CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	2020
DateRun:	11/19/2020
Experimenters:	Hayley Byra
ClientType:	Plating Company
ProjectNumber:	Project #1
Substrates:	Aluminum, Brass
PartType:	Coupon
Contaminants:	Coatings
Cleaning Methods:	Immersion/Soak
Analytical Methods:	Gravimetric, Visual
Purpose:	The purpose of this experiment was to determine the effectiveness of alternative solvents at the removal of red lacquer from metal substrates.
Experimental Procedure:	Five cleaners were prepared to 100% concentration: 1,3-Dioxolane, Cyclohexanone, Anisole, Dimethyl glutarate, and Dimethyl adipate. For each cleaner being tested, 3 aluminum and 3 brass coupons were obtained and weighed. Coupons were then soiled with red lacquer provided by the company. Coupons were then submerged into their respective cleaners at room temperature for 30 minutes. After 30 minutes, coupons were allowed to dry in air. Once dry, a clean weight was recorded. Effectiveness of the cleaners was then determined.

Results:

Cleaner	Substrate	Initial wt of Cont	Final wt of Cont	%Cont Removed	%AVG
1,3-Dioxolane	Aluminum	0.0105	0.00	100.00	101.2%
		0.0092	0.00	100.00	
		0.0139	-0.0005	103.60	
	Brass	0.0125	-0.0016	112.80	110.93%
		0.0120	-0.0004	103.33	
		0.0066	-0.0011	116.67	
Cyclohexanone	Aluminum	0.0136	-0.0002	101.47	99.47%
		0.0180	0.0003	98.33	
		0.0144	0.0002	98.61	
	Brass	0.0300	0.0002	99.33	101.67%
		0.0326	-0.0013	103.99	
		0.0352	-0.0006	101.7	
Anisole	Aluminum	0.0248	0.005	79.84	76.79%
		0.0249	0.0047	81.12	
		0.0242	0.0074	69.42	
	Brass	0.0135	-0.0011	108.15	102.5%
		0.0174	0.0012	93.10	
		0.0160	-0.001	106.25	
Dimethyl glutarate	Aluminum	0.0119	0.0722	-506.72	-467.33%
		0.0119	0.0542	-355.46	
		0.0196	0.1254	-539.80	
	Brass	0.0168	0.1805	-974.40	-832.99%
		0.0159	0.1586	-897.48	
		0.0192	0.1396	-627.08	
Dimethyl adipate	Aluminum	0.0481	0.3888	-708.32	-886.15%
		0.0243	0.2564	-955.14	
		0.0260	0.2847	-995.00	
	Brass	0.0273	0.2940	-976.92	-976.95%
		0.0356	0.2985	-738.48	
		0.0304	0.3999	-1215.46	

For aluminum substrates, 1,3-Dioxolane demonstrated the best performance with an average removal of 101.2%. Cyclohexanone was the second most effective for aluminum with an average removal of 99.47%. For brass substrates, 1,3-Dioxolane was also the most effective with an average removal of 110.93%.

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Anisole was the second most effective with an average removal of 102.5% but is closely followed by Cyclohexanone.

No further optimization is required for 1,3-Dioxolane and Cyclohexanone. Both cleaners demonstrated excellent performance in removing the lacquer via unheated immersion for 30 minutes. Coupons cleaned with these solvents had no observable solvent or soil residue remaining. Though Anisole was effective at cleaning brass substrates, further optimization is required for aluminum. Aluminum substrates possessed a slight solvent/soil residue in the cleaned area. Heated immersion testing could benefit performance on aluminum substrates. Both Dimthyl glutarate and Dimethyl adipate demonstrated extremely poor efficiency for both substrates. All coupons possessed a heavy layer of solvent and soil residue throughout the cleaned area. Heated immersion testing is necessary for improvement with these solvents.

Summary:

Substrates:	Aluminum, Brass				
Contaminants:	Coatings				
Company Name:	**Product Name:**	**Conc.:**	**Efficiency:**	**Effective:**	**Observations:**
Fisher Scientific	1,3-Dioxolane (CAS:646-06-0)	100	106.01	☑	
Fisher Scientific	Cyclohexanone (CAS: 108-94-1)	100	100.57	☑	
Fisher Scientific	Anisole (CAS: 100-66-3)	100	89.64	☑	
Fisher Scientific	Dimethyl glutarate (CAS:1119-40-0)	100	650.16	☐	
Fisher Scientific	Dimethyl adipate (CAS: 627-93-0)	100	931.55	☐	

Conclusion:

Upon completion of testing, it was determined that unheated immersion for 30 minutes is an effective method to remove red lacquer from aluminum and brass substrates for both 1,3-Dioxolane and Cyclohexanone. Anisole requires further testing via heated immersion to improve removal efficiency on aluminum substrates. Both Dimethyl glutarate and Dimethyl adipate demonstrated poor efficiency for all substrates. Heated immersion trials are necessary to improve the performance of these solvents.