

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2020
 DateRun: 12/03/2020
 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 the following concentrations: 1,3-Dioxolane 100%, Cyclohexanone 100%, Anisole 100%, Dimethyl glutarate 100%, Dimethyl adipate 100%. Dimethyl glutarate and Dimethyl adipate were heated to 120°F, while the other cleaners were tested at room temperature. Three aluminum and three brass coupons were obtained and weighed for each of the cleaners being tested. Coupons were then soiled with red lacquer provided by the company and a dirty weight was recorded. Once solutions reached the proper temperature, coupons were submerged into their respective solvents for 30 minutes. After 30 minutes had passed, coupons were dried in air for 24 hours. Once dry, a final clean weight was obtained. Effectiveness of the cleaners was then determined.

Results:	Cleaner	Substrate	Initial wt of cont	Final wt of cont	%Cont Removed	%AVG	Observations	
	1,3-Dioxolane	Aluminum	0.0331	-0.0001	100.30	100.69%		
			0.0148	-0.0002	101.35			
			0.0240	-0.0001	100.42			
		Brass	0.0619	-0.0001	100.16	101.77%		
			0.0283	-0.0008	102.83			
			0.0300	-0.0007	102.33			
	Cyclohexanone	Aluminum	0.0254	0.0004	98.42	100.49%		
			0.0201	-0.0002	101.00			
			0.0244	-0.0005	102.05			
		Brass	0.0168	-0.0015	108.93	104.79%		
			0.0141	-0.0002	101.42			
			0.0124	-0.0005	104.03			
	Anisole	Aluminum	0.0238	0.0064	73.11	82.16%	Still dirty, extended time by 15 min	
			0.0136	0.0009	93.38			
			0.0215	0.0043	80.00			
		Brass	0.0223	0.0026	88.34	75.49%		
			0.0242	0.0039	83.88			
			0.0365	0.0167	54.25			
	Dimethyl glutarate	Aluminum	0.0260	0.0058	77.69	55.78%	Pretty clean after 15 min	
			0.0218	0.0137	37.16			
			0.0221	0.0105	52.49			
		Brass	0.0446	0.0040	91.03	93.00%	Still wet after 24 hours	
			0.0244	0.0045	81.56			
			0.0203	-0.0013	106.4			
	Dimethyl adipate	Aluminum	0.0116	0.0101	12.93	22.11%	Still wet after 24 hours	
			0.0164	0.0111	32.32			
			0.0280	0.0221	21.07			
		Brass	0.0243	0.0144	40.74	56.70%		
			0.0223	0.0061	72.65			
			0.0151	0.0367	-143.05			

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1,3-Dioxolane was the most effective cleaner on aluminum substrates removing an average of 100.69% of soil. Cyclohexanone was the second most effective removing an average of 100.49%. Cyclohexanone was the most effective cleaner on brass substrates removing an average of 104.79%. 1,3-Dioxolane was the second most effective removing an average of 101.77%. No visible damage to the substrate was observed with removals over 100% and is most likely due to removing other contaminants that could have been on the coupons before testing. Adding heat significantly increased performance for Dimethyl glutarate and Dimethyl adipate from the previous unheated immersion trial. Although further optimization is still required as the temperature may need to be increased to 140°F, or agitation may be necessary for improvement.

Summary:

Substrates:		Aluminum, Brass			
Contaminants:		Coatings			
Company Name:	Product Name:	Conc.:	Efficiency:	Effective:	Observations:
Fisher Scientific	1,3-Dioxolane (CAS: 646-06-0)	100%	101.23	<input checked="" type="checkbox"/>	
Fisher Scientific	Cyclohexanone (CAS: 108-94-1)	100%	102.64	<input checked="" type="checkbox"/>	
Fisher Scientific	Anisole (CAS: 100-66-3)	100%	78.83	<input type="checkbox"/>	
Fisher Scientific	Dimethyl glutarate (CAS: 1119-40-0)	100%	74.25	<input type="checkbox"/>	Only effective for brass substrates (93%)
Fisher Scientific	Dimethyl adipate (CAS: 627-93-0)	100%	78.81	<input type="checkbox"/>	

Conclusion:

Upon completion of testing, it was determined that 1,3-Dioxolane and Cyclohexanone were the most effective cleaners for aluminum and brass substrates using unheated immersion. Adding heat significantly improved performance for Dimethyl glutarate and Dimethyl adipate. However, further optimization is still required. The next steps would be to increase the temperature and add agitation when pilot testing at the facility.