CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2020

DateRun: 11/22/2020

Experimenters: Zoe Lawson, Justin Kiander

ClientType: Metal Working

ProjectNumber: Project #1

Substrates: Stainless Steel

PartType: Coupon

Contaminants: Oil

Cleaning Methods: Immersion/Soak

Analytical Methods: Gravimetric, Visual

Purpose: The purpose of this experiment was to determine the effectiveness of cleaners in removing grind oil from stainless steel coupons via heated immersion at increased time and temperature.

Experimental Procedure: Cleaners were prepared to the following concentrations: Dimethyl glutarate 100%, SC Aircraft & Metal Cleaner 20%, SC Supersolve 20%, Crystal Simple Green Industrial Cleaner 30 parts water. All solutions except for Crystal Simple Green were heated to 120°F. Crystal Simple Green was heated to 100°F with a stir bar added for agitation. Three stainless steel coupons were obtained and weighed for each of the cleaners being tested. Coupons were then soiled with grind oil provided by the company and a dirty weight was recorded. When the solutions reached the proper temperature, coupons were submerged into their respective cleaners for 30 minutes. After 30 minutes of cleaning, coupons cleaned with SC Aircraft and SC Supersolve were submerged into a deionized water bath also at 120°F for 30 seconds. Coupons were then partially dried with a heat gun and allowed to finish drying in air for 24 hours. After the drying process, coupons were weighed, and a clean weight was recorded. Effectiveness of the cleaners was then determined.

Results:

Cleaner	Initial wt of Cont	Final wt of Cont	%Cont Removed	%AVG
Dimethyl glutarate	0.0220	0.0034	84.54	86.89%
	0.0290	0.0033	88.62	
	0.0240	0.0030	87.50	
SC Aircraft & Metal	0.0215	0.0056	73.95	84.62%
	0.0184	0.0036	80.43	
	0.0196	0.0001	99.49	
SC Supersolve	0.0160	0.0068	57.50	59.36%
	0.0147	0.0057	61.22	
	0.0028	-0.0237	946.43	
Crystal Simple Green	0.0062	-0.0027	143.55	83.31%
	0.0123	0.0031	74.80	
	0.0159	0.0013	91.82	

Bold numbers excluded from average calculations; too little soil was applied to these coupons, and do not represent cleaner performance. Soil was most likely removed quickly then the substrate was damaged due to overexposure to solvent.

Summary: Dimethyl glutarate was the most effective cleaner in removing grind oil from stainless steel substrates via heated immersion at 120°F for 30 minutes with an average removal of 86.89%. SC Aircraft & Metal was the second most effective with an average removal of 84.62%. Compared to the previous 15-minute trial, Dimethyl glutarate and SC Aircraft demonstrated increased performance. SC Supersolve and Crystal Simple Green performed slightly worse than in the 15-minute trial. However, a fresh solution of Crystal Simple Green has demonstrated significantly increased performance in 30-minute trials. Agitation most likely also had a positive impact on performance for Crystal Simple Green.

After the cleaning process, no oil was observed on any of the cleaned coupons. Dimethyl glutarate and Crystal Simple Green appeared to be the cleanest both with minimal amount of solvent left behind. Oil droplets were observed in the fresh Crystal Simple Green solution indicating removal had occurred. After the drying process, Dimethyl glutarate still possessed no visible oil, but some solvent remained on the coupons. More solvent remained on substrates cleaned with SC Aircraft and SC Supersolve. There were observable oil residues on SC Supersolve at the top portion of the cleaned area. Crystal Simple Green was mostly dry with very little solvent remaining. There was one small oil residue spot upon on substrate cleaned with Crystal Simple Green.

Though performance has generally increased, further optimization would be beneficial to performance of all cleaners by either increasing the temperature or adding a wipe step.

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Substrates:	Stainless Steel
Contaminants:	Oil

Company Name:	Product Name:	Conc.:	Efficiency:	Effective:	Observations:
Fisher Scientific	Dimethyl glutarate (CAS:1119-40-0)	100%	86.89	☑	
Gemtek Products	SC Aircraft & Metal Cleaner Super Concentrate	20%	84.62	☑	
Gemtek Products	SC Supersolve Safety Solvent	20%	59.36	☐	
Simple Green	Crystal Simple Green Industrial Cleaner & Degreaser	30 parts water	83.31	☐	

Conclusion:

Upon completion of testing, it was determined that Dimethyl glutarate was the most effective cleaner removing an average of 86.89%. Though all cleaners displayed improvement from either 15-minute trials or previous 30-minute trials, further optimization is necessary to increase performance. Increasing the temperature or incorporating a wipe step should prove to be effective next steps.