CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	2025
DateRun:	04/07/2025
Experimenters:	Amelia Wagner
ClientType:	Cleaner Manufacturer
ProjectNumber:	Project #1
Substrates:	Textile
PartType:	Coupon
Contaminants:	Blood
Cleaning Methods:	Mechanical Agitation
Analytical Methods:	Colorimeter
Purpose:	To test the efficacy of the best performing reformulation (5% enzyme mix) in comparison to the efficacy of the original formulation.

Experimental Procedure:

Testing:

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 was ten 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)

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

Where:

L=reflectance (0 black - 100 White)

Results:

Temp	Cleaner	Stain	Fabric	L initial	L dirty	L clean	% DET	AVG % DET
Unheated (60-85F)	Original	Dust + Sebum	Cotton	88.48	66.86	82.49	88.71	85.13
			Polyester	59.49	50.98	57.92	81.55	
		Clay	Cotton	84.53	77.32	82.97	78	86.89
			Polyester	58.77	78.39	59.6	95.77	
		Grass	Cotton	84.17	66.05	81.81	86.98	92.65
			Polyester	59.84	49.72	59.67	98.32	
		Cocoa	Cotton	8.26	66.04	82.4	89.79	89.79
		Blood + Milk + Ink	Cotton	84.34	42.15	63.06	49.56	49.56
	Reformulation: 5% enzyme mix	Dust + Sebum	Cotton	84.06	73.92	83.1	90.53	87.27
			Polyester	58.85	52.54	57.84	84	
		Clay	Cotton	84.38	77.64	83.17	82	90.92
			Polyester	59.36	77.81	59.39	99.84	
		Grass	Cotton	84.24	71.26	82	82.74	91.37
			Polyester	59.46	48.11	59.46	100	
		Cocoa	Cotton	84.49	51.99	82.13	92.74	92.74

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		Blood + Milk + Ink	Cotton	84.67	41.41	79.13	87.19	87.19
Heated (105-125F)	Original	Dust + Sebum	Cotton	85.22	53.55	82.55	91.6	88.32
			Polyester	58.58	53.7	57.85	85.04	
		Clay	Cotton	89.24	78.24	87.8	88	91.88
			Polyester	58.56	77.2	59.35	95.76	
		Grass	Cotton	86.05	78.16	84.85	84.79	90.60
			Polyester	59.56	51.26	59.24	96.4	
		Cocoa	Cotton	88.91	45.2	84.24	89.32	89.32
		Blood + Milk + Ink	Cotton	89	40.76	72.37	65.53	65.53
	Reformulation: 5% enzyme mix	Dust + Sebum	Cotton	86.43	52.21	83.94	92.72	85.64
			Polyester	58.43	55.36	58.07	88.27	
		Clay	Cotton	89.05	81.3	88.37	83	97.34
			Polyester	58.63	77.42	59.25	96.7	
		Grass	Cotton	86.36	78.95	86.21	97.98	93.37
			Polyester	59.56	55.28	59.42	96.73	
		Cocoa	Cotton	88.84	55.22	85.5	90	90
		Blood + Milk + Ink	Cotton	88.94	41.61	81.69	84.68	84.68

Summary:

Conclusion: The reformulation performs equal to or better than the original formulation based on average percent detergencies. Most notably, The reformulation improved the performance on the blood, milk, and ink stain significantly at both temperatures.