CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	2021
DateRun:	02/04/2021
Experimenters:	Nicole Kebler
ClientType:	Cleaner Manufacturer
ProjectNumber:	Project #2
Substrates:	Liquid
PartType:	Part
Contaminants:	None
Cleaning Methods:	
Analytical Methods:	Surfactant Titration
Purpose:	To check the quality and concentration of disinfecting quat based products using titration methods

Experimental Procedure:

Two quaternary ammonium compound test kits were used for this analysis.

The first kit was the LaMotte Quat Testing kit which tested for the ppm in the solution. A 5 mL option was used and first filled the given test tube up to the 5 mL mark. Then 5 drops of the EDTA were added to the solution and swirled to mix. Then 2 drops of phenolphthalein were added and swirled again to mix. Next, 2 drops of the Toluidine Blue Indicator were placed into the test tube, making the solution turn blue. While swirling 1 drop of the Quat Titration Solution was added at a time, until the solution changed from blue to purple. The reference chart was used to assist in the evaluation. The number of drops was counted, and the provided formula was used. The formula: (# drops -1) * 10 = ppm. (This test is able to determine ppm by multitudes of 10).

The second kit that was used was the Lovibond Minikit which had two methods of determining ppm in the solution. The first test required the smaller test tube to be filled with 10 mL of solution. Then 1 of the tablets was added into the solution and mixed it until it was fully dissolved. If the solution was blue, it indicated that there was more than 200 ppm present in the solution. If the solution turned purple, this meant there was less than 200 ppm in the solution. The second method used 50 mL of the solution in the test tube. Again 1 tablet was added into the solution, and it turned blue. Once the tablet was fully dissolved, the process required adding 1 tablet at a time until the solution changed from blue to purple. Count the tablets used and follow the formula to determine the ppm: ppm = (# of tablets * 40) - 20. This kit is less accurate than the LaMotte test because the ppm can only be multitudes of 40 (example: 6 tabs*40 - 20 = 220 and 7 tabs*40 - 20 = 260).

The control quat solution of 0.03% concentration was made in lab using 3mL of concentrated quats diluted in 97mL of DI water to equal a 100 mL solution at 3% concentration. Then the solutions was diluted further by taking 10 mL of that solution and added 90mL of DI water to equal a 100 mL solution at 0.3% concentration. Then this solution was further diluted by taking 10 mL of that solution and added 90mL of DI water to equal 100 mL at a 0.03% concentration. Chemcocide had too high of a concentration at 10% quats and therefore this was diluted from a 10% concentration, down to a 0.01% quat concentration following the same method as described above. This solution was a 0.1% dilution. A third product was added to testing to help qualify the methods. The Multi-Use Disinfectant RTU was diluted into a 50% and a 10% dilution which would equal a 0.033% quat concentration and a 0.00661% quat concentration. Sample #2 at 3% quat concentration was diluted into a 1% dilution by taking 10 mL and adding it to 90 mL of water, and then taking 10mL of that and adding 90mL of water, equating to a 1% dilution or to about a 0.03% quat concentration.

<u>Cleaners tested and their expected quat concentrations at 100% dilution:</u>

1. Doggone II (0.03%)
2. 0.03% Quat solution made in lab (0.03%)
3. Chemcocide (10%)
4. Multi-Use Disinfectant RTU (0.06%)
5. Sample #2 (approx 3%)

Results:

The solution of 0.03% quat concentration was first analyzed using all 3 methods of quat testing and the expected outcome is roughly 300 ppm. First, the LaMotte testing kit was used, and results averaged 310 ppm which was about 32 drops. The Lovibond test to determine if it was over 200 ppm was done and the solution stayed blue indicating that it does have over 200 ppm in the solution. To triple check the ppm, the tablet test was done and averaged at 320 ppm, confirming the first results. This was around the correct ppm for this concentration. Next, the Doggone II solution that is at 0.03% concentration was tested using all three methods. Results from the LaMotte ppm test showed an average of 220 ppm, 1 outlier was excluded from the analysis. The Lovibond Y/N test resulted in the tablet turning purple with 1 tablet at 10 mL, indicating there is less than or equal to 200 ppm in the solution. To confirm the results, the tablet test was performed and averaged at 190 ppm. This was lower than the expected ppm of 0.03% concentration.

To confirm the tests were accurate, additional products were evaluated. The ppm of Chemcocide at 0.01% quat concentration, Multi-Use Disinfectant RTU at 0.00661% and 0.033% quat concentration, and sample

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#2 which has an expected 0.03% concentration. The LaMotte test was used to check for ppm because it gives a more accurate number. Testing was also confirmed with the Y/N Lovibond test to determine if the products had over 200 ppm. First, the Chemcocide solution required 11 drops which equals 100 ppm, this solution turned purple when 1 tablet was added to the 10 mL; this matched the expected values. Next, sample #2 was checked using the LaMotte kit and used 30 drops which equals 290 ppm, the Lovibond test stayed blue indicating over 200 ppm. This also matched expected values. Lastly, the Multi-Use Disinfectant RTU was checked and expected ppm at 0.0661% quat concentration should be about 660 ppm. The solution tested at 100% dilution, and it was using a lot more drops than expected so it was diluted and tested at 50%. This averaged 670 ppm which is what the 100% dilution should be at. To confirm that the cleaner has double the amount of quats, a 10% dilution was tested. This averaged 130 ppm using the LaMotte kit and confirmed that there is about 1,300 ppm at 100% concentration when the expected was around 660 ppm.

Chemical	Dilution	LaMotte ppm	Lovibond ppm	Lovibond > 200 ppm (Y/N)	ppm at 100%
Doggone II 0.03%	100%	220	180	N	180-220
0.03% Solution	100%	310	320	Y	310-320
Multi-Use Disinfectant RTU 0.06%	10%	130	n/a	N	1,300
Multi-Use Disinfectant RTU 0.06%	50%	670	n/a	Y	1,340
Chemcocide 10%	0.1%	100	n/a	N	10,000
Sample #2 3%	1%	290	n/a	Y	2,900

Summary:

Conclusion:

The results of the lab-made solution of 0.03% concentration matched the expected ppm around 300 ppm. The Doggone II solution was lower than the 300-ppm expected value and was around 190-220 ppm. Chemcocide results matched the expected value of 100 ppm for a 0.01% concentration. Sample #2 average ppm was right around the expected ppm of 300 for a 0.03% quat concentration. Lastly, the Multi-Use Disinfectant RTU results were above the expected ppm and were roughly twice as much as advertised; this was confirmed with two dilutions.