

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 1999
 DateRun: 08/31/1999
 Experimenters: Jason Marshall
 ClientType: Consultant
 ProjectNumber: Project #1
 Substrates: Liquid
 PartType: Part
 Contaminants: Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil
 Cleaning Methods:
 Analytical Methods: Surfactant Titration
 Purpose: To compare surfactant levels of a cleaning solution

Experimental Procedure: To compare surfactant levels of a cleaning solution before & after passing through separation equipment (Aqueous Recovery Resources, Inc., Superator, oil-water separator) and a virgin sample of the solution. Three titrations were per sample were tested for cationic surfactant content using Bama Chem Nonionic Surfactant Kit. The general procedure is as follows:
 1. Add 50 ml of water to the vial.
 2. Add 0.50 ml sample (see note at bottom)
 3. Add 4 drops of Quat 1.
 4. If the solution is pink, add drops of Quat 3 until blue. If the solution is blue to start with, proceed to step 5.
 5. Add drops of Quat 2 until just pink, and then add two more drops.
 6. Count the number of drops of Quat 4 it takes to reach the blue endpoint.
 7. Percent by volume cationic surfactant = number of drops x factor = number of drops x 0.44 (for 0.5 ml) also, weight of cationic surfactant in sample = number of drops x 0.00165 grams (100% Quat)
 NOTE: The best sample size to take depends on the percent of active material in the blend. If it is suspected that the sample is:
 3-6% active, take 1.0 ml and use factor of 0.22
 6-10% active, take 0.5 ml and use factor of 0.44
 Unknown, take 0.1 ml and use factor of 2.20
 The chemistries used were:

| SITE | CLEANER MFR | PRODUCT | NOTES |
|--------|------------------|-----------------------|---------------------------|
| Racine | Howard Supply Co | LT-5-100 Soak Cleaner | 10 oz/gal (~8% by volume) |
| Racine | Howard Supply Co | LT-5-100 Soak Cleaner | Influent to Superator |
| Racine | Howard Supply Co | LT-5-100 Soak Cleaner | Effluent from Superator |

Results: From the titration of the three samples using the Bama Chem Cationic test method, it was clear that the Superator did not decrease the effectiveness of the cleaning solutions. The effluent sample was nearly identical to the virgin solution and was higher in cationic volume percent than the influent sample. Table 1 lists the calculations made for each solution.

| Site | Racine | | |
|------------------------------|------------|------------|----------|
| Product | Influent 1 | Effluent 1 | Virgin 1 |
| Concentration oz/gal | 10 | 10 | 10 |
| %by vol | ~8 | ~8 | ~8 |
| Volume Used | 0.1 | 0.1 | 0.1 |
| Number of Drops | 7 | 9 | 11 |
| Correction Factor | 2.2 | 2.2 | 2.2 |
| Volume of Surfactant %by vol | 15.4 | 19.8 | 24.2 |
| | | | |
| Product | Influent 2 | Effluent 2 | Virgin 2 |

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|---------------------------------|---------------|---------------|-------------|
| Concentration oz/ gal | 10 | 10 | 10 |
| %by vol | ~8 | ~8 | |
| Volume Used | 0.5 | 0.5 | 0.5 |
| Number of Drops | 30 | 44 | 45 |
| Correction Factor | 0.44 | 0.44 | 0.44 |
| Volume of Surfactant %by vol | 13.2 | 19.36 | 19.8 |
| | | | |
| Product | Influent 3 | Effluent 3 | Virgin 3 |
| Concentration | 10 | 10 | 10 |
| %by vol | ~8 | ~8 | ~8 |
| Volume Used | 0.5 | 0.5 | 0.5 |
| Number of Drops | 40 | 50 | 52 |
| Correction Factor | 0.44 | 0.44 | 0.44 |
| Volume of Surfactant %by vol | 17.6 | 22 | 22.88 |

Table 2 lists the average values for the three samples evaluated.

Table 2. Average Cationic Concentrations

| Influent | Effluent | Virgin |
|----------|----------|--------|
| 15.4 | 20.39 | 22.29 |

Summary:

Conclusion:

The cationic concentrations as calculated suggest that the Superator does not decrease the effectiveness of the cleaning solutions as the solution is passed through the oil/water separator.