

# CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2015

DateRun: 06/12/2015

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ClientType: Cleaner Manufacturer

ProjectNumber: Project #1

Substrates: Stainless Steel

PartType: Coupon

Contaminants: Oil

Cleaning Methods: Immersion/Soak

Analytical Methods: Gravimetric

Purpose: To evaluate the efficiency one cleaner on GS 34 Soil-1 and Soil-2 from stainless steel coupons using immersion technique.

Experimental Procedure: Twenty-two sets of stainless-steel coupons were weighed; each set consist of three coupons. Eleven sets of coupons were soiled with GS 34 Soil-1 and another eleven set was soiled with HS 34 Soil-2. Both soils were applied at the loading of ~100mg. The soiled coupons were oven dried for 30 minutes at 40 °C for GS 34 Soil-1 and 105°C for GS 34 Soil-2. Dirty weights were recorded for all of coupons after 15 minutes of cooling. Each set of cooled coupons were then immersed into 500 mL of its respective cleaning agent for 30 minutes standing up and soiled side facing away from one another inside the beaker. After immersion, coupons were rinsed into 500 mL water for 5 minutes. After rinsing, coupons were left to bake for an additional 30 minutes at 105 oC. It was left out to cool for another additional 15 minutes then weighed for final weights. After sitting out overnight, the cleaned coupons were weighed again for a second final weight. Thereafter the cleaned coupons were applied with a pressured towel manually onto each set of three coupons then weighted again for a third final reading to get rid of excess cleaning agents.

Some of the products were tested at a temperature of 105 C.

Soil 1: Maintenance soil = 10 grams of carbon black, 10 grams iron oxide, 100 ml WD-40, 100 ml hydraulic oil, and 100 ml gear oil.

Soil 2: Production soil = 200 ml Quench Oil and 200 ml cutting oil

Chemistries evaluated: BioCircle\_L; BioCircle\_Ultra; BioCircle\_Aero; BioCircle\_CB 100; BioCircle\_CB 100\_ALU; BioCircle\_UNO SF; Simple Green; Chem Free SW4; Aquantene 330; LPS T91; Keteca

## Results:

|                                   |            |          |           |               |
|-----------------------------------|------------|----------|-----------|---------------|
| Soil_1; Immersion_Stainless Steel |            |          |           |               |
| Cleaners                          | Initial wt | Final wt | % Removed | % Ave Removed |
| BioCircle_L                       |            |          |           |               |
|                                   | 0.0987     | 0.0112   | 88.65     |               |
|                                   | 0.092      | 0.0053   | 94.24     |               |
|                                   | 0.0976     | 0.0052   | 94.67     | 92.52         |
| BioCircle_Ultra                   |            |          |           |               |
|                                   | 0.1037     | 0.0424   | 59.11     |               |
|                                   | 0.1061     | 0.0421   | 60.32     |               |
|                                   | 0.0932     | 0.0339   | 63.63     | 61.02         |
| BioCircle_Aero                    |            |          |           |               |
|                                   | 0.1009     | 0.0128   | 87.31     |               |
|                                   | 0.1012     | 0.0077   | 92.39     |               |
|                                   | 0.1109     | 0.0144   | 87.02     | 88.91         |
| BioCircle_CB 100                  |            |          |           |               |
|                                   | 0.1174     | 0.017    | 85.52     |               |
|                                   | 0.1172     | 0.0345   | 70.56     |               |
|                                   | 0.0961     | 0.0197   | 79.5      | 78.53         |
| BioCircle_CB 100_ALU              |            |          |           |               |
|                                   | 0.1002     | 0.0416   | 58.48     |               |
|                                   | 0.1004     | 0.0396   | 60.56     |               |
|                                   | 0.1151     | 0.0096   | 91.66     | 70.23         |

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|   |             |              |               |       |
|---|-------------|--------------|---------------|-------|
| BioCircle_UNO SF                        |             |              |               |       |
|   | 0.1145      | 0.0525       | 54.15         |       |
|   | 0.1063      | 0.0429       | 59.64         |       |
|   | 0.1013      | 0.0298       | 70.58         | 61.46 |
| Simple Green                            |             |              |               |       |
|   | 0.0989      | 0.028        | 71.69         |       |
|   | 0.0921      | 0.043        | 53.31         |       |
|   | 0.1053      | 0.047        | 55.37         | 60.12 |
| Chem Free SW4                           |             |              |               |       |
|   | 0.0939      | 0.0283       | 69.86         |       |
|   | 0.1011      | 0.0379       | 62.51         |       |
|   | 0.1008      | 0.0263       | 73.91         | 68.76 |
| Aquantene 330                           |             |              |               |       |
|   | 0.0962      | 0.0392       | 37.42         |       |
|   | 0.0919      | 0.0464       | 24.37         |       |
|   | 0.1043      | 0.0419       | 41.13         | 34.31 |
| LPS T91                                 |             |              |               |       |
|   | 0.0911      | 0.0427       | 53.13         |       |
|   | 0.0921      | 0.0465       | 49.51         |       |
|   | 0.091       | 0.0208       | 77.14         | 59.93 |
| Kreussler                               |             |              |               |       |
|   | 0.1042      | 0.0007       | 99.33         |       |
|   | 0.0995      | 0.0045       | 95.48         |       |
|   | 0.101       | 0.0019       | 98.12         | 97.64 |
|   |             |              |               |       |
| Soil_2;<br>Immersion_Stainless<br>Steel |             |              |               |       |
| Cleaners Initial wt                     | Final<br>wt | %<br>Removed | % Ave Removed |       |
| BioCircle_L                             |             |              |               |       |
|   | 0.0876      | 0.018        | 79.45         |       |
|   | 0.0964      | 0.0103       | 89.32         |       |
|   | 0.1037      | 0.0121       | 88.33         | 85.7  |
| BioCircle_Ultra                         |             |              |               |       |
|   | 0.1043      | 0.0083       | 92.04         |       |
|   | 0.1005      | 0.0038       | 96.22         |       |
|   | 0.0979      | 0.007        | 92.85         | 93.7  |
| BioCircle_Aero                          |             |              |               |       |
|   | 0.0847      | 0.0056       | 93.39         |       |
|   | 0.0914      | 0.0122       | 86.65         |       |
|   | 0.0868      | 0.0075       | 91.36         | 90.47 |
| BioCircle_CB 100                        |             |              |               |       |
|   | 0.0993      | 0.0033       | 96.68         |       |
|   | 0.0848      | 0.0027       | 96.82         |       |
|   | 0.0808      | 0.0032       | 96.04         | 96.51 |
| BioCircle_CB<br>100_ALU                 |             |              |               |       |
|   | 0.0718      | 0.0028       | 96.1          |       |
|   | 0.085       | 0.0033       | 96.12         |       |
|   | 0.1041      | 0.0015       | 98.56         | 96.93 |
| BioCircle_UNO SF                        |             |              |               |       |
|   | 0.1305      | 0.0326       | 75.02         |       |
|   | 0.1021      | 0.002        | 98.04         |       |
|   | 0.0864      | 0.0001       | 99.88         | 90.98 |
| Simple Green                            |             |              |               |       |
|   | 0.1056      | 0.0002       | 99.81         |       |
|   | 0.1056      | 0.0011       | 98.96         |       |
|   | 0.0897      | 0.0001       | 99.89         | 99.55 |

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|               |        |        |       |       |
|---------------|--------|--------|-------|-------|
| Chem Free SW4 |        |        |       |       |
|               | 0.0985 | 0.0004 | 99.59 |       |
|               | 0.0923 | 0.0001 | 99.89 |       |
|               | 0.1003 | 0.0002 | 99.8  | 99.76 |
| Aquantene 330 |        |        |       |       |
|               | 0.0699 | 0.0006 | 98.28 |       |
|               | 0.0817 | 0.003  | 89.11 |       |
|               | 0.0956 | 0.0016 | 97.91 | 95.1  |
| LPS T91       |        |        |       |       |
|               | 0.1041 | 0.0002 | 99.81 |       |
|               | 0.0944 | 0.0008 | 99.15 |       |
|               | 0.085  | 0.0003 | 99.65 | 99.54 |
| Kreussler     |        |        |       |       |
|               | 0.0707 | 0.0003 | 99.58 |       |
|               | 0.0663 | 0.0002 | 99.7  |       |
|               | 0.0893 | 0.0003 | 99.66 | 99.65 |

Summary:

|                            |                                     |               |                    |                                     |                      |
|----------------------------|-------------------------------------|---------------|--------------------|-------------------------------------|----------------------|
| <b>Substrates:</b>         | Stainless Steel                     |               |                    |                                     |                      |
| <b>Contaminants:</b>       | Oil                                 |               |                    |                                     |                      |
| <b>Company Name:</b>       | <b>Product Name:</b>                | <b>Conc.:</b> | <b>Efficiency:</b> | <b>Effective:</b>                   | <b>Observations:</b> |
| J Walter Inc.              | Bio Circle L                        | 100           | 84.86              | <input checked="" type="checkbox"/> |                      |
| J Walter Inc.              | Bio Circle Ultra                    | 100           | 63.68              | <input type="checkbox"/>            |                      |
| J Walter Inc.              | Bio Circle Aero                     | 100           | 81.52              | <input checked="" type="checkbox"/> |                      |
| J Walter Inc.              | Bio Circle CB 100                   | 100           | 81.04              | <input checked="" type="checkbox"/> |                      |
| J Walter Inc.              | Bio Circle CB 100 ALU               | 100           | 71.88              | <input type="checkbox"/>            |                      |
| J Walter Inc.              | Bio Circle UNO SF                   | 100           | 56.38              | <input type="checkbox"/>            |                      |
| Environmental Intelligence | Simple Green Cleaner & Degreaser    | 100           | 72.15              | <input type="checkbox"/>            |                      |
| Chem Free Corporation      | SW-4 Ozzy Juice Degreasing Solution | 100           | 79.25              | <input type="checkbox"/>            |                      |
| Gray Mills                 | Aquatene 360                        | 100           | 64.07              | <input type="checkbox"/>            |                      |
| LPS Laboratories           | T-91, Non Solvent degreaser         | 100           | 70.97              | <input type="checkbox"/>            |                      |
| Kreussler                  | Kreussler K 4                       | 100           | 98.03              | <input checked="" type="checkbox"/> |                      |
| Keteca USA                 | Water Works Heavy Duty Degreaser    | 33            | 70.87              | <input type="checkbox"/>            |                      |

Conclusion:

An effective cleaner has an efficiency rating of 80% and higher. The most effective cleaning agent at removing GS34 Soil 1 was Kreussler with an efficiency rating of 97.64%. Aquantene 330 was the worse cleaning agent at removing GS34 Soil 1 with an efficiency of 34.31%. In comparison between the Bio Circle cleaning agents, Bio Circle L was the best with an efficiency of 92.52%. In addition to that the worse Bio Circle cleaning agent is between Bio Circle Ultra and Bio Circle UNO SF with a respective rating of 61.02% and 61.46%. Overall, the most effective cleaning agent would be as follows: Kreussler, Bio Circle L and Bio Circle Aero.

The most effective cleaning agent at removing GS34 Soil 2 is Chem Free SW4 with an efficiency of 99.76%. However Kreussler, LPS T91 and Simple Green are nearly on par with the removal efficiency of Chem Free SW4. Their respective relative difference from Chem Free SW4 in efficiency is 0.11%, 0.22% and 0.21%. The worse cleaning agent at removing GS34 Soil 2 is Bio Circle L with a removal efficiency of 85.70%. In comparison between the Bio Circle cleaning agents, Bio Circle CB 100 and Bio Circle CB 100 CLU worked the best. In addition to that Bio Circle L is the worse. Overall the most effective cleaning agent is as follows: Chem Free SW4, Kreussler and Simple Green. The best cleaning agent at removing GS34 Soil is Kreussler.