

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2016
 DateRun: 08/29/2016
 Experimenters: Carla De La Cruz
 ClientType: Jewelry Mfr
 ProjectNumber: Project #3
 Substrates: Copper, Stainless Steel
 PartType: Coupon
 Contaminants: Waxes
 Cleaning Methods: Immersion/Soak
 Analytical Methods: Gravimetric, Visual

Purpose: To find the best fit product for cleaning Leach Garner's #4 Master draw 419TT from copper and stainless steel surfaces meant to resemble the cleaning of precious metals.

Experimental Procedure: Coupons of stainless steel and copper were selected and arranged on trays, so that each cleaner had an assigned set of each surface. Before taking initial weights coupons were wiped down with Kimwipes. After taking weights the coupons were promptly soiled and reweighed. All cleaners were gathered in respective bottles and beakers. A stir bar was used in conjunction with a heating plate equipped to stir the solutions. The plates were preheated to about 40°C and thermometers were kept in them to monitor the temperature, except Honeywell's Solstice PF which boils at room temperature and was kept at about 20°C. The coupons were added to the beakers three of a kind at one time, and then allowed to sit in the heated stirred solution for 15 minutes, in 5 minute increments while observations were taken. Finally, clean weights were taken at the end of all the testing.

Results:

| Cleaner | Substrate | Initial wt. | Final wt. | % Cont Removed | % Overall |
|--------------|-----------------|-------------|-----------|----------------|-----------|
| Fluosolv CX | Stainless Steel | 0.2931 | 0.0011 | 99.62 | |
| Fluosolv CX | Stainless Steel | 0.2286 | 0.0016 | 99.3 | 99.54 |
| Fluosolv CX | Stainless Steel | 0.3030 | 0.0009 | 99.7 | |
| Fluosolv CX | Copper | 0.2231 | 0.0245 | 89.02 | |
| Fluosolv CX | Copper | 0.2441 | 0.0233 | 90.45 | 89.28 |
| Fluosolv CX | Copper | 0.2419 | 0.0281 | 88.38 | |
| Fluosolv NC | Stainless Steel | 0.2847 | 0.0331 | 88.36 | |
| Fluosolv NC | Stainless Steel | 0.2649 | 0.0282 | 89.35 | 89.19 |
| Fluosolv NC | Stainless Steel | 0.2456 | 0.0249 | 89.86 | |
| Fluosolv NC | Copper | 0.2372 | 0.0390 | 83.56 | |
| Fluosolv NC | Copper | 0.2671 | 0.0433 | 83.79 | 82.91 |
| Fluosolv NC | Copper | 0.2471 | 0.0460 | 81.38 | |
| Vetrel Sion | Stainless Steel | 0.2554 | 0.0004 | 99.84 | |
| Vetrel Sion | Stainless Steel | 0.2622 | 0.0002 | 99.92 | 99.59 |
| Vertel Sion | Stainless Steel | 0.3239 | 0.0003 | 99.91 | |
| Vertrel Sion | Copper | 0.2556 | 0.0020 | 99.22 | |
| Vertrel Sion | Copper | 0.2701 | 0.0006 | 99.78 | 99.66 |
| Vertrel Sion | Copper | 0.2637 | 0.0000 | 100.00 | |

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|--------------|-----------------|--------|--------|-------|-------|
| Honeywell PF | Stainless Steel | 0.2564 | 0.0987 | 61.51 | |
| Honeywell PF | Stainless Steel | 0.2636 | 0.1024 | 61.15 | 62.10 |
| Honeywell PF | Stainless Steel | 0.2849 | 0.1063 | 63.64 | |
| Honeywell PF | Copper | 0.2513 | 0.1274 | 49.30 | |
| Honeywell PF | Copper | 0.2275 | 0.1025 | 54.95 | 54.01 |
| Honeywell PF | Copper | 0.1951 | 0.0726 | 57.78 | |

Summary:

| | | | | | |
|--------------------------------|-------------------------|---------------|--------------------|-------------------------------------|----------------------|
| Substrates: | Copper, Stainless Steel | | | | |
| Contaminants: | Waxes | | | | |
| Company Name: | Product Name: | Conc.: | Efficiency: | Effective: | Observations: |
| NuGeneration Technologies, LLC | FluoSolv CX | 100 | 94.41 | <input checked="" type="checkbox"/> | |
| NuGeneration Technologies, LLC | FluoSolv NC 786 | 100 | 86.05 | <input checked="" type="checkbox"/> | |
| DuPont | Vertrel Sion | 100 | 99.63 | <input checked="" type="checkbox"/> | |
| Honeywell | Solstice PF with N2 | 100 | 58.10 | <input type="checkbox"/> | |

Conclusion:

The addition of heat, significantly improved the results from the previous round of testing. While before none of the cleaners cleaned well, visually, with heat at least two performed well. The FluoSolv CX being one of these, only worked on the stainless steel given that it left a substantial amount of white residue behind on the copper surfaces. The only one that worked well on both substrates was Vertrel Sion which was able to remove most of the contaminant, leaving behind little to no residue. The worst cleaner was again Honeywell's Solstice PF which did not visibly remove any contaminant, mostly just turned it a white-green color. Lastly, FluoSolv NC did not perform nearly as well as FluoSolv CX or Vertrel Sion, but did have some peeling and debris with stainless steel. It can be concluded that the best cleaner for this task was Vertrel Sion, because it was able to perform well for both substrates.