

# 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 two lower cost reformulations 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 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:

| 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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|--------------------------|----------|--------------------|--------------|-----------|--------|--------|---------|---------|
|                          |          | Clay               | Polyester    | 60.5      | 52.82  | 60.09  | 94.66%  |         |
|                          |          |                    | Cotton       | 86.13     | 77.51  | 86.12  | 99.88%  |         |
|                          |          |                    | Polyester    | 60.24     | 77.64  | 61.04  | 95.40%  |         |
|                          |          |                    | Cotton       | 85.72     | 73.34  | 85.71  | 99.92%  |         |
|                          |          | Grass              | Polyester    | 61.2      | 59.3   | 61.18  | 98.95%  |         |
|                          |          |                    | Cotton       | 85.62     | 49.07  | 85.2   | 98.85%  |         |
|                          |          | Cocoa              | Cotton       | 85.83     | 44.81  | 84.66  | 97.15%  |         |
|                          |          | Blood + Milk + Ink |              |           |        |        |         |         |
|                          |          | 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% |         |         |
| Chemtrax Reformulation 2 | Unheated | Dust + Sebum       | Cotton       | 85.66     | 80.35  | 85.6   | 98.87%  |         |
|                          |          |                    | Polyester    | 60.35     | 56.18  | 59.97  | 90.89%  |         |
|                          |          | Clay               | Cotton       | 86.03     | 77.17  | 85.97  | 99.32%  |         |
|                          |          |                    | Polyester    | 60.21     | 78.99  | 61.12  | 95.15%  |         |
|                          |          | Grass              | Cotton       | 86.14     | 83.6   | 86.11  | 98.82%  |         |
|                          |          |                    | Polyester    | 61.22     | 59.44  | 60.99  | 87.08%  |         |
|                          |          | Cocoa              | Cotton       | 85.64     | 49.7   | 85.54  | 99.72%  |         |
|                          |          | Blood + Milk + Ink | Cotton       | 86.1      | 48.06  | 80.53  | 85.36%  |         |
|                          | Heated   | Dust + Sebum       | Cotton       | 85.87     | 80.57  | 85.81  | 98.87%  |         |
|                          |          |                    | Polyester    | 60.93     | 55.69  | 59.65  | 75.57%  |         |
|                          |          | Clay               | Cotton       | 85.88     | 79.55  | 85.79  | 98.58%  |         |
|                          |          |                    | Polyester    | 60.66     | 77.61  | 60.54  | 100.71% |         |
|                          |          | Grass              | Cotton       | 85.79     | 83.27  | 85.57  | 91.27%  |         |
|                          |          |                    | Polyester    | 60.83     | 58.49  | 60.81  | 99.15%  |         |
| Cocoa                    | Cotton   | 86.02              | 48.04        | 85.23     | 97.97% |        |         |         |
| Blood + Milk + Ink       | Cotton   | 85.76              | 43.61        | 75.68     | 76.09% |        |         |         |

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

### Reformulation 1:

| Artificial Stain          | Stain Removal Index acceptable range | Cold Water      |                 |           | Hot Water       |                 |           |
|---------------------------|--------------------------------------|-----------------|-----------------|-----------|-----------------|-----------------|-----------|
|                           |                                      | 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      |

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|                                       |                       |       |       |      |       |       |      |
|---------------------------------------|-----------------------|-------|-------|------|-------|-------|------|
| 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 |

Reformulation 2:

|                                       |                                      | Cold Water      |                 |           | Hot Water       |                 |           |
|---------------------------------------|--------------------------------------|-----------------|-----------------|-----------|-----------------|-----------------|-----------|
| Artificial Stain                      | Stain Removal Index acceptable range | MS LLD Original | Reformulation 2 | Pass/Fail | MS LLD Original | Reformulation 2 | Pass/Fail |
| Dust & Sebum on Cotton                | SRI within 10 points                 | 97.75           | 98.87           | Pass      | 93.81           | 98.87           | Pass      |
| Dust & Sebum on Polyester             | SRI within 10 points                 | 94.36           | 90.89           | Pass      | 83.1            | 75.57           | Pass      |
| Clay on Cotton                        | SRI within 11 points                 | 98.28           | 99.32           | Pass      | 99.04           | 98.58           | Pass      |
| Clay on Polyester                     | SRI within 5 points                  | 96.02           | 95.15           | Pass      | 99.61           | 100.71          | Pass      |
| EMPA 112- Cocoa on Cotton             | SRI within 9 points                  | 99.78           | 99.72           | Pass      | 99.22           | 97.97           | Pass      |
| EMPA 116- Blood, Milk & Ink on Cotton | SRI within 2.5 points                | 97.05           | 85.36           | Fail      | 97.7            | 76.09           | Fail      |
| Grass on Cotton                       | SRI within 2 points                  | 96.56           | 98.82           | Pass      | 94.16           | 91.27           | Fail      |
| Grass on Polyester                    | SRI within 2 points                  | 100             | 87.08           | Fail      | 95.48           | 99.15           | Pass      |

Summary:

| <b>Substrates:</b>   |   | Textile                       |             |                                     |                |
|----------------------|---|-------------------------------|-------------|-------------------------------------|----------------|
| <b>Contaminants:</b> |   | Inks, Dirt, Clay, Food, Blood |             |                                     |                |
| Company Name:        | Product Name:                                       | Conc.:                        | Efficiency: | Effective:                          | Observations:  |
| Chemtrax             | MS LLD  | 45ml per 6.5 gallons of water | 97.48       | <input checked="" type="checkbox"/> | Temp: 60-85F   |
| Chemtrax             | Chemtrax liquid laundry detergent (reformulation 1) |                               | 97.96       | <input checked="" type="checkbox"/> | Temp: 60-85F   |
| Chemtrax             | Chemtrax liquid laundry detergent (reformulation 2) |                               | 94.40       | <input checked="" type="checkbox"/> | Temp: 60-85F   |
| Chemtrax             | MS LLD  |                               | 95.27       | <input checked="" type="checkbox"/> | Temp: 105-125F |

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|          |   |  |       |                                     |                   |
|----------|---|--|-------|-------------------------------------|-------------------|
| Chemtrax | Chemtrax liquid laundry detergent (reformulation 1) |  | 94.91 | <input checked="" type="checkbox"/> | Temp:<br>105-125F |
| Chemtrax | Chemtrax liquid laundry detergent (reformulation 2) |  | 92.28 | <input checked="" type="checkbox"/> | Temp:<br>105-125F |

**Conclusion:**

Reformulation 1 was able to pass the comparison criteria across all stains, fabric types, and temperatures. Reformulation 2 was not able to pass the comparison criteria for Blood/Milk/Ink stain on cotton or grass stains on both cotton and polyester. These fails were consistent when the testing was repeated for these stains and fabric combinations. Reformulation 1 is the best option for a lower cost reformulation.