



# Safer and Effective Alternatives to Methylene Chloride For Paint Stripping Products

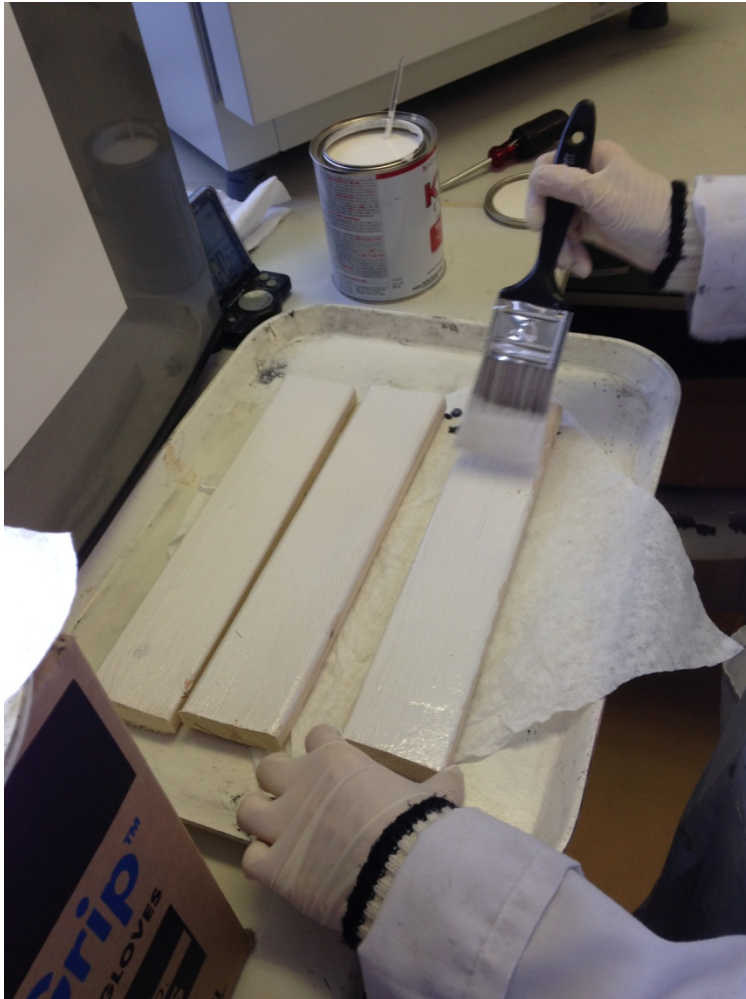
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# Lab Testing: Coupon Preparation



## Substrates:

wood, metal, masonry

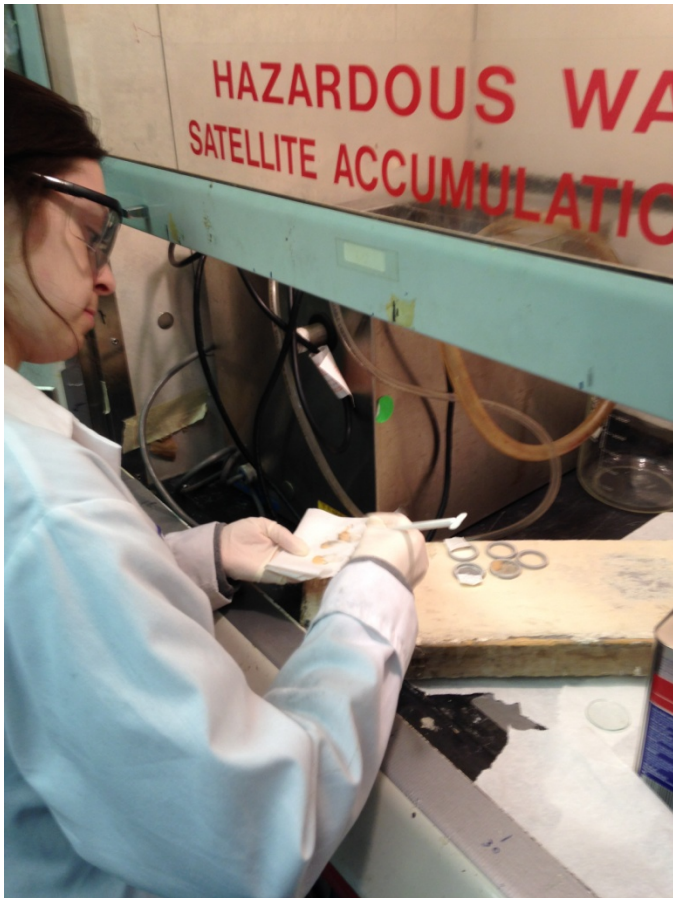
## Coatings:

- 1 primer coat
- 4 finish coats (except 6 coats for a mixed coating coupon on wood)
- Lightly sand with 100 grit sandpaper and wipe clean with isopropyl alcohol before each coating (to promote better adhesion between coating layers)

## Aging:

3 weeks in oven at 140 F (to simulate 11 months of aging)

# Lab Testing Procedure



- Glue a 1.5 inch rubber ring gasket on the test area of the test vehicle
- Use a clean pipette to add 1.5 ml of solvent blend inside the ring gasket
- Cover the ring gasket with a lab watch glass
- Start timer to initiate dwell time
- Record initial cracking time
- After dwell time: remove watch glass
- Lightly scrape off coating residue with plastic scraper & record substrate exposure

# Lab Test Results – Example



0% (bold and underline)  
substrate exposure (top layer  
not affected)



60% substrate exposure



0% substrate exposure  
(some layer(s) removed)



95% substrate exposure

# Lab Test: Methylene Chloride Based Paint Strippers



## Stryppeeze:

- Methylene chloride (25% – 30%), methanol (25 – 30%), toluene (15 – 20%), and acetone (15 – 20%).



## Klean Strip Stripper:

- Methylene chloride (60% – 100%), methanol (15 – 25%).



## Super Remover MultiLayer Stripper:

- Methylene chloride (60% – 100%), methanol (5 – 10%), and toluene (1 – 5%).



## SuperStrip:

- Methylene chloride (85% - 90%), methanol (5 – 10%), and toluene (0 – 5%).

# Lab Test: Alternative Products



NMP, Benzyl Alcohol,  
& Formic Acid



DMG, DMA, DMS,  
Triethyl phosphate



Acetone/glycol ether



NMP, DMG,  
DMA, DMS



NMP, Benzyl Alcohol



Benzyl alcohol



Benzyl alcohol, water

# Lab Test: University of Massachusetts Lowell (UML) Formulations

Formulation*	Solvents	Approximate Solvent Cost (\$ per lb)
Formulation Y	Methyl acetate DMSO Thiophene	\$0.75
Formulation 4	Methyl acetate DMSO Thiophene	\$0.94

\* Patent application filed August, 2016.

# Wood Substrate - Coatings



Oil based primer



Latex paint



Epoxy



Lacquer



Varnish



Oil based paint



Shellac



Polyurethane



# Wood Test Coupons

Pine wood substrate  
3.5" wide x 15" long

Topcoat X
Topcoat X
Topcoat X
Topcoat X
Oil primer (white)
Wood substrate

Standard coupon

Polyurethane
Polyurethane
Oil topcoat (grey)
Latex topcoat (red)
Oil topcoat (grey)
Latex topcoat (red)
Oil primer (white)
Wood substrate

Mixed coupon



# Lab Test Results Summary:

## % Wood Substrate Exposed After Test

Coupon	Dwell Time (min)	Stryp-eeze	Super Strip	Klean Strip	Super Rem-over	UML Form Y	UML Form 4	Eco-Fast	Peel Away	Citri-Strip	Ready Strip	EZ Strip	Lift-Off	Smart Strip
Epoxy (4)	20, 10	80	95	99	100	90	80	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Shellac (4)	8	65	75	70	90	85	70	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Lacquer (4)	10	75	95	85	85	90	95	0	0	0	0	0	0	0
Polyur. (4)	10	95	85	85	80	90	95	<u>0</u>	<u>0</u>	<u>0</u>	0	<u>0</u>	<u>0</u>	0
Varnish (4)	20, 12	85	85	85	95	100	80	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Oil (4)	25, 10	95	90	95	95	95	70	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Latex (4)	25	85	80	85	70	70	70	0	0	0	0	0	0	0
Mixed	20, 15	85	90	85	95	95	60	0	0	0	0	0	0	0
<b>Average</b>		<b>83</b>	<b>87</b>	<b>86</b>	<b>89</b>	<b>89</b>	<b>78</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

# Field Testing at Belcastro Furniture Restoration in Tyngsboro, MA

Decorative column  
Approximately 115 years old  
Several layers of lead based paint



## Paint Stripper Materials

Product	Supplier	Ingredients
B7 Industrial Paint Remover	Benco Sales Inc., Crossville, TN	Methylene chloride 70% - 80% Methanol 5% - 15% 2-Butoxyethanol 1% - 10% 2-Methoxymethylethoxypropanol 1% - 3% Wetting agent and wax 1% - 5%
Formulation #4	University of Massachusetts Lowell	Methyl acetate Dimethyl sulfoxide (DMSO) Thiophene

# Field Testing Procedure

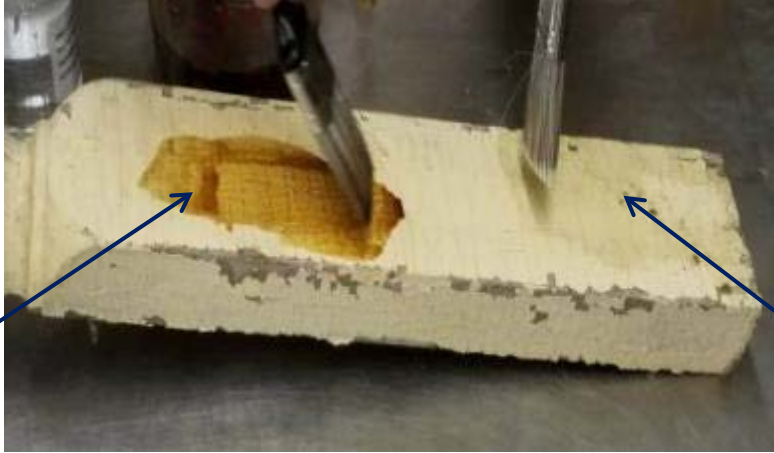
The paint removal method conducted by the Belcastro operator consisted of the following iterative process:

1. Application of the paint stripping materials onto the surface of the decorative column
2. Allowing the paint stripper to remain on the surface of the column for a few minutes
3. Scrubbing the area with ScotchBrite™ scouring pads and wire brushes
4. Wipe the area clean with a cloth rag so that photos could be taken

Steps 1 – 4 were repeated several times so that photos could be taken after 20 minutes, 29 minutes, 34 minutes, and 39 minutes of testing.

# Field Testing Results

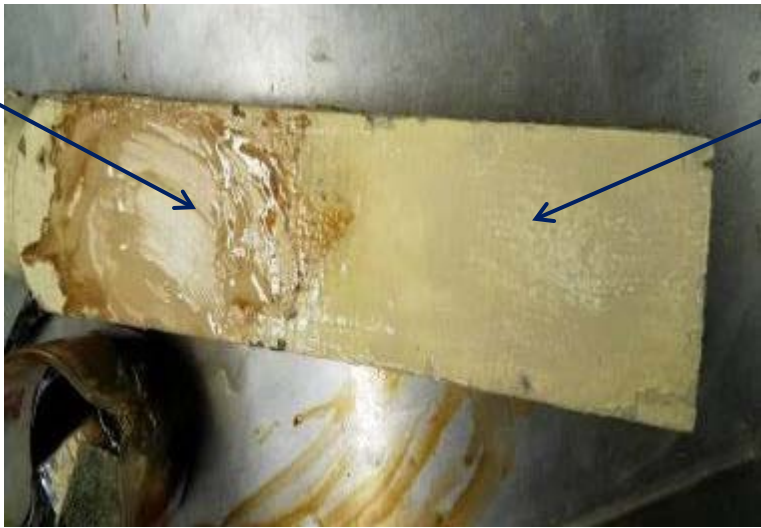
Initial application:  
Time = 0 minutes



B7  
Methylene  
Chloride

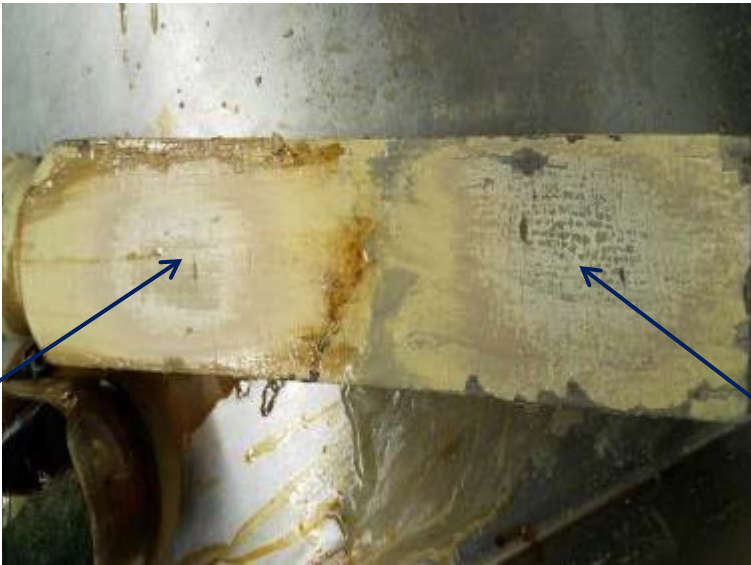
UML  
Formulation #4

Time = 20 minutes



# Field Testing Results

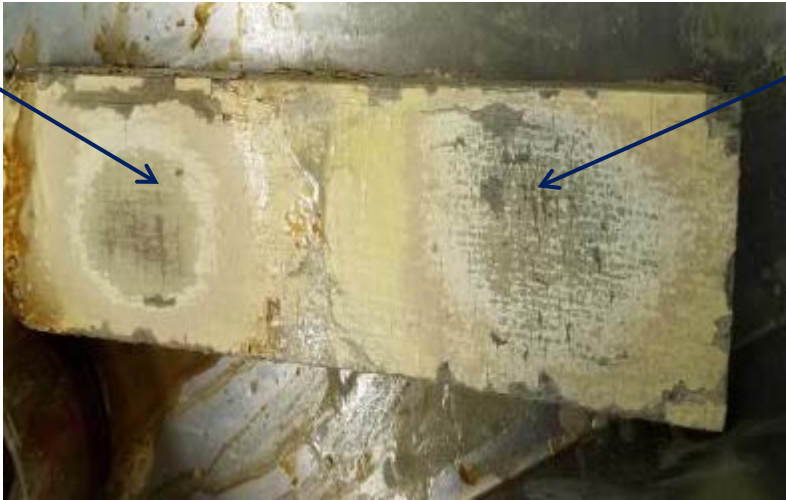
Time = 29 minutes



B7  
Methylene  
Chloride

UML  
Formulation #4

Time = 39 minutes



# Summary of Testing Results

## Lab Performance Testing:

Performance testing at the TURI Laboratory was conducted for a variety of coating materials on wood, masonry, and metal substrates. The testing results showed that the new solvent blends developed by UMass Lowell, worked equally to methylene chloride-based paint strippers and significantly better than other existing alternatives based on chemicals such as NMP, benzyl alcohol, and dibasic esters.

## Field Performance Testing:

UMass Lowell Formulation #4 performed equally to the methylene chloride based product for removing multiple layers of lead paint from an old wood substrate.