

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2019

DateRun: 08/28/2019

Experimenters: Julie Nguyen

ClientType: Capacitor Manufacturer

ProjectNumber: Project #3

Substrates: Aluminum, Ceramics

PartType: Coupon

Contaminants: Oil

Cleaning Methods: Immersion/Soak

Analytical Methods: Gravimetric, Visual

Purpose: To evaluate the effectiveness of three low foam cleaners at removing canola oil, expoxidized soybean oil, and SAS-60E from aluminum and ceramic coupons.

Experimental Procedure: Fifty-four pre-weighed coupons, eighteen for each cleaner, were soiled with Canola Oil, Soybean Oil, and SAS 60E using a clean swab. Each set of coupons was immersed in a 250mL beaker with the diluted cleaners for one minute at the vendor recommended temperature. Coupons were then transferred to a (140F) heated rinse for one minute before getting an additional one-minute dry with an air gun. Observations were made and final weights were recorded.

Results:

| Cleaner | Soil | Substrate | Initial Wt. of Cont. | Final Wt. of Cont. | % Cont. Removed | % Average |
|---------------------|-------------|-----------|----------------------|--------------------|-----------------|-----------|
| SC Aircraft & Metal | Canola Oil | Aluminum | 0.2491 | 0.0301 | 87.92 | 90.33 |
| | | | 0.2409 | 0.0093 | 96.14 | |
| | | | 0.2781 | 0.0363 | 86.95 | |
| | | Ceramic | 0.2552 | 0.0112 | 95.61 | 93.29 |
| | | | 0.2829 | 0.0241 | 91.48 | |
| | | | 0.1859 | 0.0134 | 92.79 | |
| | Soybean Oil | Aluminum | 0.3118 | 0.0716 | 77.034 | 82.80 |
| | | | 0.3032 | 0.0333 | 89.02 | |
| | | | 0.2926 | 0.0516 | 82.36 | |
| | | Ceramic | 0.2182 | 0.0174 | 92.02 | 93.83 |
| | | | 0.2629 | 0.0197 | 92.51 | |
| | | | 0.2498 | 0.0076 | 96.96 | |
| | SAS-60E | Aluminum | 0.3004 | 0.0246 | 91.81 | 90.75 |
| | | | 0.2961 | 0.0145 | 95.10 | |
| | | | 0.186 | 0.0273 | 85.32 | |
| | | Ceramic | 0.229 | 0.0155 | 93.23 | 96.07 |
| | | | 0.3552 | 0.0139 | 96.09 | |
| | | | 0.1962 | 0.0022 | 98.88 | |
| LF2100 | Canola Oil | Aluminum | 0.2994 | 0.0181 | 93.95 | 93.17 |
| | | | 0.3714 | 0.0122 | 96.71 | |
| | | | 0.2799 | 0.0312 | 88.85 | |
| | | Ceramic | 0.3887 | 0.005 | 98.71 | 97.31 |
| | | | 0.2018 | 0.0053 | 97.37 | |
| | | | 0.2616 | 0.0108 | 95.87 | |
| | Soybean Oil | Aluminum | 0.259 | 0.1128 | 56.45 | 55.01 |
| | | | 0.2114 | 0.1127 | 46.69 | |
| | | | 0.2314 | 0.0882 | 61.88 | |
| | | Ceramic | 0.2017 | 0.0024 | 98.81 | 97.57 |
| | | | 0.3269 | 0.0173 | 94.71 | |
| | | | 0.2441 | 0.002 | 99.18 | |
| | SAS-60E | Aluminum | 0.2329 | 0.0041 | 98.24 | 90.29 |
| | | | 0.2252 | 0.0483 | 78.55 | |

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|------------------------|----------------|----------|--------|--------|--------|-------|
| Aquavantage 3800 GD | | Ceramic | 0.2623 | 0.0155 | 94.09 | 96.85 |
| | | | 0.2623 | 0.004 | 98.47 | |
| | | | 0.2555 | 0.0029 | 98.86 | |
| | | | 0.2237 | 0.0152 | 93.20 | |
| | Canola Oil | Aluminum | 0.2811 | 0.0698 | 75.17 | 76.08 |
| | | | 0.2339 | 0.083 | 64.51 | |
| | | | 0.2106 | 0.0241 | 88.56 | |
| | | Ceramic | 0.2448 | 0.0855 | 65.07 | 73.34 |
| | | | 0.1772 | 0.0767 | 56.71 | |
| | | | 0.1917 | 0.0034 | 98.23 | |
| | Soybean Oil | Aluminum | 0.2358 | 0.1218 | 48.345 | 56.42 |
| | | | 0.2548 | 0.077 | 69.78 | |
| | | | 0.2835 | 0.1385 | 51.15 | |
| | | Ceramic | 0.2827 | 0.0225 | 92.04 | 70.62 |
| | | | 0.1959 | 0.1346 | 31.29 | |
| | SAS-60E | Aluminum | 0.2522 | 0.0289 | 88.54 | |
| | | | 0.2006 | 0.0032 | 98.40 | 96.93 |
| | | | 0.2271 | 0.0069 | 96.96 | |
| | | Ceramic | 0.2185 | 0.0100 | 95.42 | |
| | | | 0.2466 | 0.0769 | 68.81 | 88.97 |
| | | | 0.2169 | 0.0040 | 98.15 | |
| | | | 0.1998 | 0.0001 | 99.95 | |

Cleaner Visual Observations

| Cleaner | Substrate | Soil | Observation | Rinse |
|-----------------------------------|-----------|----------------|--|-----------------------------------|
| SC Aircraft & Metal Cleaner | Aluminum | Canola Oil | - no change | - oil spots |
| | | Soybean Oil | - no change | - oil spots |
| | | SAS-60E | - no change | - strong odor |
| | Ceramic | Canola Oil | - small amount of bubbles of coupon | - no change |
| | | Soybean Oil | - small amount of bubbles of coupon | - no change |
| | | SAS-60E | - small amount of bubbles of coupon | - strong odor |
| LF2100 | Aluminum | Canola Oil | - sizzling sound/ bubbles | - oil and bubbles at top |
| | | Soybean Oil | - foam line along top of coupon | - dilution turned cloudy |
| | | SAS-60E | - thin foam layer at top of dilution | - very strong odor |
| | Ceramic | Canola Oil | - oil spots at top of dilution | - thin oil layer at top |
| | | Soybean Oil | - oil spots at top of dilution | - thin oil layer at top |
| | | SAS-60E | - oil spots at top of dilution | - oil layer/ strong odor |

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| | | | | |
|---------------------|----------|-------------|--------------------------------------|---------------|
| Aquavantage 3800 GD | Aluminum | Canola Oil | - dilution cloudy/oil spots floating | - no change |
| | | Soybean Oil | | - no change |
| | | SAS-60E | - no change | - strong odor |
| | Ceramic | Canola Oil | - no change | - no change |
| | | Soybean Oil | - no change | - no change |
| | | SAS-60E | - no change | - strong odor |

LF2100 and Aquavantage 3800 GD had lesser overall averages due to their lack of performance on the expoxidized soybean oil. SC Aircraft & Metal Cleaners had more consistent results with all of the substrates and soils.

Summary:

| Substrates: | | Aluminum, Ceramics | | | |
|------------------------------------|---|--------------------|-------------|-------------------------------------|--|
| Contaminants: | | Oil | | | |
| Company Name: | Product Name: | Conc.: | Efficiency: | Effective: | Observations: |
| Gemtek Products | SC Aircraft & Metal Cleaner Super Concentrate | 10% | 87.96 | <input checked="" type="checkbox"/> | More consistent results with all of the substrates and soils. |
| International Products Corporation | LF 2100 (Liquid Foam Cleaner) | 5% | 79.49 | <input checked="" type="checkbox"/> | Lesser overall averages due to their lack of performance on the expoxidized soybean oil. |
| Brulin Corporation | Aquavantage 3800 GD | 140F | 76.48 | <input checked="" type="checkbox"/> | Lesser overall averages due to their lack of performance on the expoxidized soybean oil |

Conclusion:

SC Aircraft & Metal cleaner yielded the best results in removing the three tested soils. Although the acquired results don't show 100% removal, adding high-pressure agitation will likely lead to even higher overall averages than shown for all of the cleaners tested.