



RESEARCH INSTITUTE OF WOOD INDUSTRY (CRIWI), CHINESE ACADEMY OF FORESTRY (CAF)

Leaching Properties of Copper and Triazole

IRG/WP 09-30509

Zhiqiang Li, Xiaowen Li, Ying Zhang, Mingliang Jiang

Research Institute of Wood Industry
Chinese Academy of Forestry
Beijing 100091, China





1. INTRODUCTION

- Some copper based formulations such as ACQ, copper azoles are alternatives of CCA for environmental concern
- Fixation of preservatives in treated wood is a main factor for long-term protection of wood, especially for exterior circumstance
- In order to elucidate the leaching properties of copper and triazole in treated wood, the present research was conducted.

2. MATERIALS AND METHODS

■ 2.1 Wood Samples

The samples for leaching test:

Masson pine (*Pinus massonina*) sapwood,
20(L)×20(T)×20(R) mm,
4 replicas.

2.2 Preservatives

- Cu source : acetate($C_4H_6CuO_4 \cdot H_2O$),
carbonate ($CuCO_3 \cdot Cu(OH)_2 \cdot H_2O$)
- EA-ethanolamine, NH_3 - ammonia,
TEB-tebuconazole, PPZ-propiconazole,
- Cu/azole (TEB and PPZ) in the formulations :
25:1:0 or 50:1:1

Table 1 Copper formulations and components for the treatment

Formulations	Copper source	Cu content (%)	NH ₃ content (%)	EA ^a content (%)	TEB ^b content (%)	PPZ ^c content (%)
CuAz-1	acetate ^d	1.00	1.25	0	0.04	0
CuAz-2	acetate	1.00	0.88	0.94	0.04	0
CuAz-3	acetate	1.00	0.63	1.56	0.04	0
CuAz-4	acetate	1.00	0.38	2.19	0.04	0
CuAz-5	acetate	1.00	0	3.13	0.04	0
CuAz-6	acetate	1.00	1.25	0	0.02	0.02
CuAz-7	acetate	1.00	0.88	0.94	0.02	0.02
CuAz-8	acetate	1.00	0.63	1.56	0.02	0.02
CuAz-9	acetate	1.00	0.38	2.19	0.02	0.02
CuAz-10	acetate	1.00	0	3.13	0.02	0.02



CRIWI

Table 1 continued

CuAz-11	carbonate ^e	1.00	0.88	0.94	0.04	0
CuAz-12	carbonate	1.00	0.63	1.56	0.04	0
CuAz-13	carbonate	1.00	0.38	2.19	0.04	0
CuAz-14	carbonate	1.00	0	3.13	0.04	0
CuAz-15	carbonate	1.00	0.88	0.94	0.02	0.02
CuAz-16	carbonate	1.00	0.63	1.56	0.02	0.02
CuAz-17	carbonate	1.00	0.38	2.19	0.02	0.02
CuAz-18	carbonate	1.00	0	3.13	0.02	0.02
ACQ-1	acetate	1.00	1.25	0	0	0
ACQ-2	acetate	1.00	0	3.13	0	0
ACQ-3	carbonate	1.00	1.25	0.30	0	0
ACQ-4	carbonate	1.00	0	3.13	0	0

2.3 Treatment procedure

- **Vacuum process:** at 8×10^3 Pa for 5-10 min, at atmospheric pressure for 20-30min
- The total retention was calculated based on the preservative absorption and density of the samples.

2.4 Leaching procedure

- **AWPA E11-06** , Standard method of determining the leachability of wood preservatives



2.5 Copper content determination in the leachate

- Atomic Absorption Spectrometer
(**AAS**, Perkin-Elmer AAnalyst 400)

Table 2 Working conditions of atomic absorption spectrometer

Wavelength (nm)	Lamp current(mA)	Slit (mm)	Burner-head highness(mm)	Gas flow rate(L/min)	
				Acetylene	Air
324.8	15	2.7/0.8	7.5	2.5	10.0



2.6 Analytical method of TEB and PPZ in the leachate

- The **HPLC** instrument:
 - Column: C18 ,150 mm × 4.6mm,
5µm particle diameter,
 - UV detector: 225 nm.
- TEB and PPZ were determined according to
AWPA A28-05

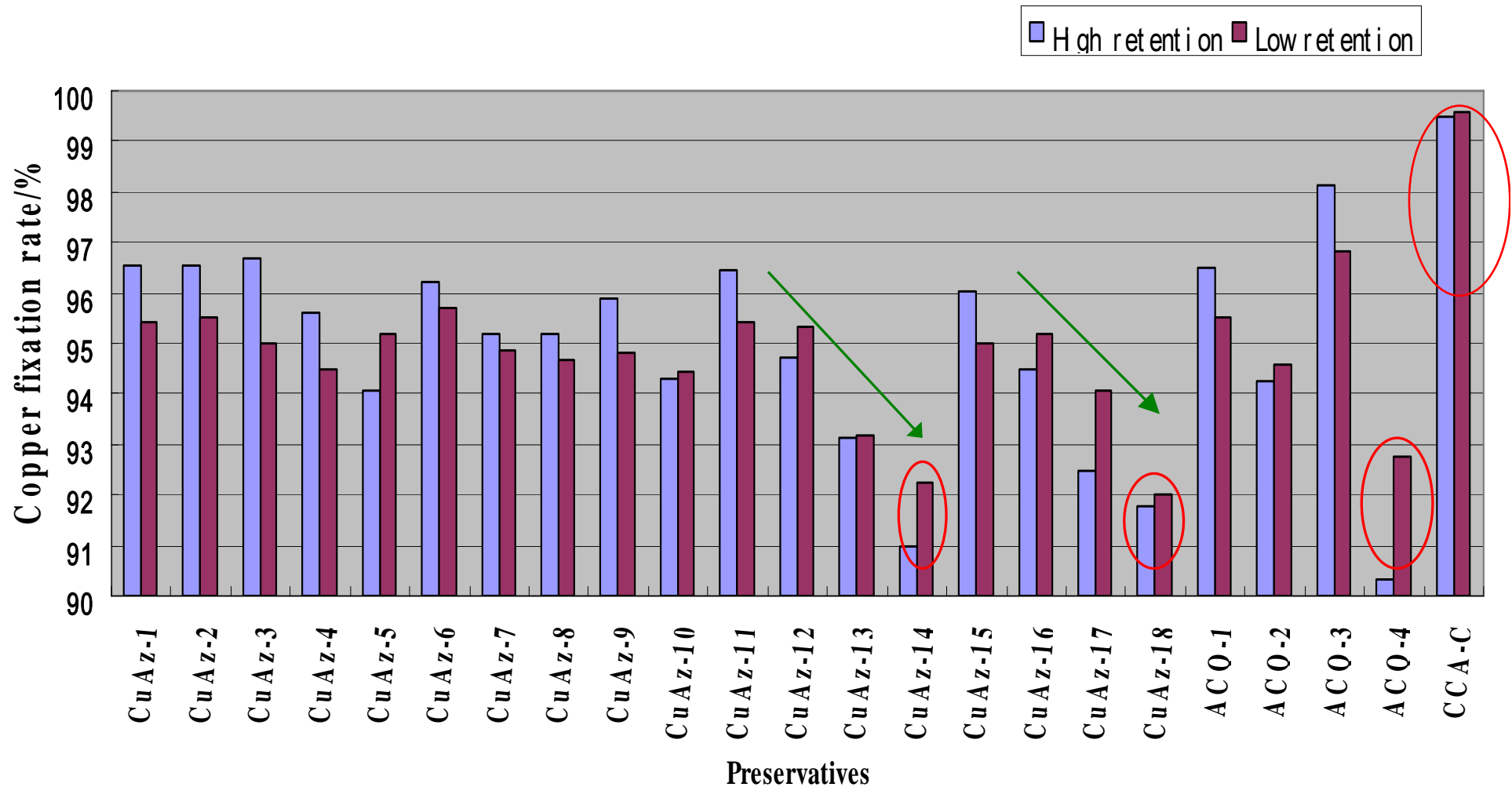


3. RESULTS AND DISCUSSION



CRIWI

3.1 Fixation rate of copper



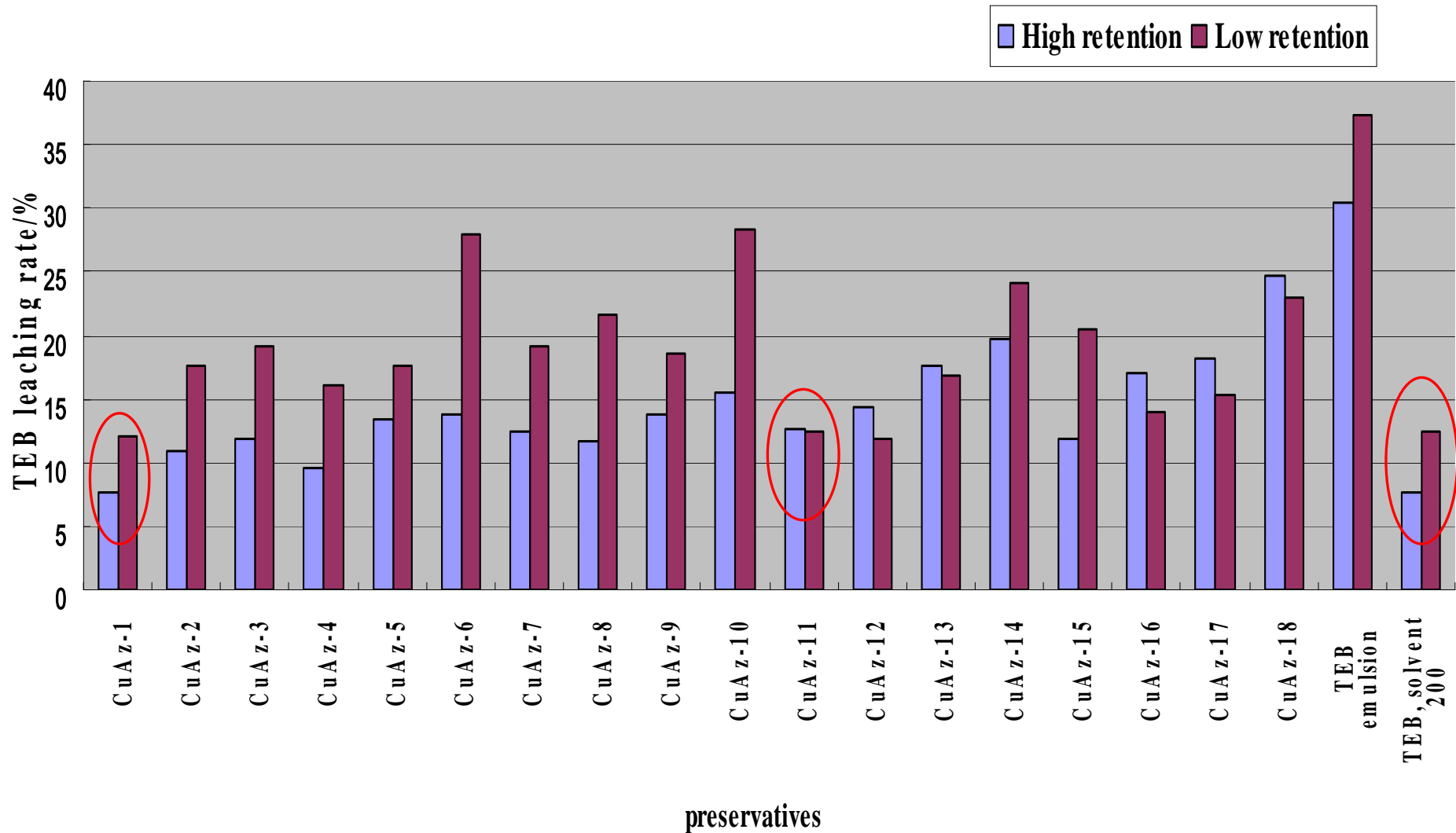


- Formulation of CCA-C had the highest copper fixation rate, it was above 99%.
- Formulations of CuAz-14, CuAz-18 and ACQ-4 are copper amine based; the copper fixation rates were slight lower than all other formulations
- From CuAz -11 to CuAz -14 and CuAz -15 to CuAz -18, the copper fixation rate was decreasing with the increase amount of ethanolamine.



CRIWI

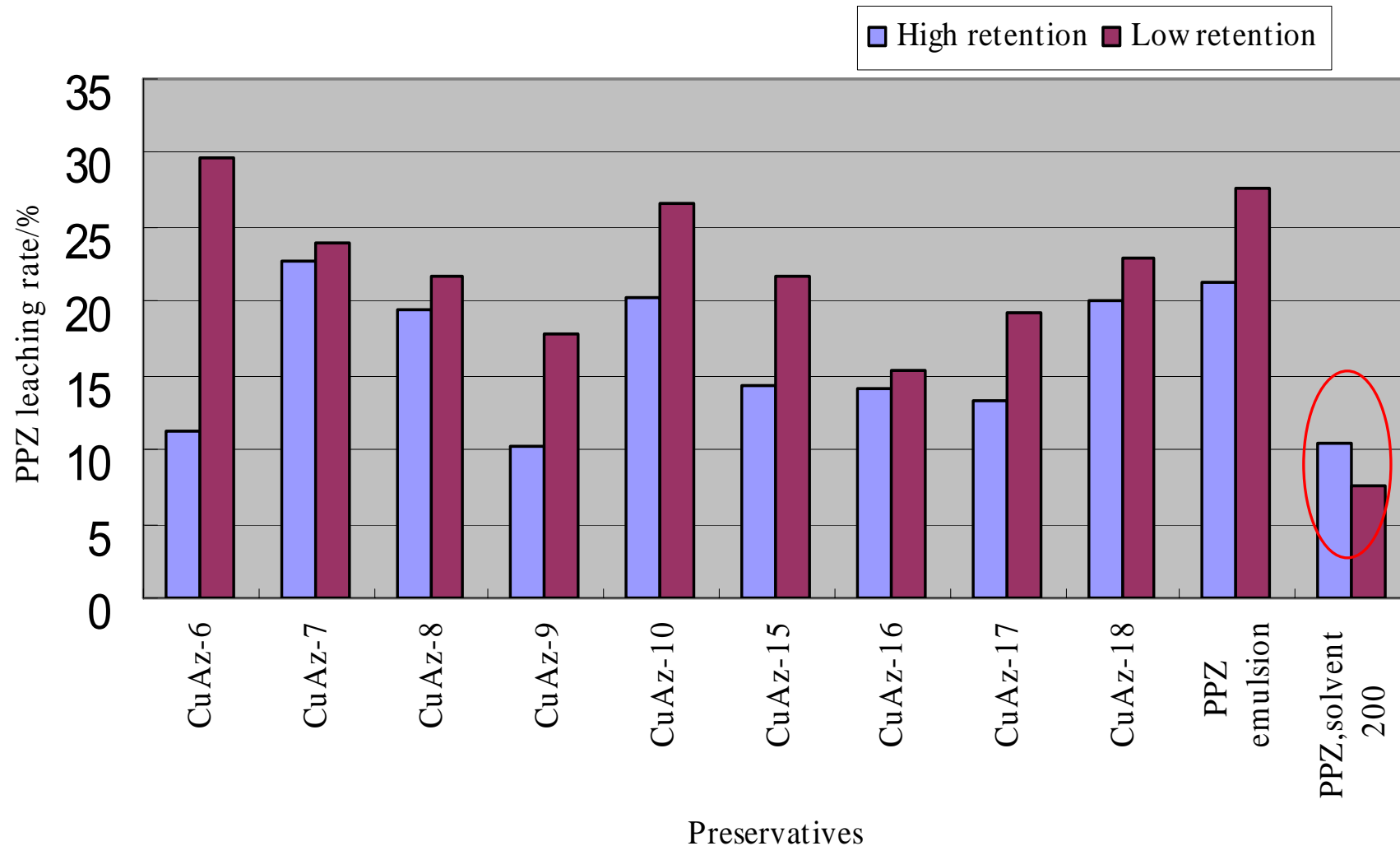
3.2 Leaching rate of TEB





- Leaching rate of TEB was from 7.7% to 37.3% in the all formulations.
- The leaching rate of TEB emulsion type is much higher than that of solvent type.
- The result indicates that addition of copper complex, especially ammonia complex, in the formulations could reduce the leaching rate of TEB

3.3 Leaching rate of PPZ








- Leaching rate of PPZ was from 7.5% to 29.6% in the all formulations.
- PPZ dissolved in solvent 200 had the lowest leaching rate was only 7.5% and 10.3%.
- For the formulations based on mixture of ammonia and ethanolamine, the PPZ leaching rate was lower than formulation based on ammonia or ethanolamine only



CRIWI

4. CONCLUSIONS

-  The fixation rate of copper ammonia was higher than that of ethanolamine based and the mixture of them
-  Copper fixation rate at relatively higher retention was slight higher than that at lower retention except for some formulations based on ethanolamine only
-  Addition of copper complex in the formulations could reduce the leaching rate of TEB



Acknowledgment:

**This research was supported by
China natural 11th five-year plan 2006BAD18B09
and 948 2006-4-95 projects.**

Thank you for your attention!

lzhq789@hotmail.com

jiangml@caf.ac.cn