

Wood protection in Ljubljana

Miha Humar Boštjan Lesar,

University of Ljubljana, Biotechnical faculty

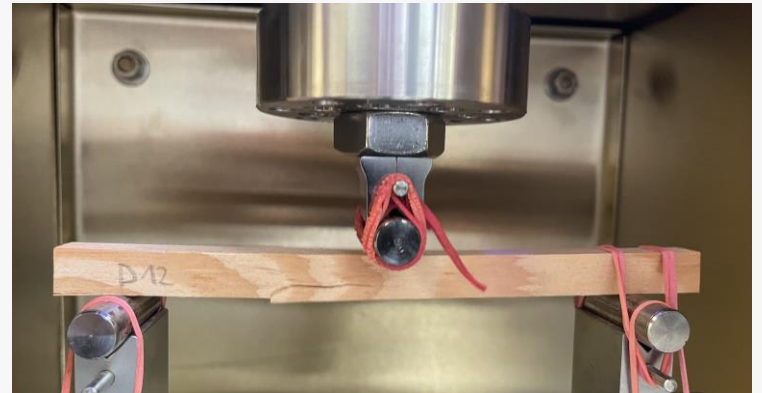
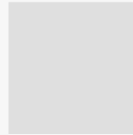
Activities

- Research
- Development
- Quality assurance
- Field testing
- Consultancy
- Cultural heritage



Research

- Natural durability
- Impregnability
- Leaching
- Wood modification



Development



Oktober 2013

*Visual
appearance*



Oktober 2016

Ali je videz lesa pomemben?

Consulting



Katastrofalni dogodki - Poplave – Avgust 2023



Field testing



Model house(2013 -2023 ...)

Wood species	Treatment
Norway spruce	Untreated
	Treated with montan wax
	Surface coated with acrylic coating
	Treated with copper-ethanolamine s
	Treated with copper-ethanolamine s
	Thermally modified
	Thermally modified and impregnated
	Thermally modified and impregnated
	Thermally modified and coated with
European larch	Untreated
	Thermally modified
Beech	Untreated
	Thermally modified
	Thermally modified and impregnated
Sweet chestnut	Untreated
Scots pine sapwood	Untreated
Scots pine heartwood	Untreated
Black poplar	Untreated
	Thermally modified
Ash	Untreated
	Thermally modified



Model house 2021



Quality assurance



Februar 2008



Februar - 2016



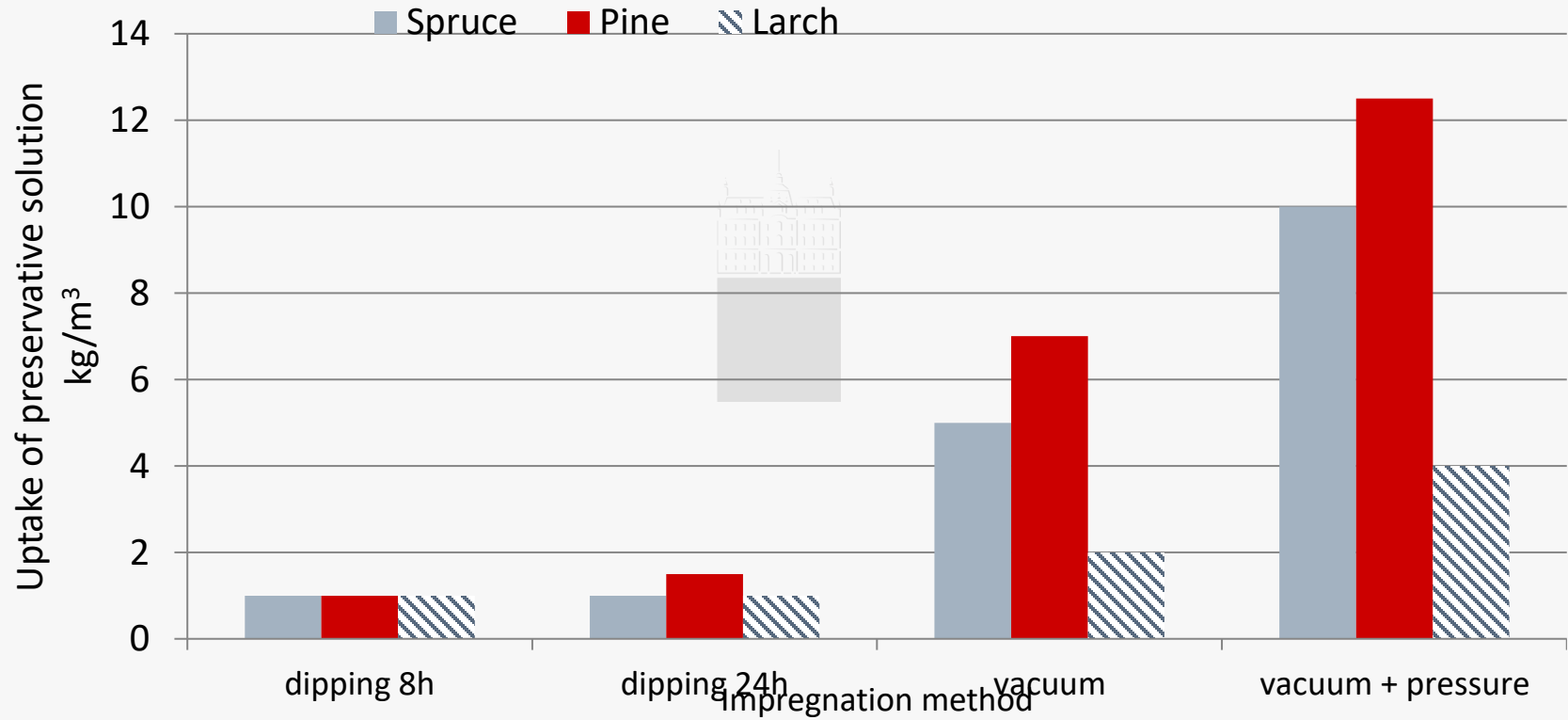
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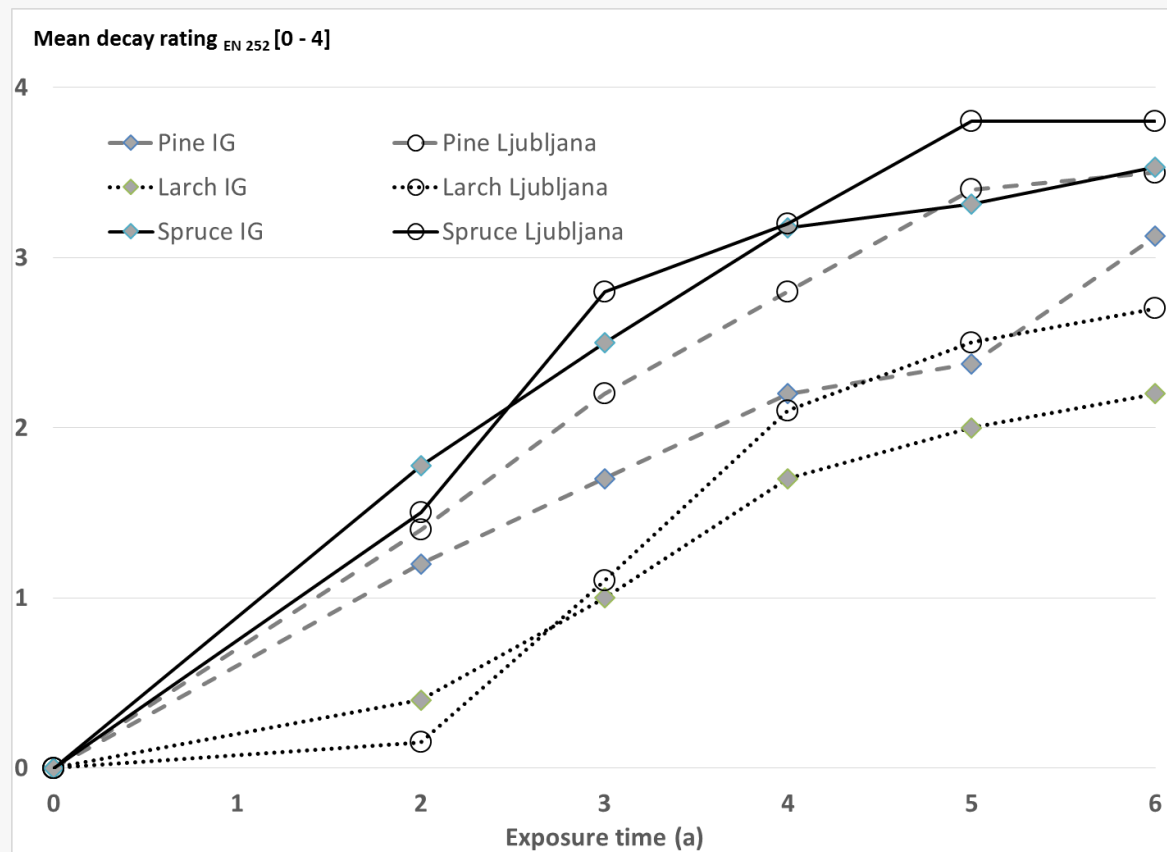
Grades

ocena	opis	definicija
0	Zdrav les	Na preizkušancu ni zaznavnih sprememb
1	Rahlo poškodovan	Na vzorcu so vidni znaki razkroja, vendar razkroj ni intenziven in je zelo prostorsko omejen: -Spremembe, ki se pokažejo predvsem kot sprememba barve ali zelo površinski razkroj, mehčanje lesa je najpogostejši pokazatelj, razkroj sega do 1 mm v globino.
2	Poškodovan	Jasne spremembe v zmernem obsegu: -Spremembe, ki se kažejo kot mehčanje lesa 1 mm do 3 mm globoko na 1 cm ² ali večjem delu vzorca
3	Zelo poškodovan	Velike spremembe: -Izrazit razkroj lesa 3 mm do 5 mm globoko na večjem delu površine (večje od 20 cm ²), ali mehčanje lesa gobje kot 10 mm na površini večji od 1 cm ²
4	Povsem propadel	Preizkušanec je močno razkrojen: -Ob padcu z višine 0,5 m se zlomi

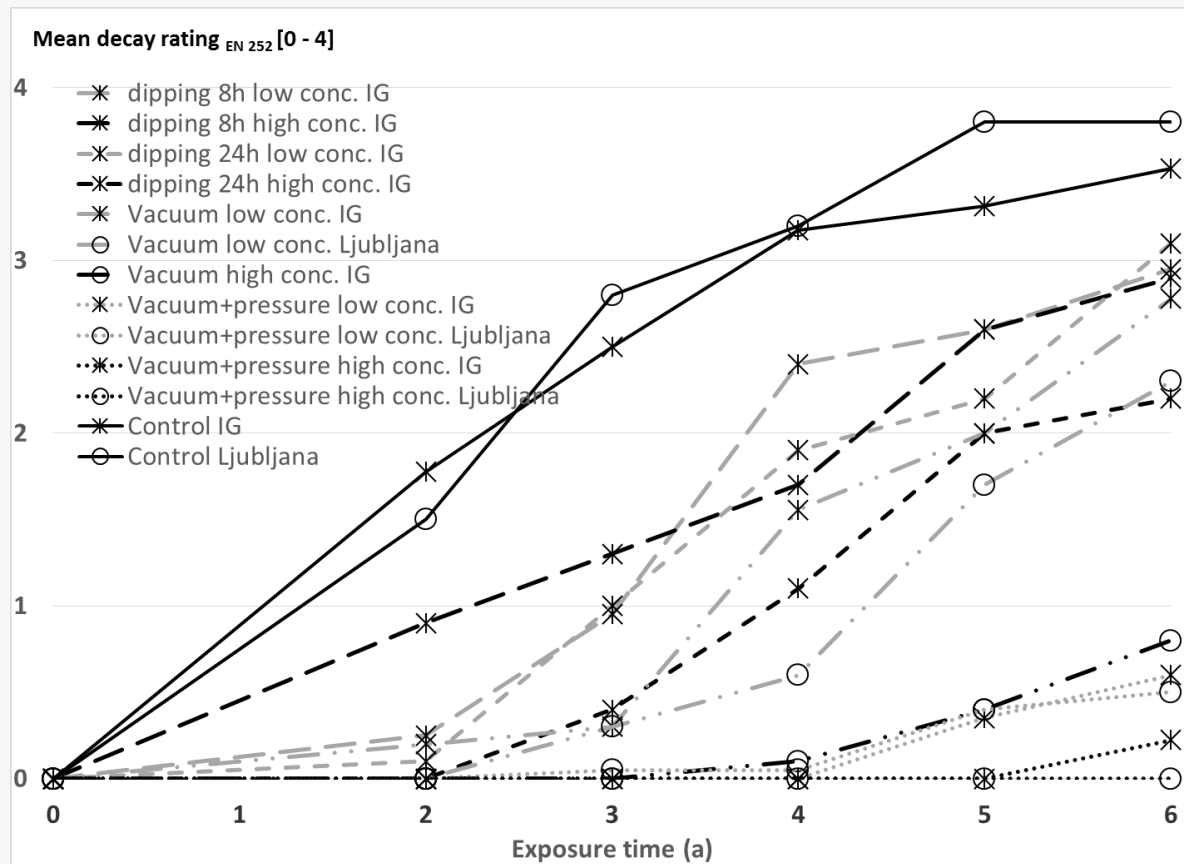
Uptake of preservative solution



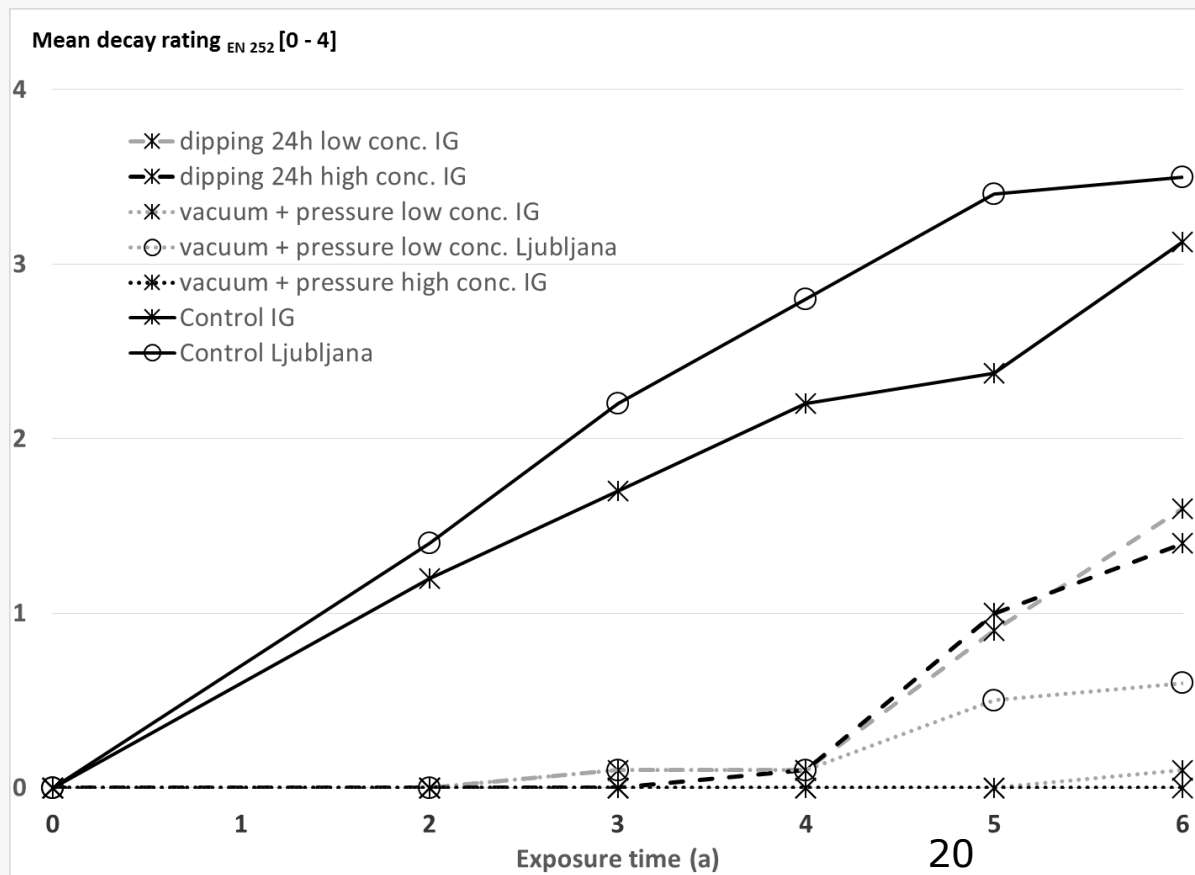
Degradation of control specimens (2009 – 2015)



Degradation of copper treated spruce



Degradation of copper treated pine



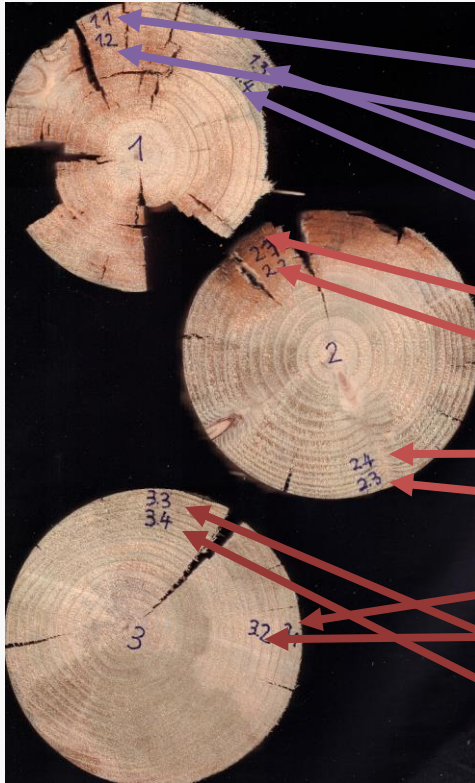
Problem solving



Premature decay after 2 y



Premature decay

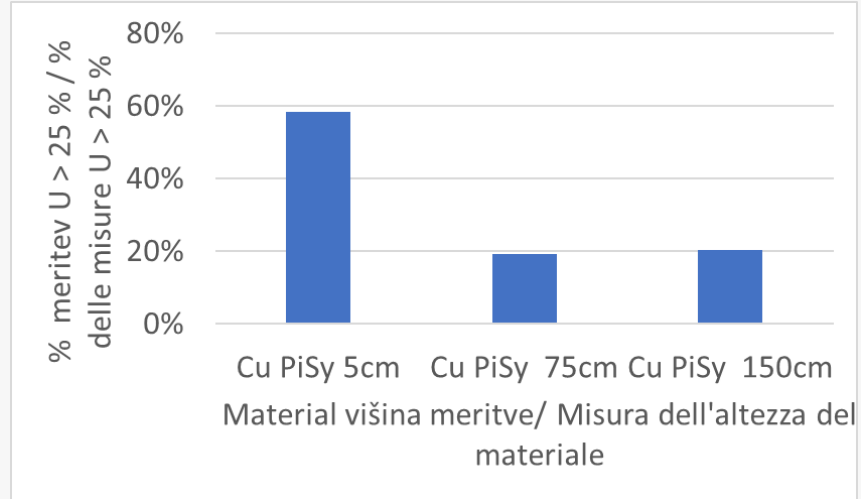


	c_{Cu} (ppm)
<u>1.1</u>	170
<u>1.2</u>	76
<u>1.3</u>	286
<u>1.4</u>	109
<u>2.1</u>	848
<u>2.2</u>	759
<u>2.3</u>	1110
<u>2.4</u>	1004
<u>3.1</u>	647
<u>3.2</u>	214
<u>3.3</u>	567
<u>3.4</u>	538

Testing of poles



MC in poles



Conclusions

- Cu treatment can provide good protection if applied correctly
- We can control the efficacy
- High quality treatment is a must to ensure quality

