

# CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2015

DateRun: 08/17/2015

Experimenters: Loc Nguyen, George Liang

ClientType: Cleaner Manufacturer

ProjectNumber: Project #7

Substrates: Textile

PartType: Part

Contaminants: Inks, Oil, Food

Cleaning Methods: Mechanical Agitation

Analytical Methods: Gloss-Color Meter

Purpose: The purpose of the experiment is to determine the relative rate of contaminant removal from the cloths by the detergent. This test method stimulates a uniform mechanical standard to properly utilize the solution.

Experimental Procedure: White cotton, white cotton polyester and purple nylon were soiled with the motor oil, mustard, Crisco, and grape juice. Each contaminant was soiled on three pieces of each type of cloth. Every piece of 4x5 in cloth was spread taut over a glass beaker and the soil was applied manually. Sample clothes were allowed to dry for a day and dirty gloss readings were taken. They were washed at approximately 85 °F for 12 min in the Terg-O-meter at an RPM of 90 using tap water with hardness of 150ppm. One milliliter of detergent was added for 2 L of water. After washing, the cloths were rinsed in water and dried for a day. Color readings were taken at the end of the day. The second part of the experiment was to study the effect of the detergent on the color fastness of orange, blue and purple fabric. Each piece of cloth was washed for 15 cycles and color fastness was recorded in terms of gloss values. Final assessment was to look at the fabric texture and rate according to the table listed below. The cleaning analysis was done by calculating the stain removal index.

$$SRI = 100 - ((Lc - Lw)^2 + (ac - aw)^2 + (bc - bw)^2)^{1/2}$$

where:  
 L = reflectance,  
 a = redness/greenness,  
 b = yellowness/blueness,  
 c = unstained fabric, washed in the treatment conditions,  
 w = stained fabric, washed in the treatment conditions.

Table Fabric Smoothness Grades by SA Replica Equivalents Description  
 Grade Observations  
 SA•5 Very smooth, pressed, finished appearance.  
 SA•4 Smooth, finished appearance.  
 SA•3.5 Fairly smooth but nonpressed appearance.  
 SA•3 Mussed, nonpressed appearance.  
 SA•2 Rumpled, obviously wrinkled appearance.  
 SA•1 Crumpled, creased and severely wrinkled appearance.

Results: Change in L value denotes the change in concentration of stain while a and b values denote the spectrum on blue and green shades in the sample. Thus these values denote the amount of stain that the detergent was capable of removing.

Thus the SRI for all the materials when the test was performed with supplied detergent is calculated as:  
 Table 2: Results from revised Gain detergent

| Cloth                  | Soil        | SRI   | Average |
|------------------------|-------------|-------|---------|
| Purple Nylon           | Motor Oil   | 97.04 | 95.92   |
|                        | Grape Juice | 92.74 |         |
|                        | Mustard     | 99.14 |         |
|                        | Shortening  | 94.76 |         |
| White Cotton Polyester | Motor Oil   | 96.37 | 81.53   |
|                        | Grape Juice | 42.71 |         |
|                        | Mustard     | 97.48 |         |
|                        | Shortening  | 89.56 |         |
| White Cotton           | Motor Oil   | 93.76 | 83.96   |

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|  |             |       |  |
|--|-------------|-------|--|
|  | Grape Juice | 70.31 |  |
|  | Mustard     | 92.62 |  |
|  | Shortening  | 79.13 |  |

The SRI for all the materials when the test was performed with comparative detergent 1 is:

Table 3: Results from Arm & Hammer detergent

| Cloth                  | Soil        | SRI   | Average |
|------------------------|-------------|-------|---------|
| Purple Nylon           | Motor Oil   | 95.37 | 96.64   |
|                        | Grape Juice | 98.59 |         |
|                        | Mustard     | 94.66 |         |
|                        | Shortening  | 97.92 |         |
| White Cotton Polyester |             |       |         |
|                        | Motor Oil   | 68.73 | 67.12   |
|                        | Grape Juice | 70.66 |         |
|                        | Mustard     | 57.79 |         |
|                        | Shortening  | 71.28 |         |
| White Cotton           | Motor Oil   | 80.71 | 86.31   |
|                        | Grape Juice | 93.78 |         |
|                        | Mustard     | 74.49 |         |
|                        | Shortening  | 96.29 |         |

The SRI for all the materials when the test was performed with comparative detergent 2 is:

Table 4: Results from Purex detergent

| Cloth                  | Soil        | SRI   | Average |
|------------------------|-------------|-------|---------|
| Purple Nylon           | Motor Oil   | 96.82 | 93.13   |
|                        | Grape Juice | 88.23 |         |
|                        | Mustard     | 88.86 |         |
|                        | Shortening  | 98.62 |         |
| White Cotton Polyester |             |       |         |
|                        | Motor Oil   | 88.16 | 86.82   |
|                        | Grape Juice | 97.75 |         |
|                        | Mustard     | 63.75 |         |
|                        | Shortening  | 97.62 |         |
| White Cotton           | Motor Oil   | 78.13 | 83.9    |
|                        | Grape Juice | 93.85 |         |
|                        | Mustard     | 65.8  |         |
|                        | Shortening  | 97.81 |         |

The results of the color fastness test were as follows:

Table 5: Color fastness test of product detergent

|             | Initial Reading | Final reading |        |       |       |        |
|-------------|-----------------|---------------|--------|-------|-------|--------|
| Cloth color | L               | a*            | b*     | L     | a*    | b*     |
| Purple      | 39.77           | 13.07         | -25.6  | 41.96 | 6.57  | -20.09 |
|             | 40.09           | 13.05         | -25.67 | 41.91 | 6.63  | -20.25 |
|             | 39.77           | 13.06         | -25.59 | 41.74 | 6.62  | -20.05 |
|             | 40.17           | 13.09         | -25.77 | 47.07 | 6.62  | -20.21 |
| Orange      | 57.42           | 48.69         | 50.92  | 59.87 | 44.98 | 54.97  |
|             | 57.34           | 48.58         | 50.66  | 60.08 | 44.97 | 54.97  |

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|------|-------|-------|--------|-------|--------|--------|
|      | 57.41 | 48.65 | 50.91  | 59.85 | 44.92  | 54.74  |
|      | 57.42 | 48.8  | 50.92  | 60.03 | 44.78  | 54.9   |
| Blue | 53.52 | -6.3  | -26.09 | 56.33 | -13.71 | -18.98 |
|      | 53.18 | -6.3  | -26.14 | 56.04 | -13.76 | -18.97 |
|      | 53.27 | -6.35 | -26.1  | 55.96 | -13.7  | -19.11 |
|      | 53.16 | -6.27 | -26.18 | 54    | -6.02  | -26.82 |

Table 6: Color fastness test of comparative detergent 1

|             | Initial Reading | Final reading |        |       |       |        |
|-------------|-----------------|---------------|--------|-------|-------|--------|
| Cloth color | L               | a*            | b*     | L     | a*    | b*     |
| Purple      | 40.2            | 13.04         | -25.65 | 39.36 | 13.2  | -25.79 |
|             | 40.32           | 13.05         | -25.75 | 40.06 | 13.01 | -25.5  |
|             | 40.25           | 13.14         | -25.82 | 40.07 | 13.49 | -26.14 |
|             | 40.01           | 13.05         | -25.58 | 40.18 | 13.16 | -25.61 |
| Orange      | 57.54           | 48.42         | 50.63  | 58.18 | 50.92 | 53.74  |
|             | 57.52           | 48.61         | 50.76  | 57.83 | 50.72 | 53.37  |
|             | 57.52           | 48.67         | 50.68  | 58.12 | 50.75 | 53.62  |
|             | 57.34           | 48.43         | 50.48  | 58.1  | 50.92 | 53.64  |
| Blue        | 53.04           | -6.25         | -26.24 | 53.62 | -5.87 | -26.99 |
|             | 53.39           | -6.27         | -26.07 | 54.18 | -6.01 | -27.16 |
|             | 53.36           | -6.24         | -26.15 | 53.86 | -6.07 | -26.59 |
|             | 53.39           | -6.25         | -26.24 | 53.83 | -6.01 | -26.83 |

Table 7: Color fastness test of comparative detergent 2

|             | Initial Reading | Final reading |        |       |        |        |
|-------------|-----------------|---------------|--------|-------|--------|--------|
| Cloth color | L               | a*            | b*     | L     | a*     | b*     |
| Purple      | 40              | 12.95         | -25.51 | 40.21 | 13.37  | -25.92 |
|             | 40.33           | 13.04         | -25.78 | 40.14 | 13.53  | -26.24 |
|             | 39.99           | 13            | -25.43 | 39.85 | 13.31  | -25.77 |
|             | 40.25           | 12.5          | -24.97 | 39.64 | 13.12  | -25.41 |
| Orange      | 57.44           | 48.83         | 51.13  | 57.92 | 50.75  | 53.51  |
|             | 57.44           | 48.34         | 50.32  | 57.91 | 50.51  | 53.08  |
|             | 57.36           | 48.47         | 50.41  | 57.81 | 50.31  | 52.44  |
|             | 57.29           | 48.22         | 50.27  | 57.8  | 50.63  | 53.23  |
| Blue        | 53.38           | -6.25         | -26.11 | 56.05 | -13.68 | -18.88 |
|             | 53.53           | -6.32         | -26.02 | 56.19 | -13.72 | -18.86 |
|             | 53.5            | -6.29         | -26.09 | 56.18 | -13.74 | -18.88 |
|             | 53.38           | -6.34         | -26.05 | 56.07 | -13.74 | -18.92 |

Average percent change in fabric color:

|               | % Change |         |        |
|---------------|----------|---------|--------|
| Supplied      | L        | a*      | b*     |
| Purple        | 0.453    | -3.586  | -1.623 |
| Orange        | -0.832   | -4.304  | -5.014 |
| Blue          | -122.787 | 27.553  |        |
| Comparative 1 |          |         |        |
| Purple        | -8.044   | 49.416  | 21.466 |
| Orange        | -4.46    | 7.739   | -7.95  |
| Blue          | -4.315   | -86.948 | 19.755 |
| Comparative 2 |          |         |        |
| Purple        | 0.689    | -1.107  | -0.233 |
| Orange        | -1.005   | -4.73   | -5.836 |
| Blue          | -1.084   | 4.198   | -2.743 |

Fabric Condition:

| Product | Comparative 1 |      |        | Comparative 2 |      |        | Supplied |      |        |
|---------|---------------|------|--------|---------------|------|--------|----------|------|--------|
| Fabric  | Orange        | Blue | Purple | Orange        | Blue | Purple | Orange   | Blue | Purple |

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|                 |     |     |     |     |     |     |     |     |     |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Sample 1        | 3.5 | 4   | 3   | 2   | 5   | 3.5 | 5   | 5   | 4   |
| Sample 2        | 3.5 | 3.5 | 3   | 3   | 5   | 3.5 | 5   | 4   | 5   |
| Sample 3        | 4   | 3.5 | 4   | 4   | 5   | 4   | 4   | 3.5 | 3.5 |
| Sample 4        | 3.5 | 3   | 3.5 | 3.5 | 4   | 3.5 | 3.5 | 4   | 5   |
| Sample 5        | 3   | 3.5 | 3   | 3   | 5   | 3.5 | 3.5 | 3.5 | 3.5 |
| Sample 6        | 3   | 3   | 4   | 2   | 5   | 3.5 | 4   | 3.5 | 4   |
| Sample 7        | 3.5 | 3   | 3   | 3   | 5   | 4   | 5   | 4   | 4   |
| Sample 8        | 3.5 | 4   | 3.5 | 3.5 | 5   | 4   | 5   | 3.5 | 3.5 |
| Sample 9        | 3.5 | 3.5 | 3   | 2   | 4   | 3.5 | 4   | 4   | 3.5 |
| Average         | 3.4 | 3.4 | 3.3 | 2.9 | 4.8 | 3.7 | 4.3 | 3.9 | 4   |
| Overall Average | 3.4 |     |     | 3.8 |     |     | 4.1 |     |     |

Summary:

|                      |                               |               |                    |                                     |                      |
|----------------------|-------------------------------|---------------|--------------------|-------------------------------------|----------------------|
| <b>Substrates:</b>   | Textile                       |               |                    |                                     |                      |
| <b>Contaminants:</b> | Inks, Oil, Food               |               |                    |                                     |                      |
| <b>Company Name:</b> | <b>Product Name:</b>          | <b>Conc.:</b> | <b>Efficiency:</b> | <b>Effective:</b>                   | <b>Observations:</b> |
| Arm & Hammer         | Clean Burst detergent         | 0.1           | 83.63              | <input checked="" type="checkbox"/> |                      |
| Henkel Corporation   | Purex detergent Dirt Lift     | 0.1           | 87.95              | <input checked="" type="checkbox"/> |                      |
| Korex Canada         | Gain Formula (revised 15-359) | 0.1           | 87.14              | <input checked="" type="checkbox"/> |                      |

Conclusion:

As can be seen from the experiment the supplied product revised Gain was slightly less effective but performed very close in comparison to the comparative product Purex Dirt Lift Action at an average of 87.14 and 87.95 SRI respectively for all soils from the three fabrics types. Both products were more effective in cleaning the soils than the comparative product Arm & Hammer Clean Burst at 83.36 SRI. There were some slight changes in color readings before and after the 15 cycles with both revised Gain and Arm & Hammer Clean Burst but insignificant change for Purex Dirt Lift Action. Revised Gain had mostly loss of color from the blue fabric whereas Arm & Hammer had loss of colors in all three fabrics. When the smoothness of the cloths after washing were manually determined and analyzed, it was concluded that the supplied product leaves the fabrics smoother with finished appearance (4.1) which is slightly better than the Purex product at a rating of 3.8. Arm & Hammer was only able to achieve a fairly smooth but non pressed appearance (3.4).