

Low Temperature Fast Curing Coatings for the Surface Treatment of Wood Composite Panels



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Why to Oil Temper Hardboard Surface?

- Improve surface hardness
 - paint hold-out
 - wear resistance
 - bonding to other substrates
- Reduce blistering and fiber-pop
- Improve surface moisture resistance
- Improve bending strength



How to Oil Temper Hardboard Surface

- Tempering oil:
linseed oil, soybean oil, tung oil, and tall oil etc.
- Drying catalysts are typically the heavy metal soaps of organic acids.
- Linseed oil is applied to the panel's surface either by a roll coater or by a spray booth.
- A high temperature bake oven is used to cure (oxidize) the tempering oil immediately after application.



Linseed Oil

- Glycerides of linolenic , oleic, linoleic, and saturated fatty acids:
 - 50% linolenic acid (3 double bonds)
 - 21% oleic acid (2 double bonds)
 - 18% linoleic acid (1 double bond)
 - 11% saturated fatty acid
- The drying of linseed oil is an oxidation and polymerization process.
- During oxidation, breakdown of the chains occurs. Products of chain scission include aldehydes and carboxylic acids.



Drives to Eliminate the High Temperature Baking

- The emissions from the process will be regulated by Maximum Achievable Control Technology (MACT) Standards in 2007. To meet the requirement, the current process will require the plants to install emissions control (RTO, RCO, WESP, or biofilter system etc.)
- The baking process reduces the moisture content of the panels, humification is often required.
- The process is energy intensive.



Approaches to Eliminate the High Temperature Baking

- Higher resin application rate.
- Change internal resin system.
- Pre-treatment with a top spray resin.
- Post-treatment with a fast curing thermosetting resin.
- Alternative fast curing tempering oil system.



Low Temperature Fast Curing Coatings

- The basic concept is to build large molecules with many reactive sites grafted onto them. The coating compound with these large multifunctional molecules can be cured at a much faster rate.
- The new system is a mixture of the novel multifunctional molecules, linseed oil, and drying catalyst.
- The coating can be cured by the residual heat from the panel pressing operations.
- The reduction in emissions is achieved by:
 - Lower percentage of linseed oil in the coating formulation, and linseed oil has been treated
 - The lower cure temperature (“no-bake”)



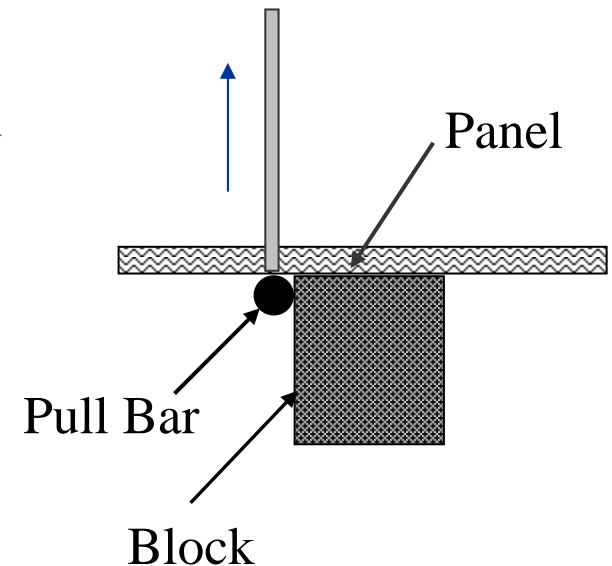
Coating Test Method to Screen Tempering Oil Formulations

1. Each formulation is coated on the backside of a paper based release liner, using a number 20 wire wound rod to obtain a 2-mil coat weight.
2. Each coating is then placed in a forced air oven at a desired temperature.
3. The coating is deemed to be cured when it can withstand a #2H pencil in pencil hardness test. The time required to reach this level of cure was recorded as “dry” or cure rate.



Panel Cleavage Test

1. Each formulation is coated on one side of a panel. The panel is then placed in a forced air oven at a desired temperature for a period of time.
2. A block is glued to the tempered face of the panel. The block is put into a clamp.
3. A pull bar is used to rip the panel off the block. The force is recorded as the rupture strength of the tempered panel.



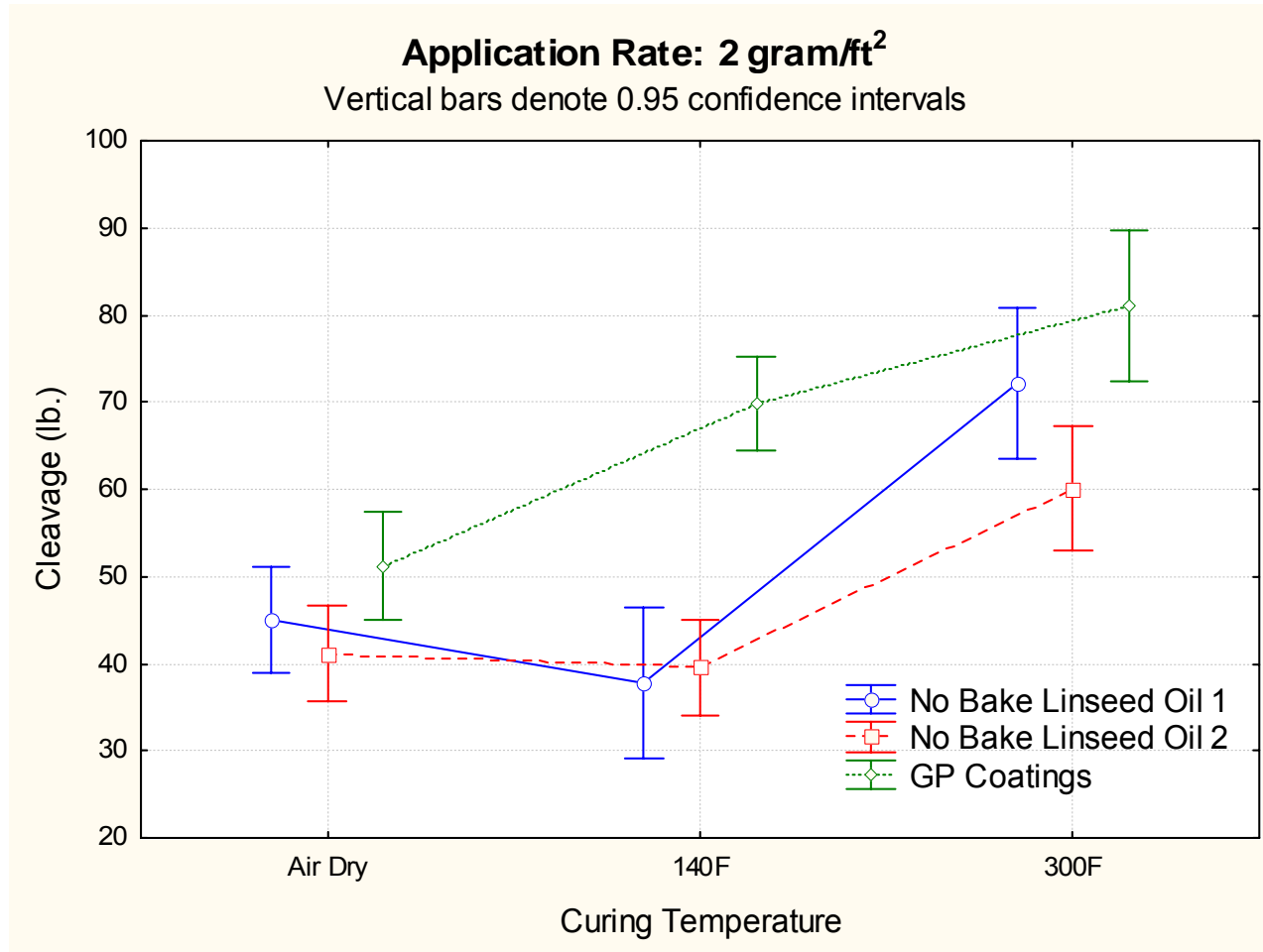


Coating Test Results

| Formulations | Dry Time 105⁰C (min.) | Dry Time 60⁰C (min.) | Film Quality |
|---|---|--|--------------------------------|
| Standard Linseed Oil Cobalt Napthanate | 10 | 30 | Tacky Film |
| Oxidized Linseed Oil Cobalt Napthanate | 10-15 | 30 | Brittle Film |
| Modified Linseed Oil Cobalt Napthanate | 8 | 20 | Tacky Film Self-Sticking |
| New Coating Formulation | 6 | 15 | Hard, Flexible, Glossy Film |

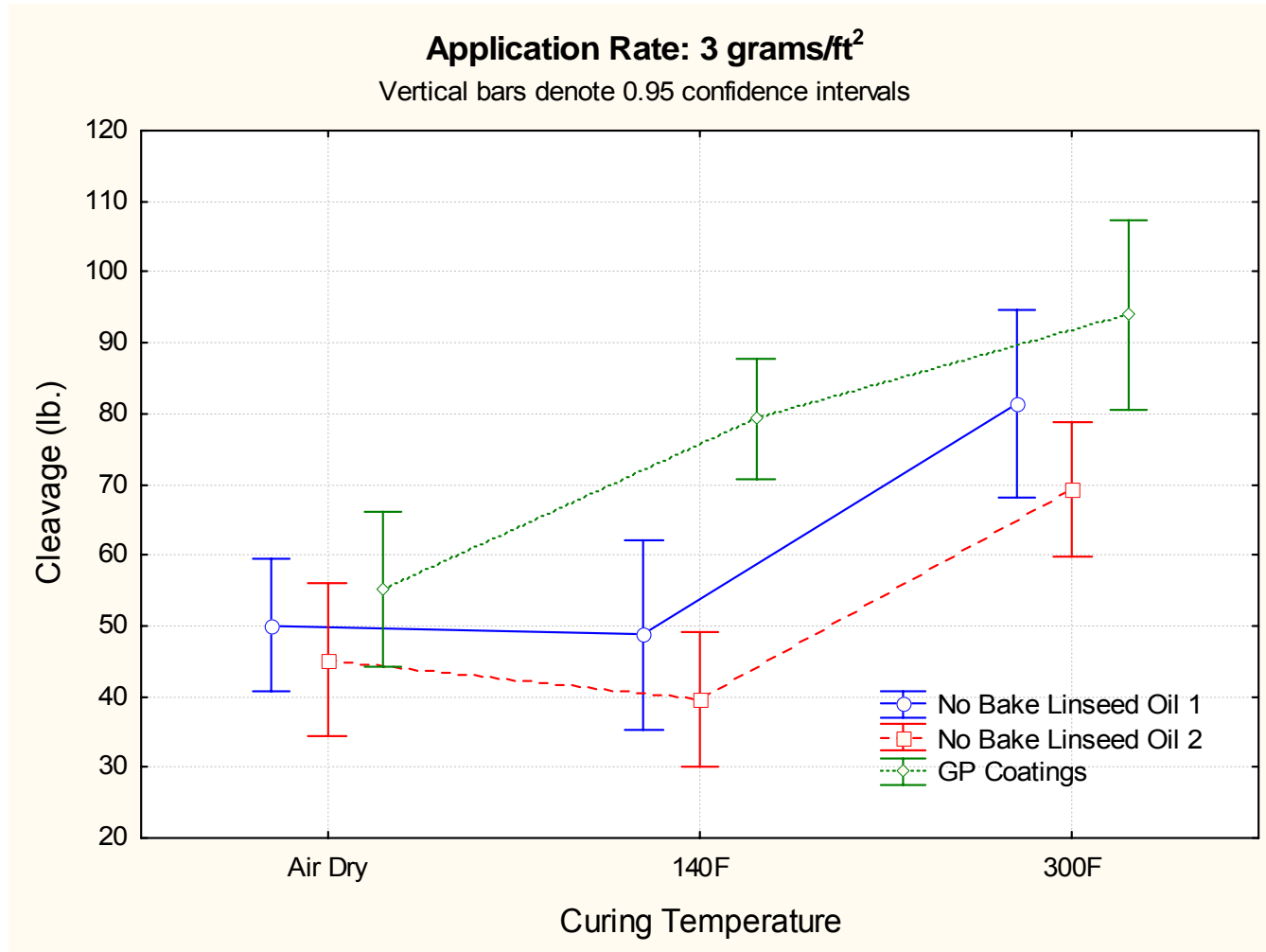


Cleavage Test Results





Cleavage Test Results (Cont.)





Summary

- A new no-bake coating technology was developed to temper hardboard panels without the need for a high temperature baking oven.
- The technology offers a low emission solution that may allow the hardboard manufacturers to avoid installing a high cost emissions control system.
- The technology is cost effective.