

# CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2025  
 DateRun: 04/14/2025  
 Experimenters: Amelia Wagner  
 ClientType: Cleaner Manufacturer  
 ProjectNumber: Project #1  
 Substrates: Textile  
 PartType: Coupon  
 Contaminants: Inks, Dirt, Clay, Food, Blood  
 Cleaning Methods: Mechanical Agitation  
 Analytical Methods: Colorimeter  
 Purpose: To test the efficacy of the best performing reformulation (4% enzyme mix) in comparison to the efficacy of the baseline product.

Experimental Procedure: Prep: 5x5 inch white cotton and blue polyester fabric swatches were used for testing. Each fabric swatch was measured for reflectance, redness/greenness, and yellowness/blueness with a colorimeter 5 times in 3 separate areas (0.5x0.5) where the fabric would eventually be stained. The three areas were treated as individual coupons. The 5 measurements for each area were averaged together and used as the representative measurements of the specified area/coupon. Each area was stained with the correct soil type and left to air dry for 24 hours. Colorimeter measurements of each stain were then recorded.

Washing procedure: The fabric swatches were washed in a washing machine with 45 mL of Liquid Laundry Detergent and 6.5 gallons of water on a normal washing cycle set for a medium load. The water used has a water hardness level of 63 PPM mg/L. The washing cycle consisted of a wash step (~12 mins), a rinse step (~14 mins), and a spin step (~5 mins). Half of the fabric swatches were washed unheated with a temperature range of 60F-85F, while the other half was washed heated with a temperature range of 105F-125F. The fabric swatches were dried in the drying machine on a heated gentle/tumble setting for 30 mins. After drying, the colorimeter was used to re measure the 3 staining areas on each fabric swatch.

**Analysis:**

Detergency: Unadjusted measure of the percentage the cleaned fabric was returned to its original state (uses only L values/measures of lightness)

$$\% \text{ Detergency} = 100X((L_{\text{clean}} - L_{\text{dirty}}) / (L_{\text{initial}} - L_{\text{dirty}}))$$

Where:

L=reflectance (0 black - 100 White)

Results:

Cleaner	Temp	Soil/ Stain	Fabric	L Initial	L Dirty	L Clean	% DET
MS LLD	60-85F	Dust + Sebum	Cotton	84.48	66.86	82.49	88.71
			Polyester	59.49	50.98	57.92	81.55
		Clay	Cotton	84.53	77.32	82.97	78
			Polyester	58.77	78.39	59.6	95.77
		Grass	Cotton	84.17	66.04	81.81	86.98
			Polyester	59.84	49.72	59.67	98.32
		Cocoa	Cotton	84.26	66.04	82.4	89.79
	Blood + Milk + Ink	Cotton	84.34	42.15	63.06	49.56	
	105-125F	Dust + Sebum	Cotton	85.22	53.55	82.55	91.60
			Polyester	58.58	53.7	57.85	85.04
		Clay	Cotton	89.24	78.24	87.8	88
			Polyester	58.56	77.2	59.48	98.59
		Grass	Cotton	86.05	78.16	84.85	84.79
			Polyester	59.56	51.26	59.24	96.14
Cocoa		Cotton	88.91	45.2	84.24	89.32	
Blood + Milk + Ink	Cotton	89	40.76	72.37	65.53		
Reformulation (4% enzyme mix)	60-85F	Dust + Sebum	Cotton	85.83	73.58	85.8	99.76

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		Polyester	61.04	53.17	59.62	82
	Clay	Cotton	85.35	76.14	85.75	99
		Polyester	60.91	76.97	61.42	96.82
	Grass	Cotton	86.05	80.94	85.9	97.06
		Polyester	61.12	58.33	61.05	97.49
	Cocoa	Cotton	85.65	45.23	85.38	99.33
	Blood + Milk + Ink	Cotton	85.77	40.79	83.57	95.11
105-125F	Dust + Sebum	Cotton	85.85	75.16	85.56	97.29
		Polyester	61.04	52.69	59.95	86.95
	Clay	Cotton	85.65	78.2	85.42	96.91
		Polyester	60.24	67.18	60.30	98.63
	Grass	Cotton	85.89	78.25	85.59	96.07
		Polyester	60.94	57.01	60.91	99.24
	Cocoa	Cotton	85.58	43.7	85.2	99.09
	Blood + Milk + Ink	Cotton	85.85	40.47	82.33	92.24

The reformulation performed the same on the dust+ sebum stain on polyester as the original formulation but showed an improved performance from the original formulation on dust + sebum on cotton. The reformulation improved efficacy across all other stains, most notably the blood + milk + ink stain.

While the addition of heat seems to improve the efficacy of the original formulation, the addition of heat does not seem to effect the efficacy of the 4% enzyme mix reformulation.

The table below compare the measurements of the MS LLD baseline product tested, and the 4% enzyme mix reformulation measurements.

Artificial Stain	Stain Removal Index acceptable range	Cold Water			Hot Water		
		MS LLD	4% enzyme mix	Pass/Fail	MS LLD	4% enzyme mix	Pass/Fail
Dust & Sebum on Cotton	SRI within 10 points-	88.71	99.76	Pass	91.6	97.29	Pass
Dust & Sebum on Polyester	SRI within 10 points-	81.55	82	Pass	85.04	86.95	Pass
Clay on Cotton	SRI within 11 points	78	99	Pass	96.91	96.91	Pass
Clay on Polyester	SRI within 5 points	95.77	96.82	Pass	98.59	98.63	Pass
EMPA 112-Cocoa on cotton	SRI within 9 points	89.72	99.33	Pass	89.32	99.09	Pass
EMPA 116-Blood/Milk/Ink on Cotton	SRI within 2.5 points	49.56	95.11	Pass	65.53	92.24	Pass
Grass on Cotton	SRI within 2 points	86.98	97.06	Pass	84.79	96.07	Pass
Grass on Polyester	SRI within 2 points	98.32	97.49	Pass	96.14	99.24	Pass
Overall Cleaning Ability (sum) SRI		668.61	766.57		707.92	766.42	

Summary:

<b>Substrates:</b>	Textile
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<b>Contaminants:</b>		Inks, Dirt, Clay, Food, Blood			
<b>Company Name:</b>	<b>Product Name:</b>	<b>Conc.:</b>	<b>Efficiency:</b>	<b>Effective:</b>	<b>Observations:</b>
Chemtrax	MS LLD		83.59	<input checked="" type="checkbox"/>	Temp: 60-85F
Chemtrax	MS LLD		87.02	<input checked="" type="checkbox"/>	Temp: 105-125F
Chemtrax	Chemtrax liquid laundry detergent	4% enzyme mix	95.82	<input checked="" type="checkbox"/>	Temp: 60-85F
Chemtrax	Chemtrax liquid laundry detergent	4% enzyme mix	95.80	<input checked="" type="checkbox"/>	Temp: 105-125F

**Conclusion:**

Increasing the concentration of the enzyme mix (equal parts of each of the 5 enzymes) from 2% to 4% greatly increased the efficacy of the product in removing all stains from both polyester and cotton. The only stain and fabric type that did not see increased efficacy using the 4% enzyme mix is dust + sebum on polyester.

The overall cleaning power of the 4% enzyme mix reformulation at both temperatures is much greater than the overall cleaning power of the MS LLD sample overall cleaning power and greater than the tested MS LLD overall cleaning power.