CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	2025
DateRun:	07/15/2025
Experimenters:	Amelia Wagner
ClientType:	Cleaner Manufacturer
ProjectNumber:	Project #2
Substrates:	Textile
PartType:	Coupon
Contaminants:	Inks, Dirt, Clay, Food, Blood
Cleaning Methods:	Mechanical Agitation
Analytical Methods:	Colorimeter
Purpose:	To test the efficacy of one lower cost reformulation of the Chemtrax liquid laundry detergent containing the 4% enzyme mix identified from previous testing.

Experimental Procedure:

Prep: 5x5 inch white cotton and blue polyester fabric swatches were used for testing. Each fabric swatch was measured for reflectance 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 top loader 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)

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

Where:

L=reflectance (0 black - 100 White)

Results:

Formulation	Temp	Soil/ Stain	Fabric	L Initial	L Dirty	L Clean	% DET
MS LLD	Unheated	Dust + Sebum	Cotton	85.88	73.43	85.6	97.75%
			Polyester	60.26	54.76	59.95	94.36%
		Clay	Cotton	85.89	78.34	85.76	98.28%
			Polyester	60.52	79.13	61.26	96.02%
		Grass	Cotton	85.74	79.63	85.53	96.56%
			Polyester	60.43	58.88	60.43	100.00%
		Cocoa	Cotton	85.69	49.68	85.61	99.78%
		Blood + Milk + Ink	Cotton	85.71	44.68	84.5	97.05%
	Heated	Dust + Sebum	Cotton	85.86	82.95	85.68	93.81%
			Polyester	60.48	55.39	59.62	83.10%
		Clay	Cotton	85.9	79.65	85.84	99.04%
			Polyester	60.79	76.07	60.85	99.61%
		Grass	Cotton	85.72	78.19	85.28	94.16%
			Polyester	61.22	59.67	61.15	95.48%
		Cocoa	Cotton	85.86	48.67	85.57	99.22%
		Blood + Milk + Ink	Cotton	85.58	44.24	84.63	97.70%
Chemtrax Reformulation 1	Unheated	Dust + Sebum	Cotton	85.84	75.59	85.72	98.83%

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			Polyester	60.5	52.82	60.09	94.66%
		Clay	Cotton	86.13	77.51	86.12	99.88%
			Polyester	60.24	77.64	61.04	95.40%
		Grass	Cotton	85.72	73.34	85.71	99.92%
			Polyester	61.2	59.3	61.18	98.95%
		Cocoa	Cotton	85.62	49.07	85.2	98.85%
		Blood + Milk + Ink	Cotton	85.83	44.81	84.66	97.15%
	Heated	Dust + Sebum	Cotton	85.63	78.96	85.31	95.20%
			Polyester	60.53	58.62	60.05	74.87%
		Clay	Cotton	85.88	80.2	85.87	99.82%
			Polyester	60.87	79.28	60.64	101.25%
		Grass	Cotton	85.7	77.38	85.1	92.79%
			Polyester	60.51	58.67	60.48	98.37%
		Cocoa	Cotton	85.94	40.89	85.41	98.82%
		Blood + Milk + Ink	Cotton	85.57	44.33	84.8	98.13%

The table below compare the measurements of the MS LLD baseline product tested, and the measurements of the reformulations.

Reformulation 1:

		Cold Water			Hot Water		
Artificial Stain	Stain Removal Index acceptable range	MS LLD Original	Reformulation 1	Pass/ Fail	MS LLD Original	Reformulation 1	Pass/ Fail
Dust & Sebum on Cotton	SRI within 10 points	97.75	98.83	Pass	93.81	95.2	Pass
Dust & Sebum on Polyester	SRI within 10 points	94.36	94.66	Pass	83.1	74.87	Pass
Clay on Cotton	SRI within 11 points	98.28	99.88	Pass	99.04	99.82	Pass
Clay on Polyester	SRI within 5 points	96.02	95.4	Pass	99.61	101.25	Pass
EMPA 112-Cocoa on Cotton	SRI within 9 points	99.78	98.85	Pass	99.22	98.82	Pass
EMPA 116-Blood, Milk & Ink on Cotton	SRI within 2.5 points	97.05	97.15	Pass	97.7	98.13	Pass
Grass on Cotton	SRI within 2 points	96.56	99.92	Pass	94.16	92.79	Pass
Grass on Polyester	SRI within 2 points	100	98.95	Pass	95.48	98.37	Pass

Summary:

Conclusion: Reformulation 1 was able to pass the comparison criteria across all stains, fabric types, and temperatures.