CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	1999
DateRun:	05/23/1999
Experimenters:	Jason Marshall
ClientType:	Consultant
ProjectNumber:	Project #1
Substrates:	Liquid
PartType:	Coupon
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil
Cleaning Methods:	
Analytical Methods:	Surfactant Titration
Purpose:	To compare surfactant levels

Experimental Procedure:

To compare surfactant levels of a cleaning solution before and after passing through separation equipment (Aqueous Recovery Resources, Inc., Suparator, oil-water separator)
Three titrations were per sample were tested for nonionic surfactant content using Bama Chem Nonionic Surfactant Kit. The general procedure is as follows:
1. ADD APPROXIMATELY 25 ML OF WATER TO MIXING VIAL
2. ADD 8 DROPS OF INDICATOR SOLUTION TO VIAL. COLOR SHOULD BE GREEN.
3. ADD 15 DROPS OF 20% SULFURIC ACID TO VIAL (20 DROPS IF STRONGLY ALKALINE DETERGENTS ARE TESTED) AND SWIRL. COLOR SHOULD NOW BE PURPLE. (CAUTION: HANDLE THIS SOLUTION WITH CARE. IT IS CORROSIVE AND MAY CAUSE BURNS.)
4. ADD 0.5ML OF NONIONIC DETERGENT SOLUTION TO VIAL AND SWIRL, COLOR SHOULD NOW TURN BACK TO GREEN OR YELLOW-GREEN.
5. ADD TITRATING SOLUTION DROPWISE WHILE COUNTING UNTIL THE COLOR CHANGES TO A WINE-RED OR PURPLE. (ABOUT HALFWAY TO THE ENDPOINT THE COLOR WILL BE TAN OR LIGHT BROWN). NOTE THE NUMBER OF DROPS NEEDED AND MULTIPLY BY 0.5 TO GET % BY VOLUME OF NONIONIC DETERGENT. EACH DROP IS EQUIVALENT TO 0.0028 GRAMS OF SURFACTANT.

CHOOSE SAMPLE SIZE THAT WILL REQUIRE 10-20 DROPS OF TITRANT FOR BETTER ACCURACY. FOR VERY CONCENTRATED SURFACTANT SOLUTIONS USE A 0.10ML SAMPLE SO AS TO CONSERVE REAGENTS. FOR A 0.10ML SAMPLE USE A FACTOR OF 2.5.

FOR WEAKER SOLUTIONS:
1.00ML SAMPLE USE A FACTOR OF 0.25
10.00ML SAMPLE USE A FACTOR OF 0.025
100.00ML SAMPLE USE A FACTOR OF 0.0025

SOME INTERFERENCES - ACID SOLUBLE ANIONIC DETERGENTS CATIONIC DETERGENTS SOME AMINES STRONG OXIDIZERS
SUCH AS HYPOCHLORITES, NITRITES, ETC. HIGHLY CONCENTRATED DYES

Results:

When comparing the results of the influent and effluent to the initial clean cleaner, both samples had far less surfactant levels. The two samples still had noticeable levels of oil in them. From the titration calculations, the effluent had higher amounts of surfactant than the influent. Table 1 lists the average titration levels for the three samples.
Table 1. Surfactant Calculations

Reading	Baseline	Influent	Effluent
1	40	3.25	4.25
2	37.5	3.25	4
3	42.5	3.5	4.29
Average	40	3.33	4.18

The data used to calculate the averages is listed in attached files.
Data For Calculations

Experimenter	Marshall				
Date	5/24/99		For sample size	Factor	Factor Calculation
Client			mL	f	ratio
Client Type	Consultant		0.5	0.5	0.25
SCL #	99-6104-01-5		1	0.25	0.25
Test Type	Nonionic		10	0.025	0.25
Cleaner Mfr	Church & Dwight Co		100	0.0025	0.25

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Product Name	Armakleen M-Aero “Clean”		2	0.125	0.25
Concentration Used	5	%			
Drops Required	16				
Sample Size	2	mL			
Wt of Surfactant	0.0448 grams				
drop * f	2	% vol nonionic surfactant			
Dilution correction	20				
Total Surfactant	40				
Mfr	Church & Dwight Co				
Product	Armakleen M-Aero				
Conc. %	5				
Volume	2				
Wt of Surf	0.0448	in Sample			
% Surf.	2	in Sample			
Total Surf %	4	Full strength			
“Clean 2”					
Concentration Used	5	%	For sample size	Factor	Factor Calculation
Drops Required	15		mL	f	ratio
Sample Size	2	mL	2	0.125	0.25
Wt of Surfactant	0.042	grams			
drop * f	1.875	% vol nonionic surfactant			
Dilution correction	20				
Total Surfactant	37.5				
Mfr	Church & Dwight Co				
Product	Armakleen M-Aero				
Conc. %	5				
Volume	2				
Wt of Surf 0.042		in Sample			
% Surf.	1.875	in Sample			
Total Surf % 37.5		Full strength			
“Clean 3”					
Concentration Used	5	%	For sample size	Factor	Factor Calculation
Drops Required	17		mL	f	ratio
Sample Size	2	mL	2	0.125	0.25

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Wt of Surfactant	0.0476	grams			
drop * f	2.125	% vol nonionic surfactant			
Dilution correction	20				
Total Surfactant	42.5				
Mfr	Church & Dwight Co				
Product	Armakleen M-Aero				
Conc. %	5				
Volume	2				
Wt of Surf	0.0476	in Sample			
% Surf.	2.125	in Sample			
Total Surf %	42.5	Full strength			
Experimenter	Marshall		For sample size	Factor	Factor Calculation
Date	5/24/99		mL	f	ratio
Client					
Client Type	Consultant		0.5	0.5	0.25
SCL #	99-6104-01-5		1	0.25	0.25
Test Type	Nonionic		10	0.025	0.25
Cleaner Mfr	Church & Dwight Co		100	0.0025	0.25
Product Name	Armakleen M-Aero Influent 1		20	0.0125	0.25
Concentration Used	5	%			
Drops Required	13				
Sample Size	20	mL			
Wt of Surfactant	0.0364	grams			
drop * f	0.1625	% vol nonionic surfactant			
Dilution correction	20				
Total Surfactant	3.25				
Mfr	Church & Dwight Co				
Product	Armakleen M-Aero				
Conc. %	5				
Volume	20				
Wt of Surf	0.0364	in Sample			
% Surf.	0.1625	in Sample			
Total Surf %	3.25	Full strength			
Influent 2					
Concentration Used	5	%	For sample size	Factor	Factor Calculation

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Drops Required	13		mL	f	ratio
Sample Size	20	mL	20	0.0125	0.25
Wt of Surfactant	0.0364	grams			
drop * f	0.1625	% vol nonionic surfactant			
Dilution correction	20				
Total Surfactant	3.25				
Mfr	Church & Dwight Co				
Product	Armakleen M-Aero				
Conc. %	5				
Volume	20				
Wt of Surf	0.0364	in Sample			
% Surf.	0.1625	in Sample			
Total Surf %	3.25	Full strength			
Influent 3					
Concentration Used	5	%	For sample size	Factor	Factor Calculation
Drops Required	14		mL	f	ratio
Sample Size	20	mL	20	0.0125	0.25
Wt of Surfactant	0.0392	grams			
drop * f	0.175	% vol nonionic surfactant			
Dilution correction	20				
Total Surfactant	3.5				
Mfr	Church & Dwight Co				
Product	Armakleen M-Aero				
Conc. %	5				
Volume	20				
Wt of Surf	0.0392	in Sample			
% Surf.	0.175	in Sample			
Total Surf %	3.5	Full strength			
Experimenter	Marshall				
Date	5/24/99		For sample size	Factor	Factor Calculation
Client			mL	f	ratio
Client Type	Consultant		0.5	0.5	0.25
SCL #	99-6104-01-5		1	0.25	0.25
Test Type	Nonionic		10	0.025	0.25
Cleaner Mfr	Church & Dwight Co		100	0.0025	0.25
Product Name			20	0.0125	0.25

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	Armakleen M-Aero Effluent 1				
Concentration Used	5	%			
Drops Required	17				
Sample Size	20	mL			
Wt of Surfactant	0.0476	grams			
drop * f	0.2125	% vol nonionic surfactant			
Dilution correction	20				
Total Surfactant	4.25				
Mfr	Church & Dwight Co				
Product	Armakleen M-Aero				
Conc. %	5				
Volume	20				
Wt of Surf	0.0476	in Sample			
% Surf.	0.2125	in Sample			
Total Surf %	4.25	Full strength			
Effluent 2					
Concentration Used	5	%	For sample size	Factor	Factor Calculation
Drops Required	9	*less than 10 drops	mL	f	ratio
Sample Size	15	mL	15	0.016667	0.25
Wt of Surfactant	0.0252	grams			
drop * f	0.15	% by volume of nonionic surfactant			
Dilution correction	20				
Total Surfactant	3				
Mfr	Church & Dwight Co				
Product	Armakleen M-Aero				
Conc. %	5				
Volume	15				
Wt of Surf	0.0252	in Sample			
% Surf.	0.15	in Sample			
Total Surf %	3	Full strength			
Effluent 3					
Concentration Used	5	%			
Drops Required	14				
Sample Size	17.5	mL		Factor	

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			For sample size		Factor Calculation
Wt of Surfactant	0.0392	grams	mL	f	ratio
drop * f	0.2	% vol nonionic surfactant	17.5	0.014286	0.25
Dilution correction	20				
Total Surfactant	4				
Mfr	Church & Dwight Co				
Product	Armakleen M-Aero				
Conc. %	5				
Volume	17.5				
Wt of Surf	0.0392	in Sample			
% Surf.	0.2	in Sample			
Total Surf %	4	Full strength			
Effluent 4					
Concentration Used	5	%	For sample size	Factor	Factor Calculation
Drops Required	15		mL	f	ratio
Sample Size	17.5	mL	17.5	0.014286	0.25
Wt of Surfactant	0.042	grams			
drop * f	0.214286	% vol nonionic surfactant			
Dilution correction	20				
Total Surfactant	4.285714				
Mfr	Church & Dwight Co				
Product	Armakleen M-Aero				
Conc. %	5				
Volume	17.5				
Wt of Surf	0.042	in Sample			
% Surf.	0.214286	in Sample			
Total Surf %	4.285714	Full strength			

Summary:

Substrates:	Liquid				
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil				
Company Name:	**Product Name:**	**Conc.:**	**Efficiency:**	**Effective:**	**Observations:**
Church & Dwight Co Inc.	Armakleen M Aero	5	0.00	☐	

Conclusion:

After titrating the samples provided, the Suparator appears to not decrease the surfactant concentrations. Effluent surfactant levels were found to be slightly higher than the influent levels, but both were far less than the original amounts.