

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2022
 DateRun: 03/22/2022
 Experimenters: Zoe Lawson, Tatyanna Moreland Junior
 ClientType: General
 ProjectNumber: Project #2
 Substrates: Copper
 PartType: Part
 Contaminants: Oil
 Cleaning Methods: Ultrasonics
 Analytical Methods: Gravimetric, Visual
 Purpose: To evaluate the removal of Oak FR-529 from copper fin stock.

Experimental Procedure: 18 samples of copper fin stock were weighed and set aside for 4 hours, 1 day, and 7 days. They were all dipped in the Oak FR-529 oil and all excess oil was allowed to drip off. They were then weighed for dirty weights. The 1 day and 7 day samples were set aside. After four hours, six of the coupons were ready to be cleaned. The cleaners were heated to their vendor recommended temperatures (Mirachem 500 at 33% concentration and 140F and Waterworks at 33% concentration and 105F) and were placed in the heated ultrasonics tank. Three coupons per cleaner were immersed and the ultrasonics tank was run for 15 minutes at 40 KhZ. They were then placed on trays and left to dry. After drying, they were weighed for clean weights. The 1 day samples were weighed the next day before and after the same method of cleaning. The 7 day samples were weighed after 1 day and weighed at 7 days before and after cleaning.

Results: Gravimetric Results:

| Cleaner | Time | Initial wt. of cont. | Final wt. of cont. | %Cont Removed | % Average |
|--------------|---------|----------------------|--------------------|---------------|-----------|
| Mirachem 500 | 7 days | 0.0151 | 0.0024 | 84.11 | 89.01 |
| | | 0.0234 | 0.0023 | 90.17 | |
| | | 0.0235 | 0.0017 | 92.77 | |
| Waterworks | 7 days | 0.0324 | 0.0002 | 100.62 | 96.65 |
| | | 0.0200 | 0.0003 | 98.50 | |
| | | 0.0120 | 0.0011 | 90.83 | |
| Mirachem 500 | 1 day | 0.0164 | 0.0002 | 98.78 | 97.43 |
| | | 0.0191 | 0.0004 | 97.91 | |
| | | 0.0205 | 0.0009 | 95.61 | |
| Waterworks | 1 day | 0.0272 | 0.0002 | 99.26 | 97.87 |
| | | 0.0227 | 0.0002 | 99.12 | |
| | | 0.0293 | 0.0014 | 95.22 | |
| Mirachem 500 | 4 hours | 0.0267 | 0.0085 | 68.16 | 68.58 |
| | | 0.0236 | 0.0098 | 58.47 | |
| | | 0.0244 | 0.0051 | 79.10 | |
| Waterworks | 4 hours | 0.0200 | 0.0100 | 50.00 | 61.81 |
| | | 0.0222 | 0.0060 | 72.97 | |
| | | 0.0221 | 0.0083 | 62.44 | |

The table below demonstrates the changes in weight of the contaminant on the copper fin stock over 1 day and 7 days before any cleaning occurred.

Changes In Cont. Weight Overtime

| Cleaner | Time | Initial Day wt. | Change in wt. after 1 Day | Change in wt. after 7 days | Remaining wt. to be cleaned |
|--------------|--------|-----------------|---------------------------|----------------------------|-----------------------------|
| Mirachem 500 | 7 days | 0.0151 | -0.0131 | -0.0003 | 0.0017 |
| | | 0.0234 | -0.0207 | 0.0000 | 0.0027 |
| | | 0.0235 | -0.0216 | -0.0002 | 0.0017 |
| Waterworks | 7 days | 0.0324 | -0.0294 | 0.0000 | 0.0030 |
| | | 0.0200 | -0.0174 | -0.0004 | 0.0022 |

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|--------------|-------|--------|---------|---------|--------|
| | | 0.0120 | -0.0093 | -0.0005 | 0.0022 |
| Mirachem 500 | 1 day | 0.0164 | -0.0147 | - | 0.0017 |
| | | 0.0191 | -0.0171 | - | 0.0020 |
| | | 0.0205 | -0.0181 | - | 0.0024 |
| Waterworks | 1 day | 0.0272 | -0.0210 | - | 0.0062 |
| | | 0.0227 | -0.0205 | - | 0.0022 |
| | | 0.0293 | -0.0267 | - | 0.0026 |

Summary:

| Substrates: | | Copper | | | |
|----------------------|----------------------------------|---------------|--------------------|--------------------------|--|
| Contaminants: | | Oil | | | |
| Company Name: | Product Name: | Conc.: | Efficiency: | Effective: | Observations: |
| Mirachem Corporation | Mirachem 500 | 33% | | <input type="checkbox"/> | Not effective after 4 hours. Efficiency increased after 1 day as the majority of the contaminant evaporated. |
| Keteca USA | Water Works Heavy Duty Degreaser | 33% | | <input type="checkbox"/> | Not effective after 4 hours. Efficiency increased after 1 day as the majority of the contaminant evaporated. |

Conclusion:

Both cleaners were not very effective at removing the oil after 4 hours. Removal results improved greatly from 4 hours to 1 day. After 1 day the majority of the contaminant on the copper fin stock had evaporated and both cleaners were effective. Between 1 and 7 days there was little change between the amount of contaminant that remained on the substrate. Removal results after 7 days was consistent with Waterworks and very effective. Mirachem 500 results after 7 days had decreased slightly and was less effective overtime at removing the contaminant.