



Influence of the retention and penetration of Cu based preservatives on the performance of softwoods in ground

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Copper based wood preservatives

- Copper compounds are one of the most important biocides for wood preservation
 - Traditional: Copper-Chromium (arsenic), boron
 - Use of Cr in EU was limited after 2006
 - New solutions – state of the art
 - Copper amine
 - Micronised Cu



Cu EA - issues

- ❑ Copper-ethanolamine solutions
 - The most important wood preservatives in EU for wood in ground contact
 - Less effective as CCA and CCB
 - Lack of performance data



Aim

- ❑ There are premature failures of copper treated wood reported
- ❑ Lack of performance data



Retention specification

Chromfreie Holzschutzmittel Zulassung Deutschland

Schutzmittel	Wirkstoffe	Zulassung Deutschland		Zulassung Frankreich	
		GK 4	GK 3	NTR Finland, Norwegen, Dänemark, Irland u. Schweden GK 4	GK 4
Wirkstoffe – Kupfer/Kupfer-HDO/Bor					
Wolmanit CX 10	Kupfer 16,3 HDO 3,5 Bor 5,0	7 kg (4)kg	4 kg (3)kg	9 kg (18) kg	7,5 kg (15)kg
Wolmanit CX 8	Kupfer 13,04 HDO 2,8 Bor 4,0	7,5 kg (5)kg	5 kg (3,75)kg	11 kg (22) kg	9,4 kg (18,4)kg
Wolmanit CX 8 WB	Kupfer 13,04 HDO 2,8	7,5 kg	4 kg	11 kg (22)	
Wirkstoffe – Kupfer/Ammoniumverbindungen (Quat) Bor					
Kemwood ACQ 2300	Quat 8,4 Kupfer 15,2				
Kemwood ACQ 1900	Quat 4,75 Kupferhydroxidcarbonat 17,30	15 kg	12,5 kg	18 kg (36) kg	
Korasit KS	Quat 8,4 Kupfer 15,2	9 kg (6)kg	4,5 kg (3)kg		15 kg (30)kg

Retention specification

Wood preservatives approved by the Nordic Wood Preservation Council

Wood preservative	Retention requirement* in <i>Pinus spp</i> sapwood, kg/m ³ Class**				Approval valid until	Certificate No
	M	A	AB	B		
WATER-BORNE TYPE						
CCA products						
OK-K33 type C [#]	24.0	12.0	-	-	2009-12-31	79
CCP products						
Kemwood KCP Flytande	60.0	30.0	30.0	-	2010-12-31	122
Celcure P50 Flytande	60.0	30.0	-	-	2012-12-31	3
CC products						
Kemwood KC 73 [#]	-	10.0	10.0	-	2008-12-31	11
Korasit KC-s	26.0	19.0	-	-	2012-12-31	186
Tanalith CC oxide 3403	26.0	18.0	-	-	2009-12-31	98
CB + triazole products						
Tanalith E/Tanalith E 3491	-	18.0	13.0	-	2011-12-31	165
Tanalith E-7/Tanalith E 3492	-	16.0	8.0	-	2009-12-31	168
ACQ products						
Kemwood ACQ 1900	-	36.0	19.0	-	2012-12-31	87
Celcure AC 800	-	36.0	19.0	19.0	2012-12-31	181
ACQ 2200	-	-	12.0	-	2009-12-31	175
Celcure AC 500	-	-	12.0	-	2009-12-31	183

Retention specification

Table 2: Retention of wood preservatives for different wood species and service lives (kg/m³)

Country	Durability requirement	Wood	Wood preservative in kg/m ³										
			CCA		CCB		CCF		Impralit KDS		Wolmanit CX		C
	in years	EHC ¹⁾	3	4	3	4	3	4	3	4	3	4	
Germany ²⁾	Not specified ³⁾	Soft- and hardwood ⁴⁾	4	6	4	8	5	6	3	4	2-5 ⁵⁾	3-5 ⁵⁾	
	40-50	Poles, pine ⁶⁾	---	14	---	14	---	14	---	---	---	---	---
	20	Poles, spruce ⁶⁾	---	10	---	10	---	10	---	10	---	---	---
	7)	Sleepers, beech ⁶⁾	---	---	---	---	---	---	---	---	---	---	---
	7)	Sleepers, Oak ⁶⁾	---	---	---	---	---	---	---	---	---	---	---

Current national approaches to defining retentions in use

Hubert Willeitner, Germany

Penetration?









February 2008



February - 2016



Aim

- How penetration and retention affects the performance in ground?

Material

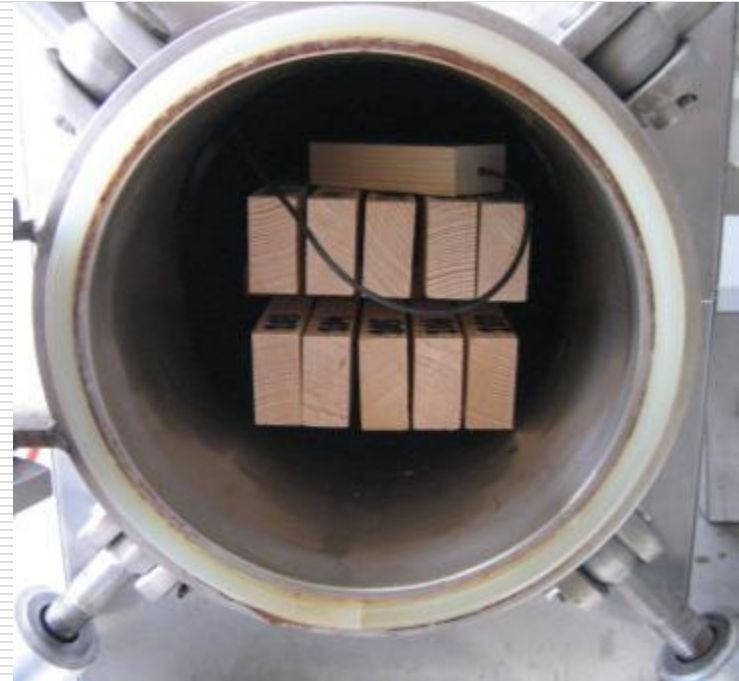
- Three wood species
 - Scots pine sapwood (*Pinus sylvestris*)
 - Norway spruce (*Picea abies*)
 - European larch (*Larix decidua*)
- Dimensions EN 252, EN 113; ENV 807
 - $2,5 \times 5,0 \times 50 \text{ cm}^3$
- Copper-ethanolamine based preservative solution (two concentrations)



Methods

□ Impregnation procedures

- Dipping – 8 h
- Dipping - 24 h
- Vacuum (0,1 bar-30 min)
- Vacuum – pressure (0,1 bar-30 min; 10 bar-3 h; 0,2 bar-10 min)



Exposure



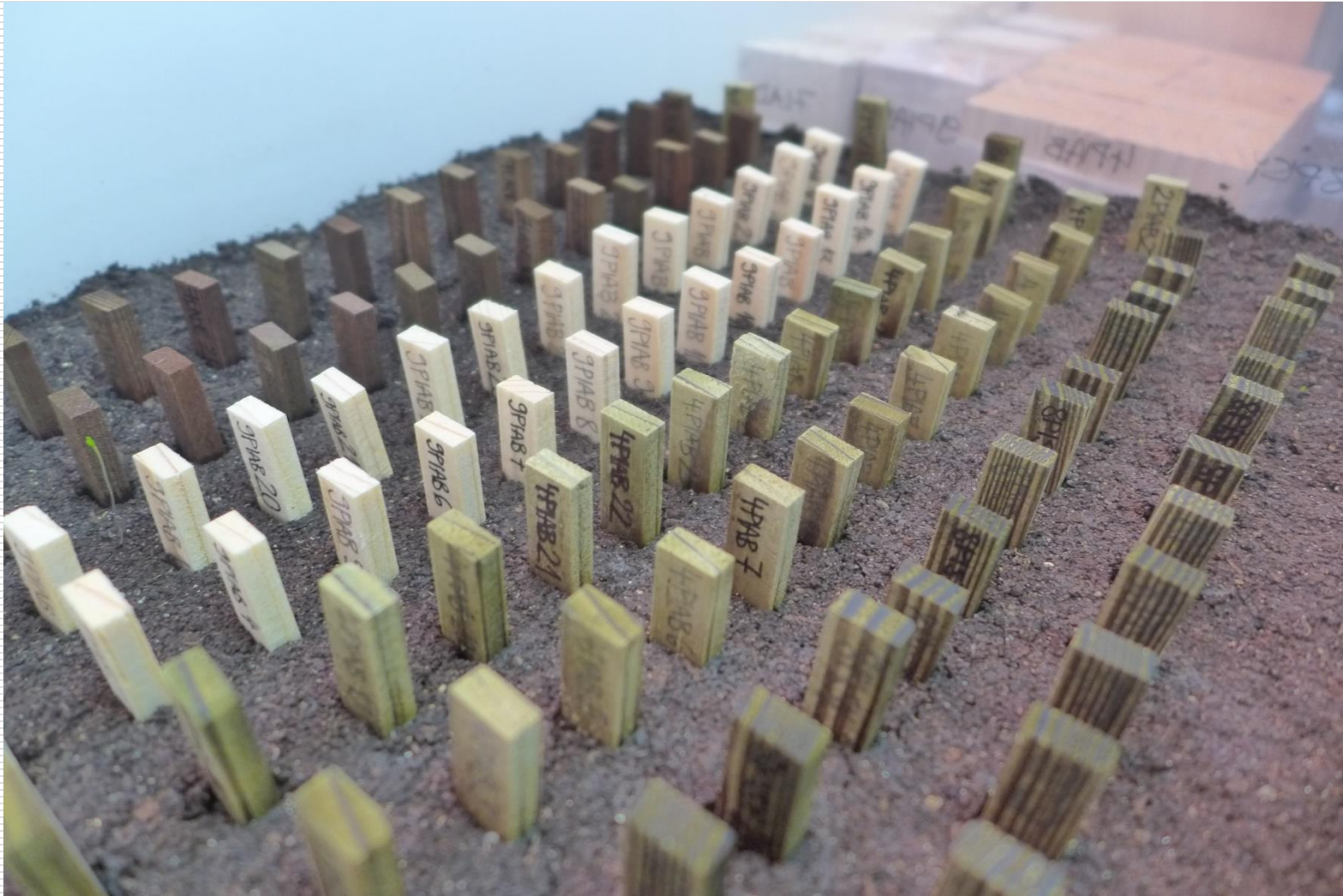
EN 252



Grading system

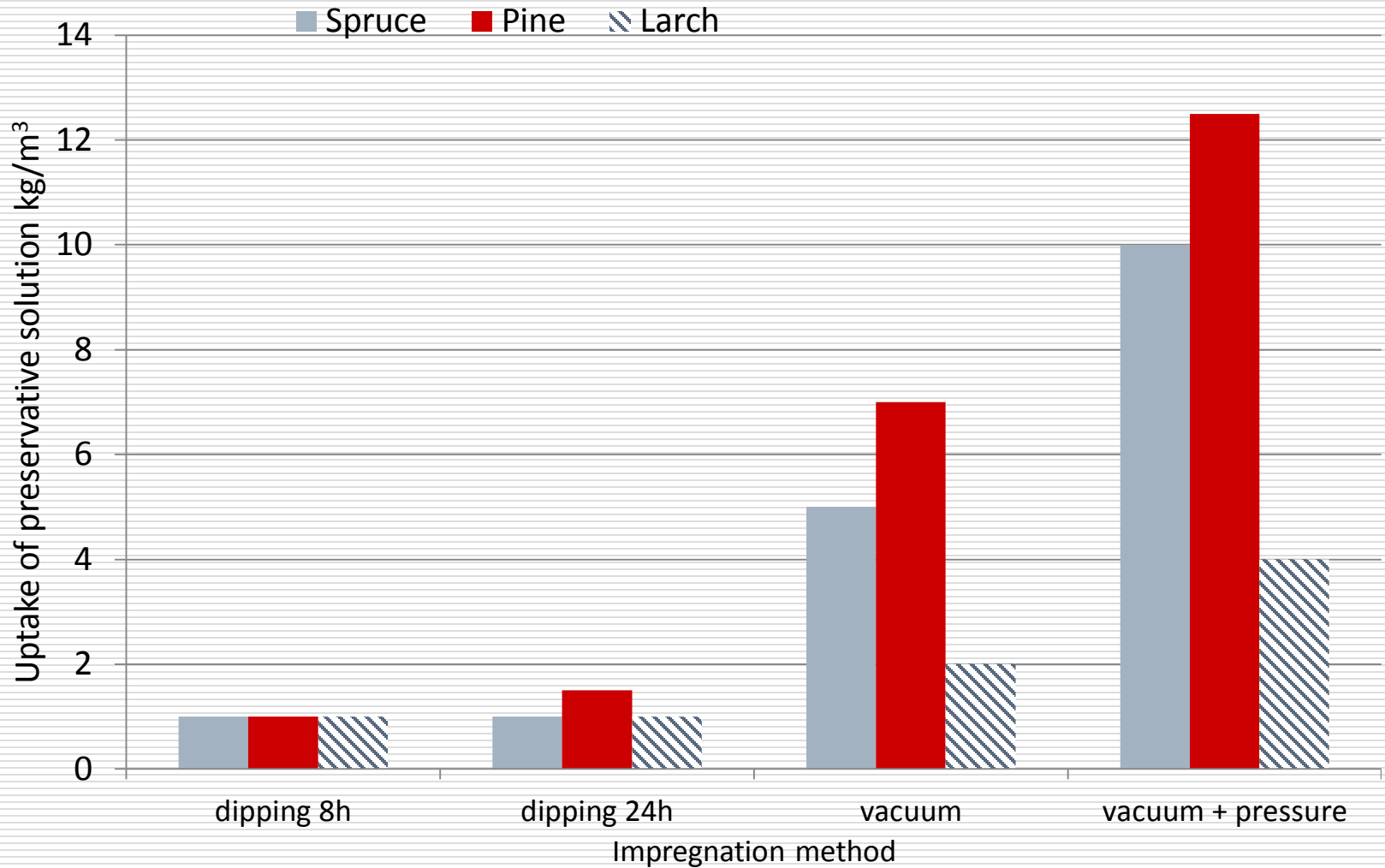
Rating	Description	Definition
0	Sound	No evidence of decay. Any change of colour without softening has to be rated as 0.
1	Slight attack	Visible signs of decay, but of very limited intensity or distribution: <ul style="list-style-type: none">- changes which only reveal themselves externally by very superficial degradation, softening of the wood being the most common symptom, to an apparent depth in the order of one millimetre
2	Moderate attack	Clear changes to a moderate extent according to the apparent symptoms: <ul style="list-style-type: none">- changes which reveal themselves by softening of the wood to a depth of approximately 1 to 3 millimetres over more than 1 cm² per stake.
3	Severe attack	Severe attack <ul style="list-style-type: none">- marked decay in the wood to a depth of more than 3 millimetres over a wide surface (more than 20 cm²) or by softening deeper than 10 mm over more than 1 cm² per stake
4	Failure	Impact failure of the stake

ENV 807

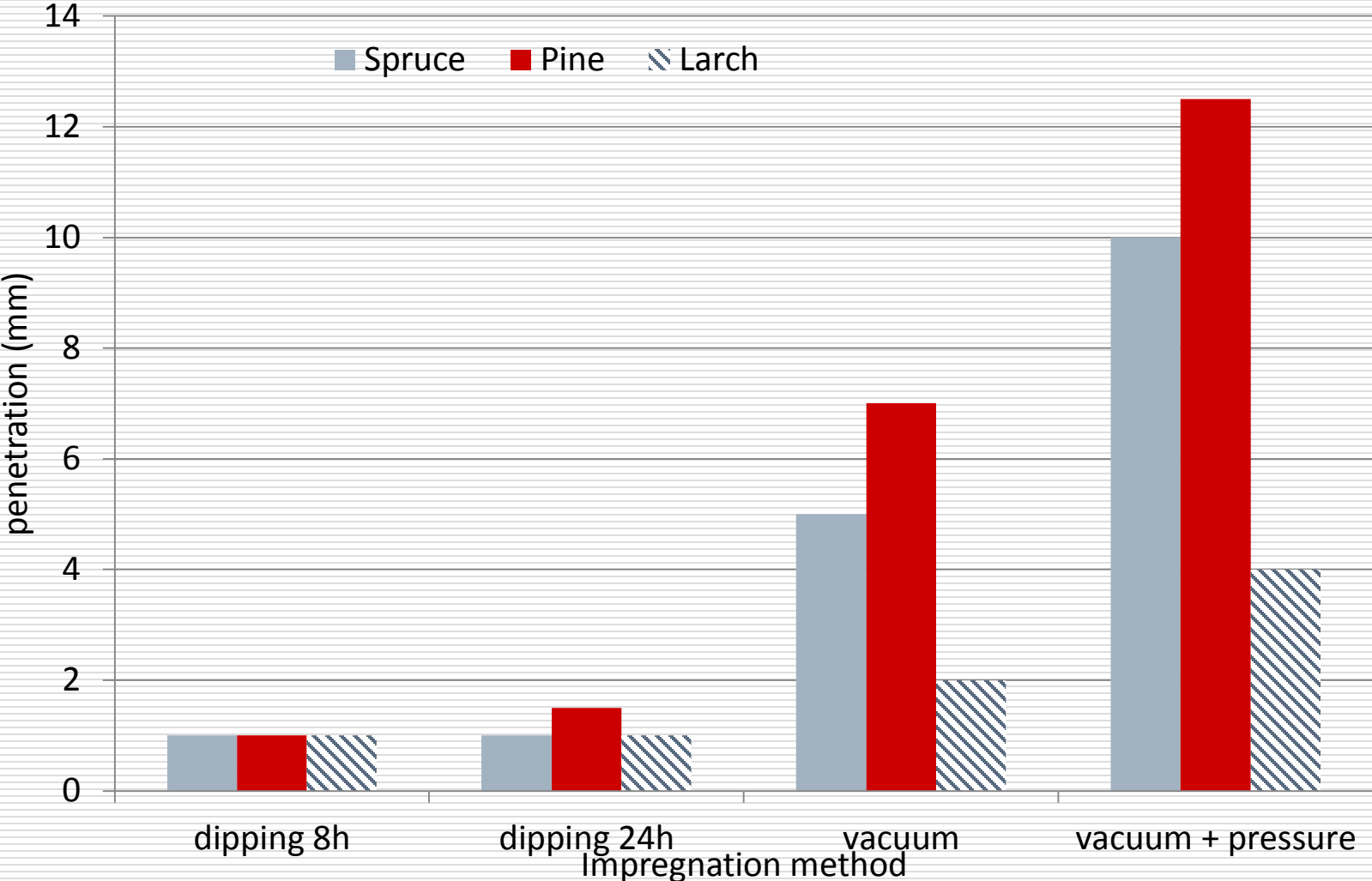


Results

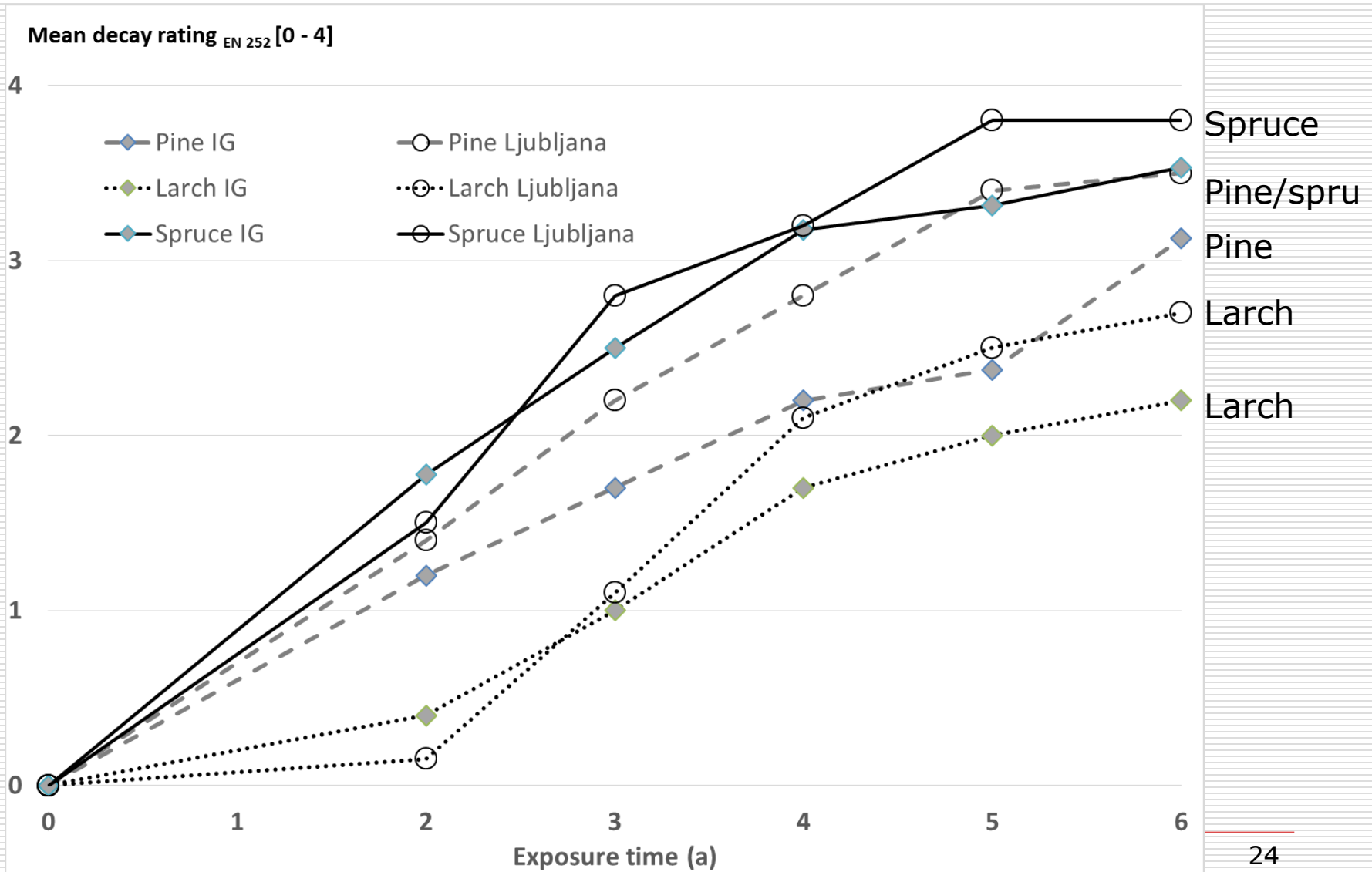
Uptake of preservative solutions



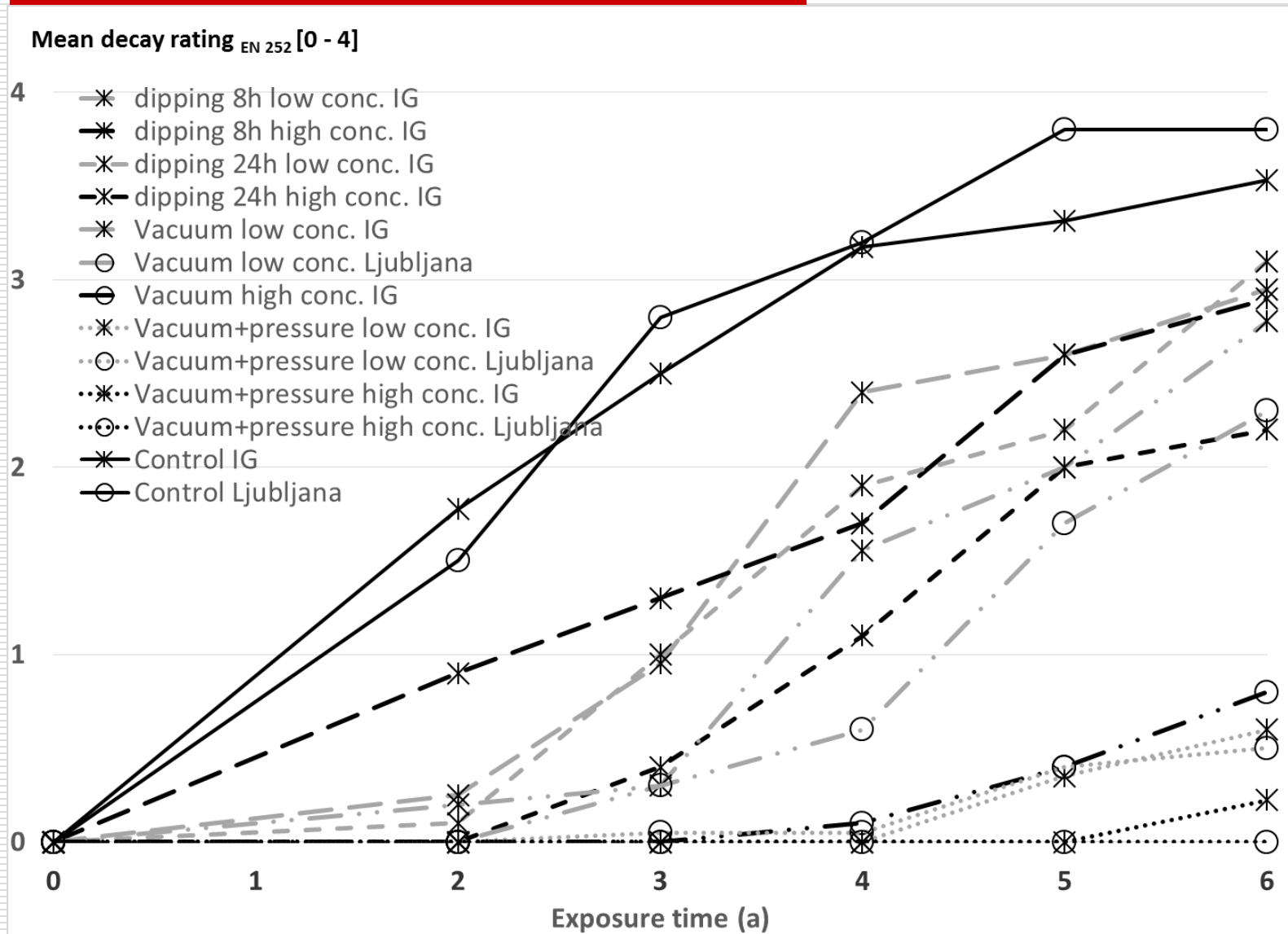
Penetration



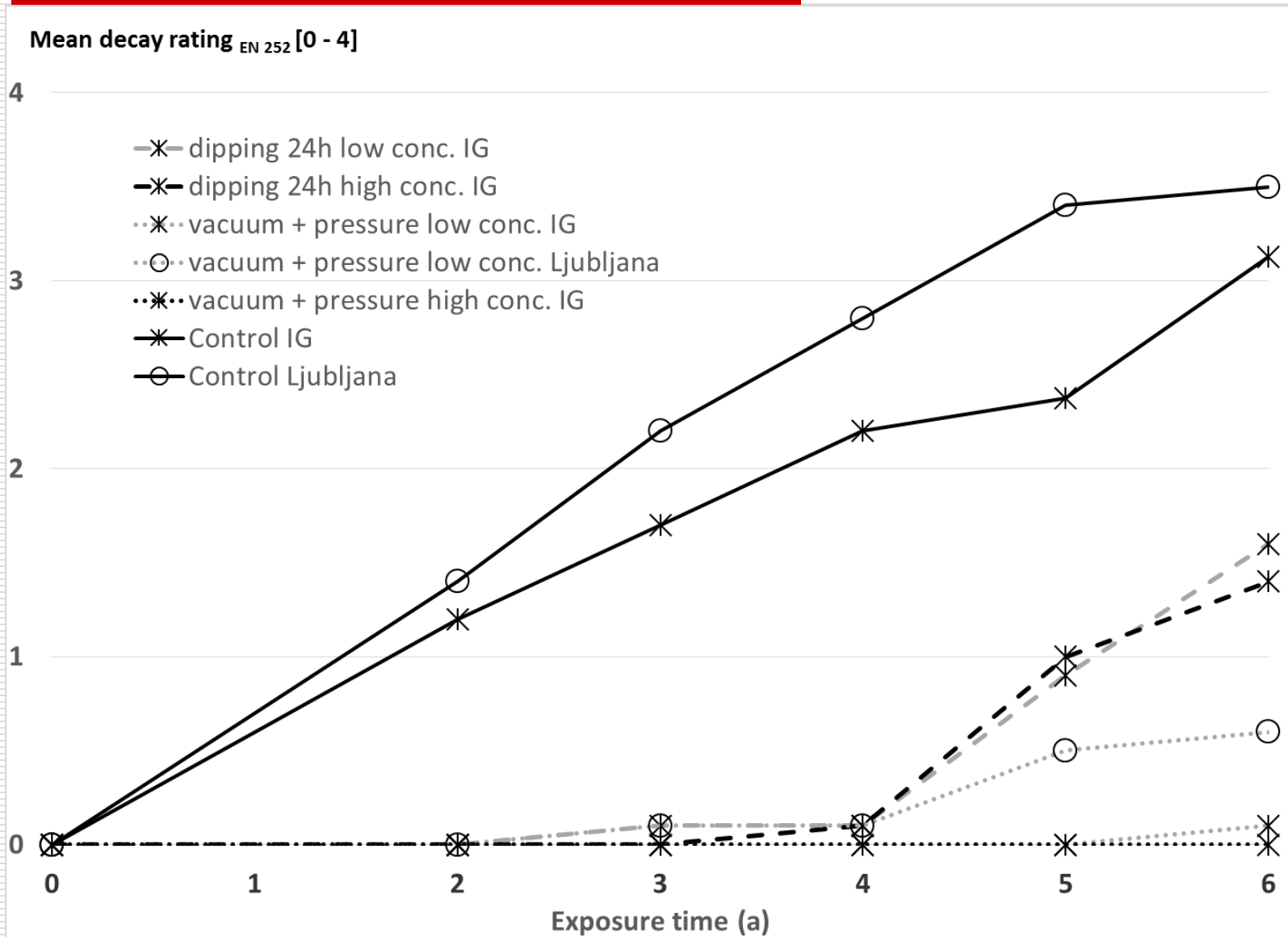
Degradation of control specimens (2009 – 2015)



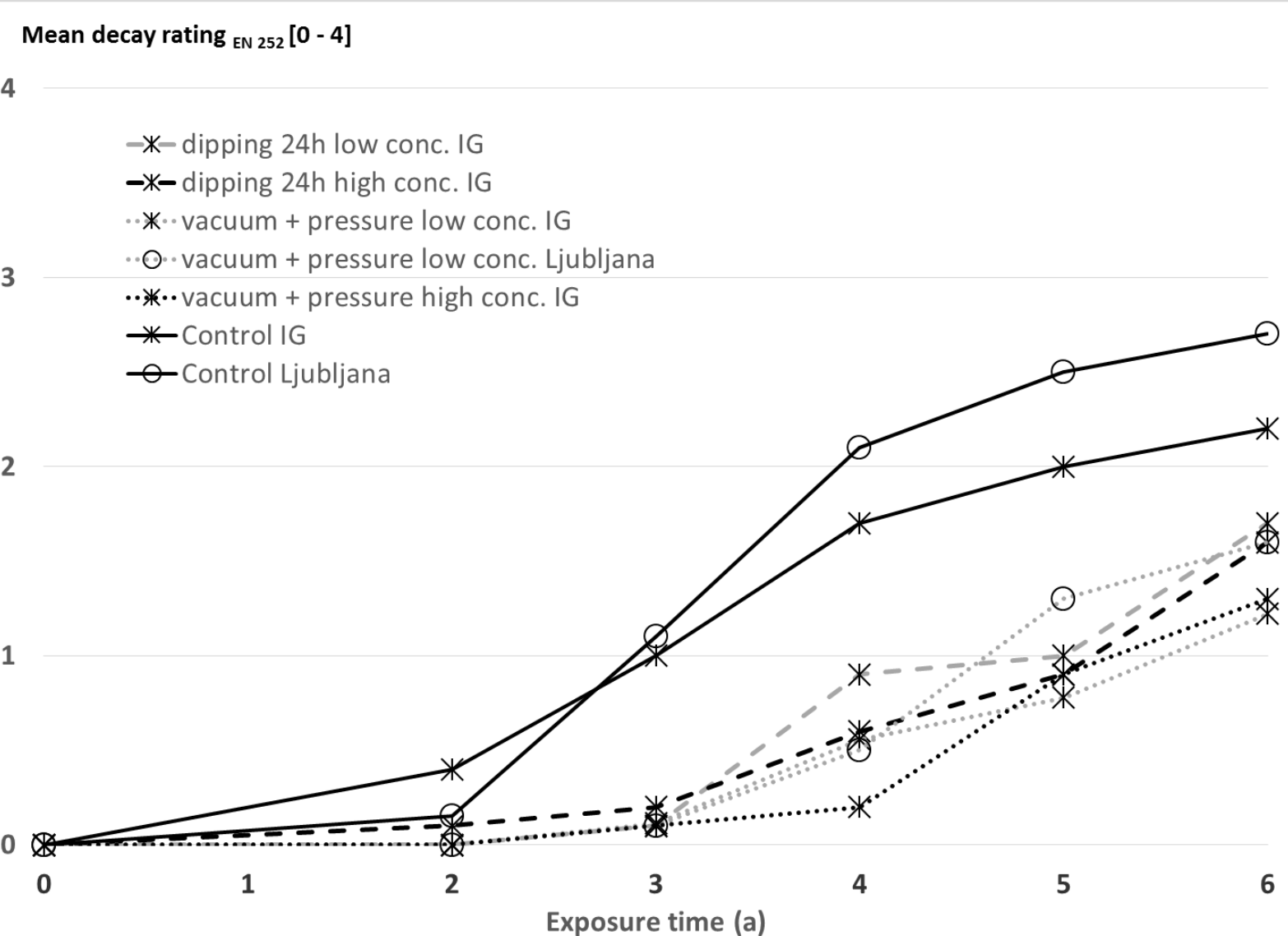
Degradation of copper treated spruce



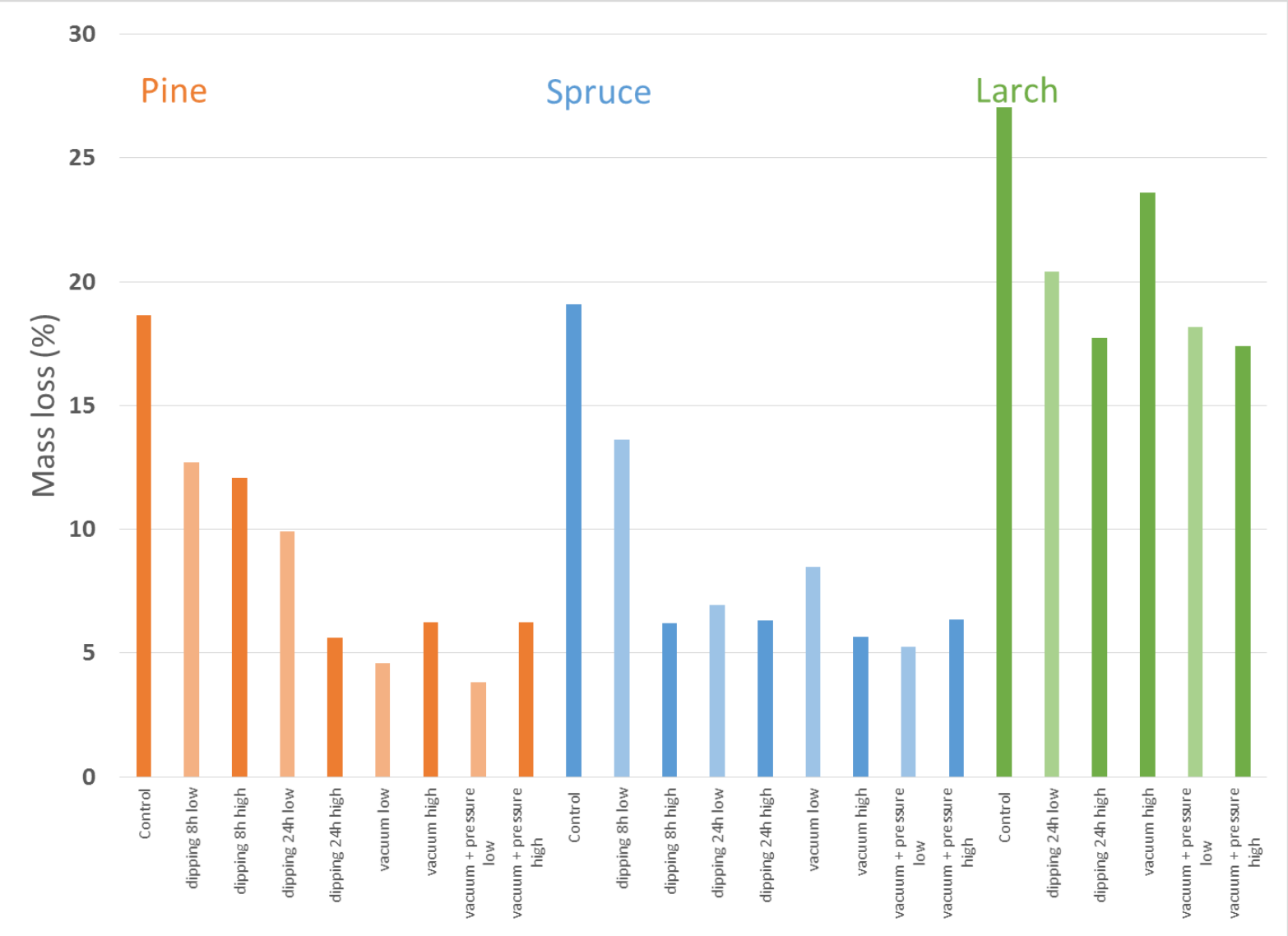
Degradation of copper treated pine



Degradation of copper treated Larch



ENV 807 comparison



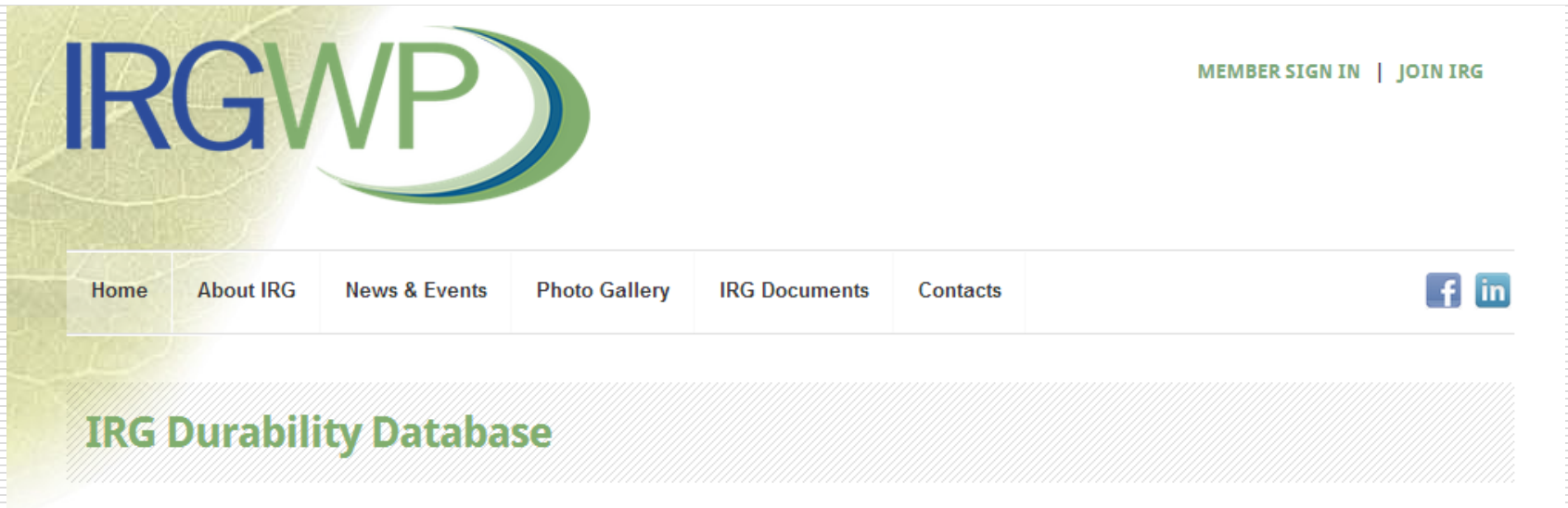
Conclusions

- ❑ If copper-ethanolamine based wood preservatives are not applied in sufficient retention and penetration, decay is postponed only for few years.
- ❑ Quality control of retention and penetration is a must

Future work

- Perform EN 113 studies
- Above ground studies

Original data



<http://www.irg-wp.com/durability/index.html>

Thank you

