CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	1996
DateRun:	02/20/1996
Experimenters:	Jay Jankauskas, Sutherman Ramesh
ClientType:	Coatings Manufacturer
ProjectNumber:	Project #1
Substrates:	Stainless Steel
PartType:	Coupon
Contaminants:	Adhesive, Coatings
Cleaning Methods:	Immersion/Soak
Analytical Methods:	Gravimetric
Purpose:	To test the soil loading characteristics

Experimental Procedure:

The purpose of this trial is to test the soil loading characteristics of the EP-921 and HTF 85B as compared to NMP. By observing how efficient the chemicals are at various levels of dissolved urethanes, the best performing terpene can be picked out.
Three 400ml beakers were filled with 350 ml of each chemical. The initial plan of this experiment is to clean 5 coupons in each chemistry at each percentage of soil loading. The soil loading will be done as a weight percentage of basecoat #51144 to the total weight of contaminated cleaning solution. Soil loadings will be increased in increments of 10% from 0% to 30%. So a total of 30 coupons will be cleaned for each chemical.
Cleaning will be performed at 160F for 30 minutes with stir-bar agitation. Rinsing will start with a one minute tap water rinse at 130F followed by a brief acetone rinse (so the gravimetric results do not pick up residual cleaner). The coupons will then be dried under a UV light for 10 minutes and then allowed to cool down overnight.
Since it was determined that the Basecoat #51144 was tougher to remove, we just experimented with this to expedite the soil loading tests. All coupons were contaminated in an identical fashion to the phase 1 testing.
To determine the amount of Basecoat #51144 needed to achieve a particular percentage, the specific gravity of the cleaning solutions was obtained from the MSDS sheets (NMP=1.025, EP-921=.9800, HTF85B=.9932). The below chart shows the grams of basecoat #51144 that needs to be added to each chemistry to achieve a specified loading

Product	10%	20%	30%
NMP	40.00	89.69	153.75
EP-921	38.11	85.75	147.00
HTF85B	38.86	86.91	148.98

The amount of urethane removed during cleaning was taken into consideration when increasing the soil loading. All urethane added to increase soil loading was uncured to reduce the time taken to dissolve. A note of some of the assumptions made with respect to chemical volume. It was assumed that there wereno evaporative and drag-out losses. So for all soil loading calculations made, a solvent volume of 350 ml was used.

SUBSTRATE MATERIAL: 304 Stainless Steel Coupons
CONTAMINANTS: Durane Base Coatings #51144
CONTAMINATING PROCESS USED: Rubbed on with swab and allowed to cure overnight

Results:

GRAVIMETRIC RESULTS

NMP- No soil loading.

sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
1	60.4200	61.2718	60.4887	0.7831	91.93%
2	59.7665	60.4789	59.8633	0.6156	86.41%
3	60.4839	61.3083	60.6515	0.6568	79.67%
4	59.9056	60.6630	59.9399	0.7231	95.47%
5	60.0143	60.9037	60.1513	0.7524	84.60%
				3.531	87.62%
					6.21%

Inland Tech-EP-921no soil loading

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sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
1	60.6562	61.3097	60.6566	0.6531	99.94%
2	60.7081	61.3835	60.7082	0.6753	99.99%
3	60.3344	61.3955	60.3350	1.0605	99.94%
4	60.7016	61.6404	60.7170	0.9234	98.36%
5	60.3590	61.2314	60.3592	0.8722	99.98%
				4.1845	99.64%
					0.72%

Terpene Tech HTF85B-No soil loading

sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
1	59.9047	60.8014	59.9049	0.8965	99.98%
2	60.2195	60.8220	60.2197	0.6023	99.97%
3	60.4770	61.1145	60.4773	0.6372	99.95%
4	60.2211	60.8589	60.2211	0.6378	100.00%
5	60.0083	60.7290	60.0090	0.7200	99.90%
				3.4938	99.96%
					0.04%

NMP-10% soil loading

sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
6	60.4197	61.2909	60.5188	0.7721	88.62%
7	59.7668	60.5674	59.8698	0.6976	87.13%
8	60.4838	61.4613	60.6831	0.7782	79.61%
9	59.9053	60.9938	60.0204	0.9734	89.43%
10	60.1101	60.9607	60.3303	0.6304	74.11%
				3.8517	83.78%
					6.66%

Inland Tech EP-921-10% soil loading

sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
6	60.6562	61.3019	60.6708	0.6311	97.74%
7	60.0137	60.6603	60.0164	0.6439	99.58%
8	60.7082	61.6846	60.7346	0.9500	97.30%
9	60.2780	61.0849	60.2823	0.8026	99.47%
10	60.3344	61.4548	60.4056	1.0492	93.65%
				4.0768	97.55%
					2.41%

Terpene Tech HTF85B-10% soil loading

sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
6	60.539	61.4090	60.5428	0.8662	99.56%
7	60.7019	61.8941	60.7044	1.1897	99.79%
8	60.5755	61.2914	60.5788	0.7126	99.54%
9	60.3591	61.2216	60.3643	0.8573	99.40%
10	59.3007	60.1078	59.3208	0.787	97.51%
				4.4128	99.16%
					0.93%

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NMP-20% soil loading

sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
11	60.6562	61.4064	60.6783	0.7281	97.05%
12	60.0137	60.7303	60.0804	0.6499	90.69%
13	60.7082	61.2288	60.7426	0.4862	93.39%
14	60.2780	60.9753	60.4015	0.5738	82.29%
15	60.3344	61.1885	60.4885	0.7000	81.96%
				3.138	89.08%
					6.74%

Inland Tech EP-921-20% soil loading

sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
11	60.1058	60.6858	60.1275	0.5583	96.26%
12	60.2287	61.0412	60.2767	0.7645	94.09%
13	60.5201	61.2172	60.5646	0.6526	93.62%
14	60.2423	60.9690	60.3341	0.6349	87.37%
15	59.9511	60.6721	60.0110	0.6611	91.69%
				3.2714	92.61%
					3.35%

Terpene Tech HTF85B-20% soil loading

sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
11	59.9047	60.7873	59.9083	0.8790	99.59%
12	60.2195	60.9210	60.2228	0.6982	99.53%
13	60.4770	61.0192	60.4990	0.5202	95.94%
14	60.2211	61.0052	60.2619	0.7433	94.80%
15	60.0083	60.7387	60.0424	0.6963	95.33%
				3.5370	97.04%
					2.34%

NMP-30% soil loading

sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
16	60.5386	61.7741	60.7543	1.0198	82.54%
17	60.7016	61.9505	61.2649	0.6856	54.90%
18	60.5752	61.7028	60.9753	0.7275	64.52%
19	60.3590	61.2255	60.7621	0.4634	53.48%
20	59.9047	60.9930	60.4955	0.4975	45.71%
				3.3938	60.23%
					14.15%

Inland Tech EP-921-30% soil loading

sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
16	60.6562	61.6654	60.8742	0.7912	78.40%
17	60.0137	61.1050	60.2685	0.8365	76.65%
18	60.7082	61.8099	60.9082	0.9017	81.85%
19	60.2780	61.4399	60.5666	0.8733	75.16%
20	60.3344	61.2438	60.5804	0.6634	72.95%
				4.0661	77.00%

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					3.37%

Terpene Tech HTF85B-30% soil loading

sample #	clean mass (g)	mass with contamination (g)	mass after cleaning (g)	contaminant removed (g)	Percent Removal
16	60.4197	61.4393	60.5603	0.8790	86.21%
17	59.7668	60.6630	59.9172	0.7458	83.22%
18	60.4839	61.5339	60.5702	0.9637	91.78%
19	60.1101	61.3927	60.4882	0.9045	70.52%
20					
				3.493	82.93%
					9.00%

Summary:

Substrates:	Stainless Steel
Contaminants:	Adhesive, Coatings

Company Name:	Product Name:	Conc.:	Efficiency:	Effective:	Observations:
ISP Technologies	N Methyl Pyrrolidone	100	87.62	☑	
Inland Technologies Inc	EP 921	100	99.64	☐	
Tarksol Inc	Tarksol HTF 85 B	100	99.96	☑	

Conclusion:

All data obtained shows that the HTF85B is the best solvent tested for Coatings Manufacturer and should be tested on a pilot scale level. Phase III testing will focus on determining the most effective aqueous cleaner (U.S. Polychem & General chemical products).