

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2017
 DateRun: 05/30/2017
 Experimenters: George Liang, Vinh Tran
 ClientType: Cleaner Manufacturer
 ProjectNumber: Project #1
 Substrates: Copper
 PartType: Coupon
 Contaminants: Coatings
 Cleaning Methods: Manual Wipe
 Analytical Methods: Gravimetric

Purpose: To evaluate supplied product (Quicksolv DMC) for varnish removal from copper coupons.

Experimental Procedure: A set of pre-weighed copper coupons were soiled with 0.5 grams of Shellac amber varnish using a hand held swab. Another set of pre-weighed copper coupons were soiled with 0.5 grams of red lacquer using a hand held swab. After soiling the coupons with the respective soil, each coupon was re-weighed to determine the amount of contaminant added.

Cleaning Process:

Three copper coupons soiled with the same soil were placed into a Gardner Straight Line Washability unit. A Wypall X60 reinforced wipe was attached to the cleaning sled and soaked with 1 spray of cleaning solution. Each coupon was sprayed once with the same cleaning solution. Each cleaning solution was used at full concentration. The solution was allowed to penetrate/contact for 30 seconds followed by cleaning in the SLW unit for 20 cycles (~33 seconds).

Efficacy Rating Process:

After cleaning, the coupons were left to sit at room temperature for 1 hour before re-weighing the coupons for the amount of contaminants removed. The efficacy of a cleaner is measured by the amount of contaminant removed using gravimetric analysis. An effective cleaner is one that is observed to have an efficacy rating of 85% or higher.

Chemistries Evaluated: Quicksolv DMC; Acetone

Results: None of the cleaners were effective in removing either of the varnishes (red and amber) from the copper coupons using manual cleaning. The sample cleaner (Quicksolv DMC) was observed to be less effective than the comparative cleaner (acetone) with removing shellac amber varnish from copper coupons; with respective efficacy ratings of 44.06% and 62.67%. Similarly, the sample cleaner (Quicksolv DMC) was observed to be less effective than the comparative cleaner (acetone) with removing red lacquer from copper coupons; with respective efficacy ratings of 15.55% as compared to 41.86%. Table pertaining to the amount of contaminant added and removed using a gravimetric scale, to measure the efficacy of the respective cleaners.

| Cleaner | Soil Type | Initial wt. of Cont. (g) | Final wt. of Cont. (g) | Cont. Removed (%) | Avg. Cont. Removed (%) | Overall Avg. Cont. Removed (%) |
|------------------------|-----------------------|--------------------------|------------------------|-------------------|------------------------|--------------------------------|
| Quicksolv DMC_Trial 1 | Shellac Amber Varnish | 0.2278 | 0.0934 | 59 | 41.91 | 44.06 |
| | | 0.2065 | 0.0957 | 53.66 | | |
| | | 0.2343 | 0.2037 | 13.06 | | |
| Quicksolv DMC_Trial 2* | Shellac Amber Varnish | 0.2454 | 0.161 | 34.39 | 46.22 | 44.06 |
| | | 0.2443 | 0.1631 | 33.24 | | |
| | | 0.3816 | 0.1106 | 71.02 | | |
| Quicksolv DMC_Trial 1 | Red Lacquer | 0.1974 | 0.184 | 6.79 | 7.96 | 15.55 |
| | | 0.2124 | 0.1942 | 8.57 | | |
| | | 0.2056 | 0.1881 | 8.51 | | |
| Quicksolv DMC_Trial 2* | Red Lacquer | 0.2048 | 0.1857 | 9.33 | 23.14 | 15.55 |
| | | 0.1917 | 0.1694 | 11.63 | | |
| | | 0.3331 | 0.1717 | 48.45 | | |
| Acetone_Trial 1 | Shellac Amber Varnish | 0.2184 | 0.1178 | 46.06 | 57.19 | 62.67 |
| | | 0.2365 | 0.0901 | 61.9 | | |
| | | 0.2272 | 0.0827 | 63.6 | | |
| Acetone_Trial 2* | Shellac Amber Varnish | 0.2387 | 0.0784 | 67.16 | 68.16 | 62.67 |

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|---------------------|----------------|--------|--------|-------|-------|-------|
| | | 0.2444 | 0.0627 | 74.35 | | |
| | | 0.2506 | 0.0928 | 62.97 | | |
| Acetone_Trial 1 | Red Lacquer | 0.2497 | 0.1793 | 28.19 | 40.1 | 41.86 |
| | | 0.1386 | 0.0324 | 76.62 | | |
| | | 0.4146 | 0.3504 | 15.48 | | |
| Acetone_Trial 2* | | 0.1859 | 0.0183 | 90.16 | 43.62 | |
| | | 0.256 | 0.2163 | 15.51 | | |
| | | 0.1997 | 0.1494 | 25.19 | | |

*Note that there are two cleaning trials because the first trials were observed to have a high standard deviation. Therefore; a second trial was conducted to verify the results of the first trial.

Summary:

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|--------------------------------|----------------------|---------------|--------------------|--------------------------|---|
| Substrates: | Copper | | | | |
| Contaminants: | Coatings | | | | |
| Company Name: | Product Name: | Conc.: | Efficiency: | Effective: | Observations: |
| J.T. Baker | Acetone | 100 | 62.67 | <input type="checkbox"/> | Shellac Amber Varnish; Red Lacquer 15.55; Red Lacquer 41.86 |
| Inventec Performance Chemicals | Quicksolv DMC | 100 | 44.06 | <input type="checkbox"/> | Shellac Amber Varnish 44.06; Red Lacquer 15.55 |

Conclusion:

In conclusion, the sampled cleaner (Quicksolv DMC) was not as effective as the comparative cleaner (acetone) in removing varnish contaminants on copper coupons from both the first and second manual cleaning test trials.