CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2024

DateRun: 11/14/2024

Experimenters: Amelia Wagner

ClientType: Textile Mfr

ProjectNumber: Project #1

Substrates: Stainless Steel

PartType: Coupon

Contaminants: Plastic

Cleaning Methods: Manual Wipe

Analytical Methods: Gravimetric, Timing

Purpose: To test the efficacy of non HAP/VOC exempt alternative solvents to manually remove three types of polymers from stainless steel.

Experimental Procedure: Three 304 stainless steel coupons were assigned to each of the soils per solvent resulting in a total of 27 coupons total. Each coupon was weighed with a mass balance and had their initial weights recorded. Each coupon was then soiled with its respective polymer and catalyst mixture. To soil each coupon, a pipette was used to apply a 0.5ml of the correct polymer catalyst mixture in a stripe across the middle of the coupons. The stripe of soil was then spread with a paint scraper to apply a thin coating to the bottom half of the coupon. After drying for 30 seconds, the next layer was applied. Each coupon was soiled with a total of 5 layers. After the soil was applied, the coupons were placed in the oven at 325F for 5 mins to cure the polymers. Each coupon had their dirty weights recorded. Each coupon was then timed while manually wiped with a cotton rag dipped in the respective solvent with circular motions. Manual wiping was ceased when all visible soil was removed from a coupon. If all visible soil was not able to be fully removed at 5 mins, cleaning was ceased. Coupons were then left to air dry for 30 mins before recording their clean weights.

Results:

Cleaner	Soil	Initial wt of cont.	Final wt of cont.	%Cont Removed	% AVG	% Overall	Time until clean	Secs AVG	Secs Overall
Dimethyl Carbonate	7195 NF Alum	0.018	0	100	93.76	92.09	40	37	42
		0.0318	0.0032	89.9371			30		
		0.0496	0.0043	91.3306			41		
	7229	0.0341	0.0043	87.39	88.93		52	61	
		0.0536	0.006	88.806			67		
		0.0468	0.0044	90.5983			65		
	7223	0.0789	0.0065	91.7617	93.57		19	28	
		0.1157	0.0109	90.5791			37		
		0.1043	0.0017	98.3701			28		
Propylene Carbonate	7195NF Alum	0.023	0.0013	94.3478	90.11	86.61	132	146	96
		0.0353	0.0051	85.5524			165		
		0.0418	0.004	90.4306			140		
	7229	0.0181	0.0068	62.4309	73.04		48	72	
		0.056	0.0142	74.6429			67		
		0.049	0.0088	82.0408			100		
	7223	0.1765	0.0076	95.6941	96.69		140	71	
		0.2276	0.0016	99.297			26		
		0.1338	0.0066	95.0673			46		
Tert Butyl Acetate	7195NF Alum	0.0625	0.0082	86.88	88.8	92.95	75	55	71
		0.0537	0.0042	92.1788			43		
		0.0561	0.0071	87.344			46		
	7229	0.0518	0.0061	88.2239	92.69		102	96	
		0.0575	0.0079	86.2609			126		
		0.0448	-0.0016	103.571			60		
	7223	0.1935	0.0081	95.814	97.37		57	63	
		0.1567	0.005	96.8092			61		
		0.1953	0.001	99.488			71		
Methyl Acetate	7195 NF Alum	0.0716	0.003	95.8101	94.67	97.48	72	46	31

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		0.0671	0.0064	90.462			43		
		0.0440	0.001	97.7273			23		
	7229	0.0953	0.0012	98.7408	98.9		30	40	
		0.0931	0.0003	99.6778			44		
		0.1042	0.0018	98.2726			45		
	7223	0.1808	0.0012	99.3363	98.87		9	8	
		0.1693	0.0018	98.9368			7		
		0.0902	0.0015	98.337			8		
Acetone	7195 NF Alum	0.0691	0.0003	99.5658	99.6362	99.57	11	17	12
		0.0668	0.0000	100.0000			8		
		0.0913	0.0006	99.3428			32		
	7229	0.0639	0.0000	100.0000	99.3103		12	10	
		0.0522	0.0008	98.4674			10		
		0.0559	0.0003	99.4633			8		
	7223	0.2930	0.0000	100.0000	99.7637		8	8	
		0.1989	0.0006	99.6983			8		
		0.2456	0.0010	99.5928			8		

Propylene Carbonate did not evaporate in 30 mins post cleaning, so the coupons tested with propylene carbonate were dried with the heat gun before taking clean weights

Summary:

Substrates:	Stainless Steel				
Contaminants:	Plastic				
Company Name:	**Product Name:**	**Conc.:**	**Efficiency:**	**Effective:**	**Observations:**
Alfa Aesar	Dimethyl Carbonate 99%	99%	92.09	☑	42 seconds until clean (average)
Fisher Scientific	Propylene carbonate 99.5% (CAS:108-32-7)	99.5%	86.61	☑	96 seconds until clean (average)
Lyondell Chemical Company	Tertiary butyl acetate	100%	92.95	☑	71 seconds until clean (average)
Alfa Aesar	Methyl Acetate	100%	97.48	☑	31 seconds
Fisher Scientific	Acetone (CAS: 67-64-1)	99%	99.57	☑	12 seconds until clean

Conclusion:

Acetone is the most effective solvent in removing the three polymers from stainless steel based on the high percentage of soil removed as well as it taking the least amount of time on average to manual remove all visible soil from each coupon. Acetone is closely followed by Methyl Acetate for effectiveness based on the high percentage of soil removed and taking a short amount of time on average. Dimethyl Carbonate also performed well gravimetrically but took longer than both Methyl acetate and Acetone. Propylene Carbonate is the least effective based on having the lowest percentage of soil removed and taking the most time to manually remove all visible soil from each coupon. Tert Butyl Acetate is equally effective as Dimethyl Carbonate based on the percentage of soil removed, however it took longer than Dimethyl Carbonate to manually remove all visible soil from each coupon and took quite a bit of elbow grease.