picea orientalis* L.) treated with copper azole (CBA-A) and copper / crom / arsenic (CCA).

EXPERIMENTAL METHODS



Wood species

Picea orientalis

2 x 2 x 3 cm



Chemicals



% 2 CCA

% 2 CBA-A

➤ Nitric acid

➤ Acetic acid



-50/50 pre-diluted nitric acid (a 65 percent solution)

- acetic acid (2 %, v / v) aqueous solutions

two different immersing durations

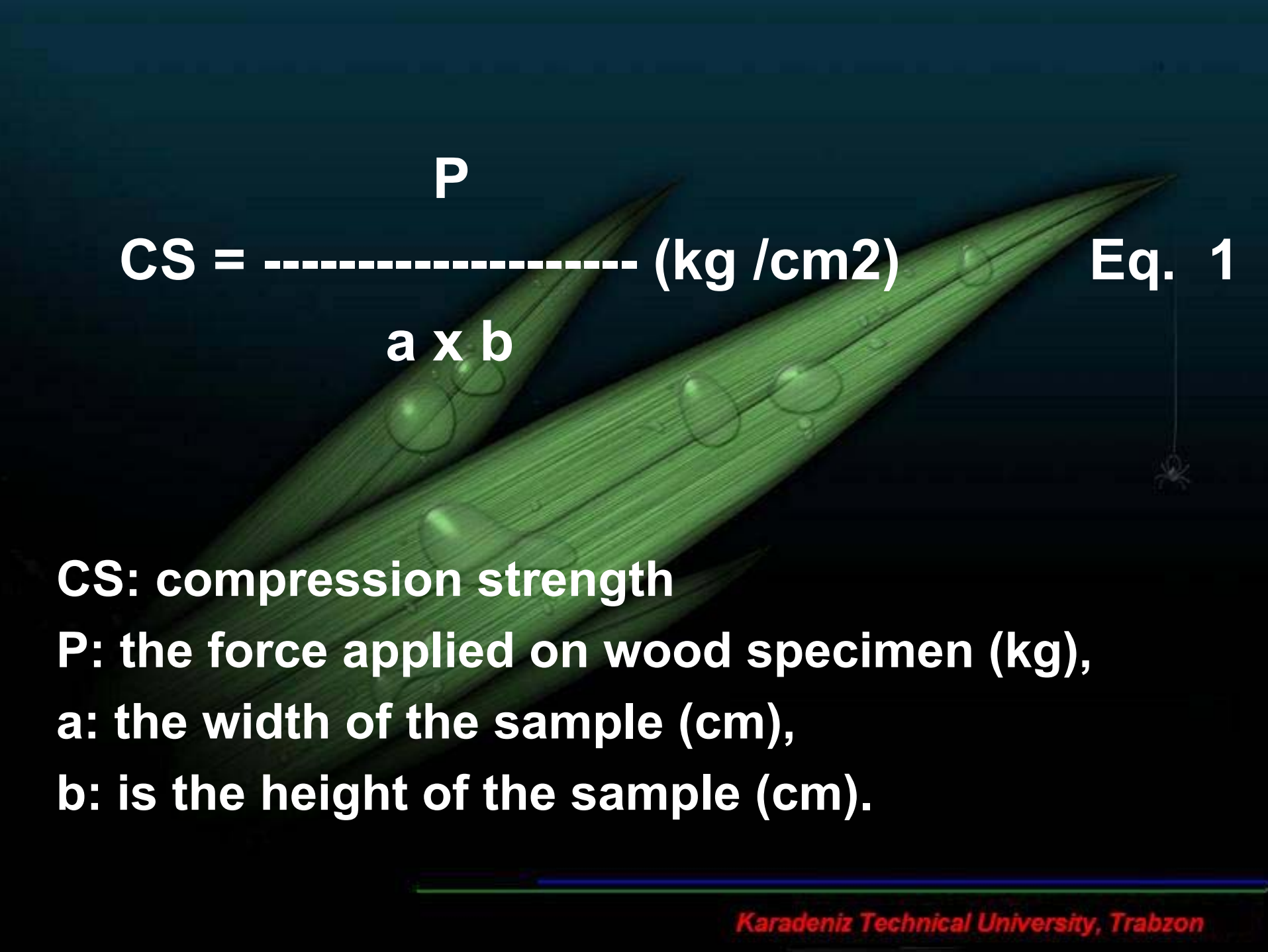


- **3 hours** (in nitric acid solution)
- **3 hours** (in acetic acid solution)



- **6 hours** (in nitric acid solution)
- **6 hours** (in acetic acid solution)

at room temperature.


$$CS = \frac{P}{a \times b} \text{ (kg /cm}^2\text{)} \quad \text{Eq. 1}$$

CS: compression strength

P: the force applied on wood specimen (kg),

a: the width of the sample (cm),

b: is the height of the sample (cm).

DECAY TEST



- Decay resistance test, according to the EN 113 standard
- Dimension of the specimen; 5 x 10 x 15mm
- Brown-rot fungi; *Coniophora puteana*

- Weight loss of each sample caused by fungi is given by Eq.(2):






$$\text{Weight loses (\%)} = \frac{m_0 - m_d}{m_0} \times 100 \quad \text{Eq.(2)}$$

m_0 : dry mass prior to test
 m_d : dry mass after the test

The background of the slide features a close-up photograph of several green, pointed leaves, likely from a plant like a bamboo or reed. The leaves are covered with numerous clear water droplets of various sizes, which are in sharp focus. The lighting is soft, highlighting the texture of the leaves and the glistening surface of the water. The overall color palette is dominated by various shades of green and blue, with the water droplets providing a bright, reflective contrast.

RESULTS AND DISCUSSION

Table 1: Copper (Cu) contents of spruce wood specimens pre-treated with nitric and acetic acid solutions

Preservative type	Treatment Duration [h]	Cu contents [ppm] X
CCA	3 hours / Nitric acid	252 
	6 hours / Nitric acid	342
	3 hours / Acetic acid	419
	6 hours / Acetic acid	450 
CBA-A	3 hours / Nitric acid	286 
	6 hours / Nitric acid	345
	3 hours / Acetic acid	395
	6 hours / Acetic acid	481 
CCA (control)	-	282
CBA-A(control)	-	302

X: Mean

Ratio of increase in Cu content (%)

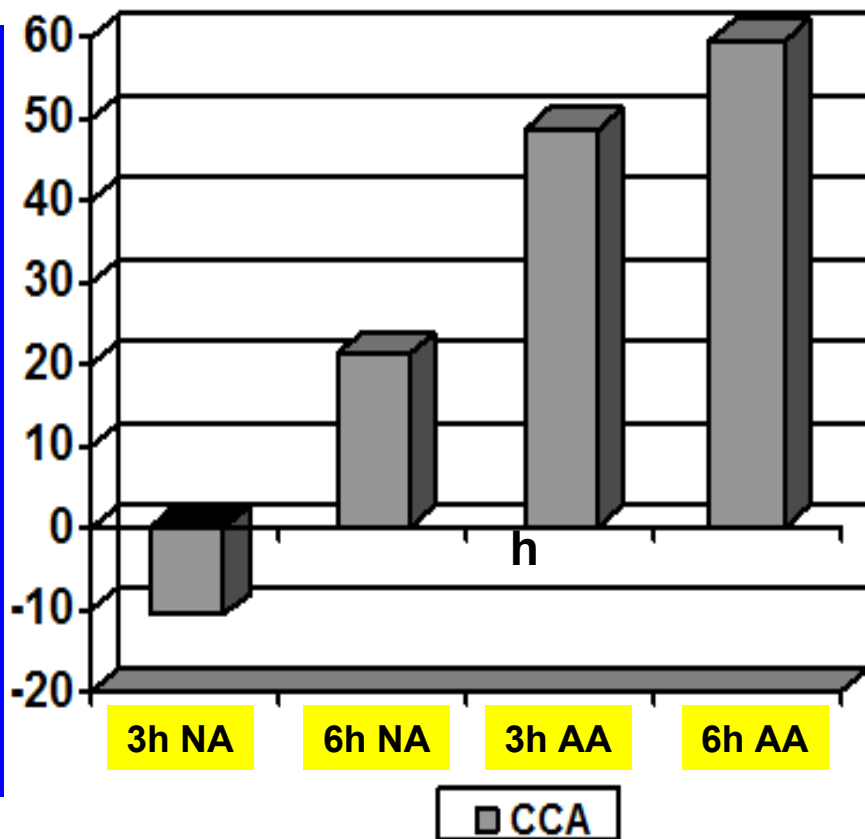


Fig 1. Ratio of increase of copper content in CCA impregnation

Ratio of increase in Cu content (%)

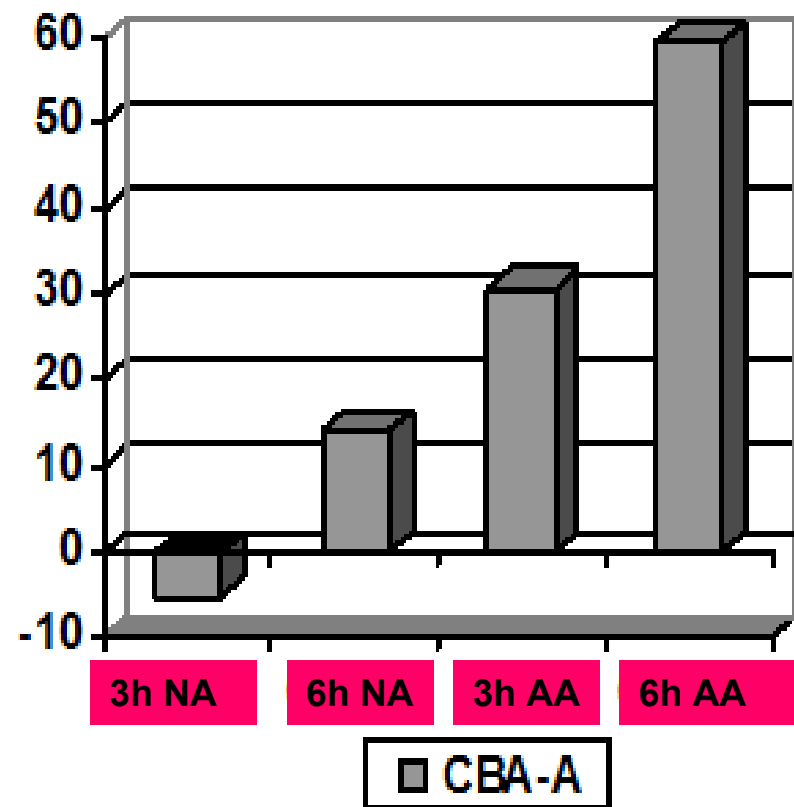


Fig 2. Ratio of increase of copper content in CBA-A impregnation

Table 2: Compression strength values of spruce wood specimens pre-treated with nitric and acetic acid solutions

Preservative type	Treatment Duration [h]	Compression Strength [kg / cm ²]	
		X	Sd
CCA	3 hours / Nitric acid	388	27
	6 hours / Nitric acid	447	26
	3 hours / Acetic acid	468	29
	6 hours / Acetic acid	475	13
CBA-A	3 hours / Nitric acid	465	15
	6 hours / Nitric acid	445	27
	3 hours / Acetic acid	495	24
	6 hours / Acetic acid	498	18
CCA (control)	-	405	6
CBA-A(control)	-	405	8
CONTROL	Non-treated	440	19

X: Mean , Sd: Standard deviation

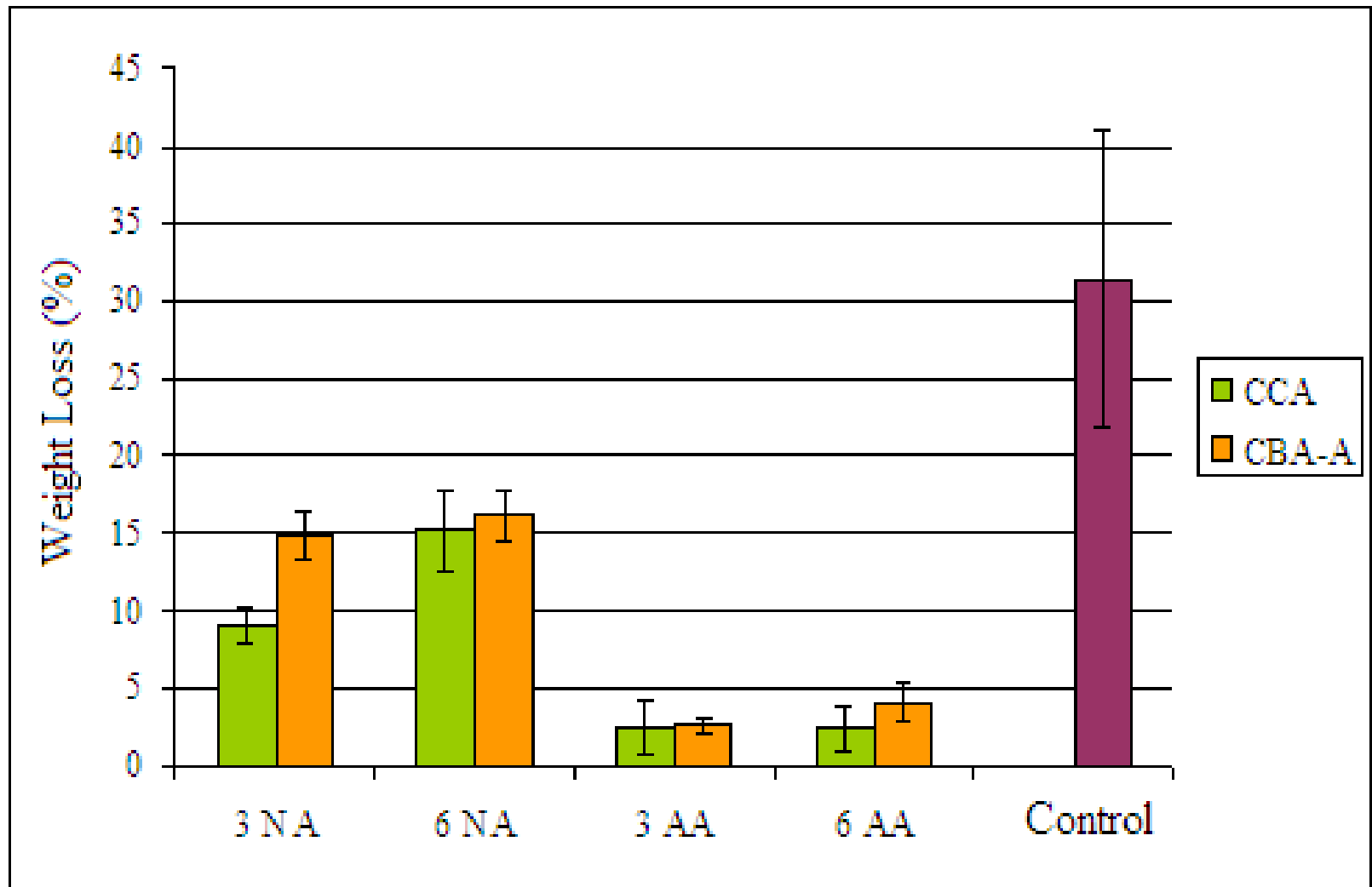
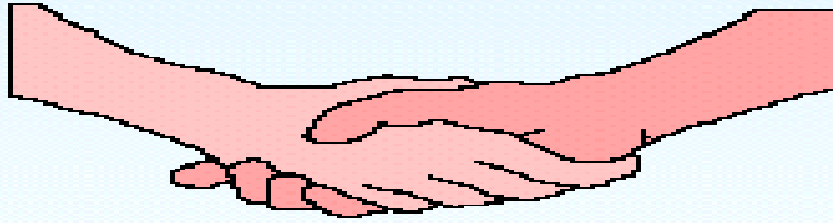


Fig 3. Weight loss (%) of samples exposed to *C. puteana*

CONCLUSIONS

- Compression strength values slightly increased compared to the control groups in most of the variations.
- Acetic acid pre-treatment showed better performance than that of nitric acid pre-treatment regarding to increasing copper retention and decay resistance.
- To obtain more effective results, experimental matrix can be changed for different acid types and immersion periods.



**THANK YOU FOR YOUR
ATTENTION**