

Fixation of CCA and Stabilization of Current Copper Based Preservatives



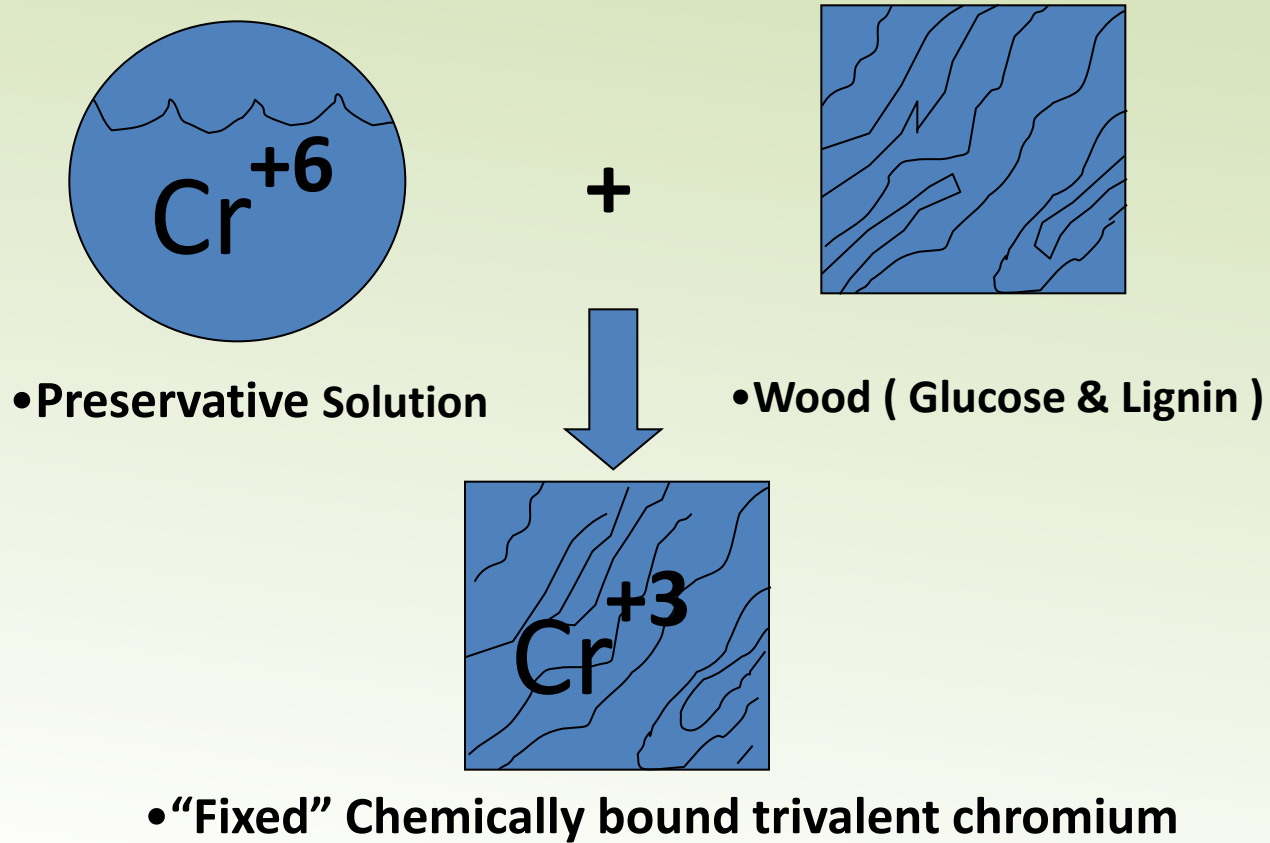
What is CCA Fixation

- Fixation of the Chromated Copper Arsenate preservative in wood occurs in several stages, for example; 50% - 70% of the chromium is thought to fix on contact with the wood
- Hexavalent chromium ($\text{Cr}6$) is reduced to low toxicity, low solubility $\text{Cr}3$. $\text{Cr}3$ reacts with the arsenic and precipitates it As. The resulting pH increase towards neutral, reduces solubility which causes the CCA to precipitate into insoluble copper/arsenic compounds which the chromium binds to the wood
- The level of fixation is dependent on;
 - The chrome/copper/arsenate balance in the solution, the higher the chrome the stronger the bonding. However, the higher the retention the longer it takes to fix.
 - The rate of CCA fixation is species dependent due to the presence of wood extractives. This means that heartwood should fix faster than sapwood.
- The fastest fixation rates occur when the wood is exposed to high temperatures, high humidity, and has been stickered.
- A fixed "shell" of 12.5 mm is considered adequate to protect from interior losses of unfixed preservative.
- In ambient temperature fixation, the surface layers fix last due to surface cooling and drying.
- In high-temperature fixation, the inner core will be less fixed when removed from the fixation unit, but stored heat in the wood will continue fixation.
- The chromium fixation process is easy to follow through the colour reaction between $\text{Cr}6$ and chromotropic acid.



What is CCA Fixation

“Fixation” is a chemical reaction process



Time to Fixation

Time to fixation can vary greatly depending of what temperatures the process is subjected to.

- It can take several months to complete fixation at ambient temperatures of 5 to 7°C
- From 1 to 3 weeks to complete fixation at ambient temperatures at 20 to 25°C
- From 3 to 4 hours to complete fixation at ambient temperatures at 75°C



SPF LUMBER

Accelerated Fixation

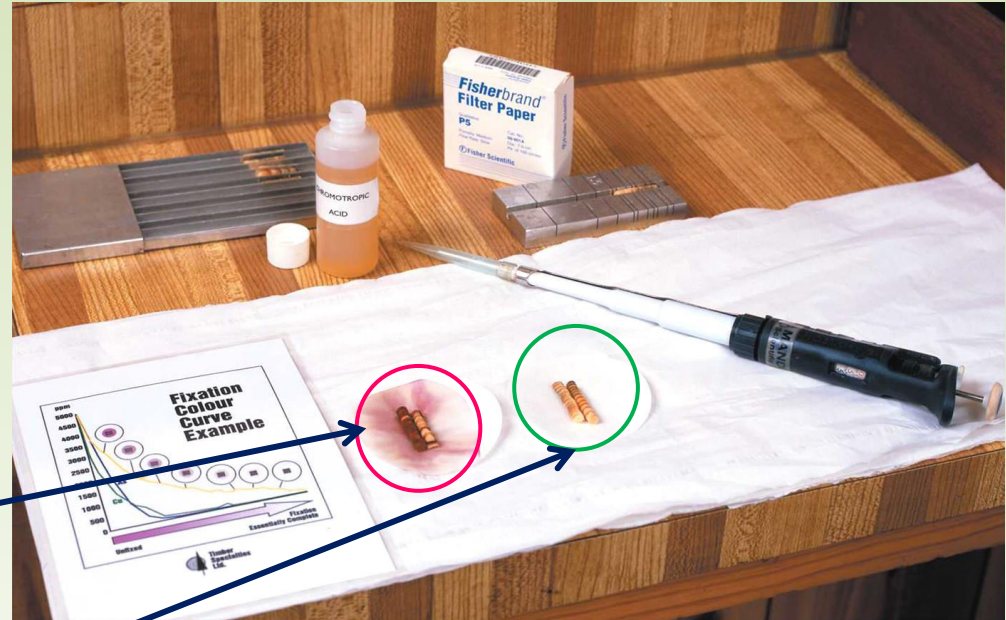
Fix Method	Temp. (F)	Time (Hrs)	Cr Fix (%)	Chromo. Acid
Steaming	160	3.3	99.9	Pass
Hot Air	150-160	2.5	97-99	Not Tested



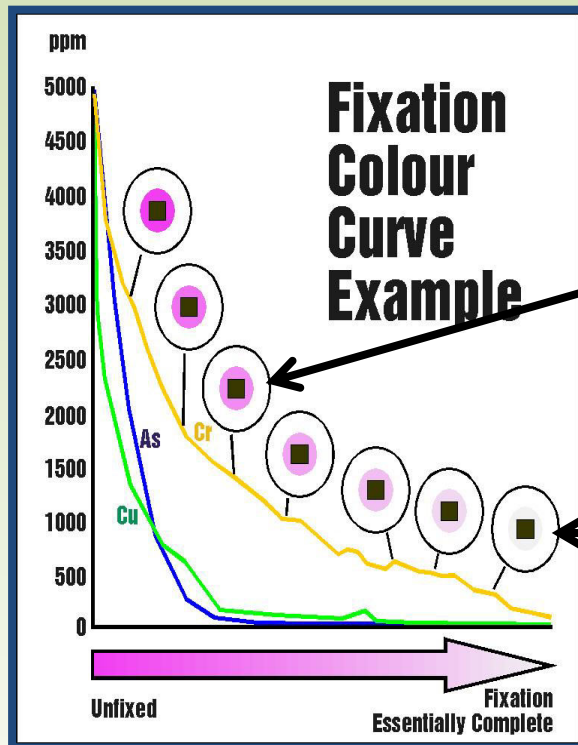
How do you know it is Fixed

Chromotropic acid test

- Wood Preservation Canada – CCA in Wood Fixation Sampling and Analysis Procedures
 - Minimum detection limit is 15 ppm
 - TRD requires non-detect (no colour) for a pass.
- Equipment required for test:
 - Chromotropic acid
 - Pipette
 - Filter paper
 - Boring tray
- Lumber is not fixed and can not be removed from drip pad
- Indication of lumber can be removed from drip pad



Chromotropic acid test

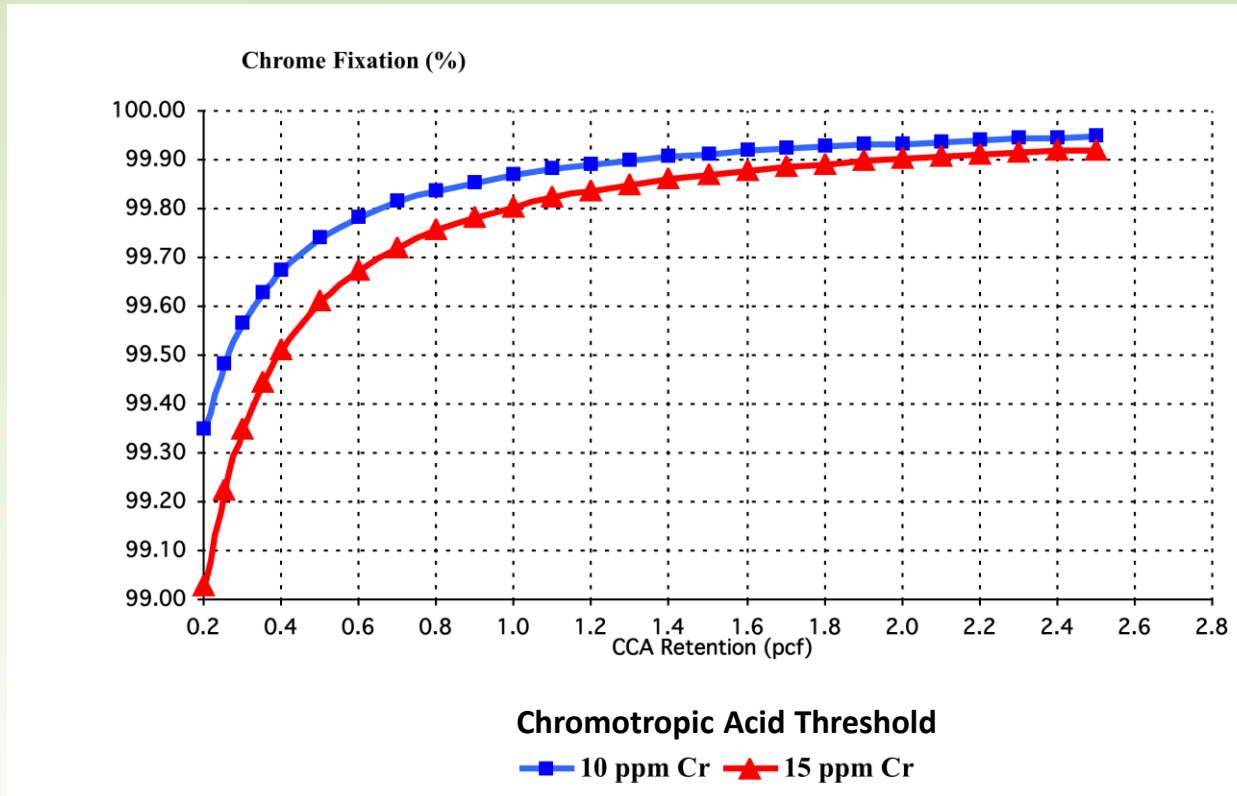


This is a tool supplied by a chemical supplier which will give an indication of the level of fixation in a wood sample. Fixed samples must still show a “clear” results with no purple showing.



CHROME FIXATION VS CCA RETENTION

Chromotropic Acid Indicator



This graph shows that for an in-ground treatment of 0.4pcf, fixation has to be between 99.5 and 99.6% to pass the Chromotropic acid test of 15ppm.

FIXATION

Options

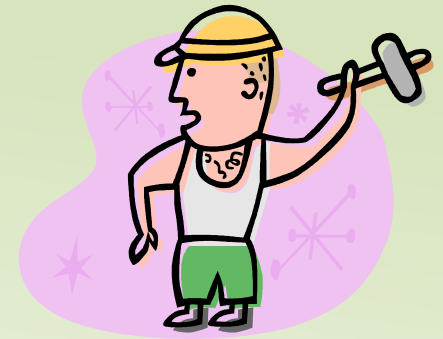
- Ambient – leaving the wood in a covered area under whatever ambient temperatures are. Time to fix – 1-3 months. Would need huge drip pads.
- Steam – fixing in cylinder; pulling a vacuum and then drawing in steam and breaking the vacuum till fixing temperature is achieved. Very fast method and all condensate is recovered for future use. Time to fix – 2-4 hrs.
- Hot Air – Uses dry kiln with steam injection, takes 3-4 hours. If no steam injected, the wood could dry without being fixed.
- Hot Water – in-cylinder, by flooding the cylinder with very hot water, fast heat transfer and fixes in 1-3 hrs. It also washes the wood leaving a good appearance. Can cause chemical imbalance problems if not careful.



Benefits of Accelerated Fixation

- Benefits of Accelerated Fixation at the Plant

- minimizes impact of wood treating operation
- meets EC TRD's (CWPCA)
- meets CSA O80 Standards
- wood can be shipped immediately
- wood can be safely handled
- reduces storage requirements



- Benefits of Accelerated Fixation to the User

- Fixation ensures treated wood will perform as expected
- Fixation greatly improves leach resistance
- Accelerated fixation ensures treated wood is safe to handle
- Fixation provides more consistent product, i.e.. more uniform colour



Procedures for Determining Stabilization in Copper Based Preservatives

- Three fundamental questions must be answered:
 - How to test for stabilization?
 - Is there any standardized method to be used at the plant level to determine stabilization?
 - To which level must copper amine complex be stabilized to assume it is stabilized in the wood?
- The current TRD stabilization requirements at treating plants are:
 - Fresh treated lumber hold for 48 hours on drip pad
 - Wood must be touch dry and no drippage
 - Wood can be wrapped after it is touch dry
 - Wood can be removed from drip pad to unprotected yard



Procedures for Determining Stabilization in Copper Based Preservatives

- New methods of determination of stabilization:
- Proposed CSA Standard Method A366-08XX
- Standard Method for Measuring Stabilization of Inorganic Copper from Treated Wood
- Development stage
- Other methods have been used with portable instruments and have proven to be both convenient and affordable.



Portable Colorimeter for analyzing Copper levels in leachate

This small portable kit will analyze low quantities of copper in solution up to 5ppm of copper. The leachate would be diluted before being analyzed.

This unit can be used for various chemicals depending on the kit purchased.



Laboratory Equipment suitable for in-plant use

Spectrophotometer



Colorimetric
Chemical



Wood Preservation Canada