CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2021

DateRun: 01/05/2021

Experimenters: Justin Kiander

ClientType: Additive Manufacturing

ProjectNumber: Project #1

Substrates: Plastic

PartType: Coupon

Contaminants: Resins/Rosins

Cleaning Methods: Immersion/Soak

Analytical Methods: Gravimetric, Visual, HSPiP

Purpose: The purpose of this experiment was to determine the effectiveness of baseline solvents in removing soil from 3D printed coupons via unheated immersion.

Experimental Procedure: One 3D printed "Elastic Coupon" was obtained for each of the 24 baseline HSPiP solvents tested. An initial weight was recorded, then coupons were soiled with Photopolymer Resin (Elastic) and a dirty weight was recorded. Coupons were submerged into their respective solvents for 10 minutes at room temperature. After 10 minutes, coupons were dried in air for 24 hours. Following the drying step, a clean weight was recorded. Effectiveness of the solvents was determined by rating the removal of resin and damage to the substrate.

Results:

Solvents	Initial wt of cont	Final wt of cont	%Cont Removed	Resin Removal	Damage to Susbtrate
Toluene	0.03	-0.01	133.33	1	0
Dimethyl Carbonate	0.03	0	100	0	1
Xylene	0.02	0.02	0	1	1
Benzyl Alcohol	0.1	0.43	-330	0	1
Ethylene Glycol	0.09	0.1	-11.11	0	1
Methyl Acetate	0.02	0	100	1	1
Undecane	0.06	0.03	50	0	1
Ethyl Acetate	0.03	0	100	1	0
Methanol	0.04	0	100	1	0
Ethanol	0.05	0	100	1	0
1,3-Dioxolane	0.02	0.02	0	1	0
Diethyl Carbonate	0.03	0.01	66.67	1	0
1-Propanol	0.03	0	100	1	0
2-Propanol	0.03	0.01	66.67	1	1
Propylene Carbonate	0.02	0.04	-100	0	1
Thiophene	0.05	0	100	1	0
1-Methoxy-2-Propanol	0.03	0.02	33.33	1	0
DMSO	0.02	0.05	-150	0	1
Acetone	0.04	0.03	25	1	0
1-Butanol	0.05	0.02	60	1	1
Dimethyl Glutarate	0.04	0.06	-50	1	1
Anisole	0.02	0.05	-150	1	0
2-Butoxy Ethyl Acetate	0.05	0.08	-60	1	0

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Ethyl Lactate	0.06	0.05	16.67	1	0

Rating Key:

Resin Removal: 0 = Not Removed, 1 = Removed

Damage to Substrate: 0 = Not Damaged, 1 = Damaged

Ethyl Acetate, Methanol, Ethanol, 1-Propanol, and Thiophene were the most effective solvents removing the resin without damaging the substrate. A cloudy residue or discoloration was observed on coupons cleaned with Dimethyl Carbonate, Xylene, Methyl Acetate, Undecane, 2-Propanol, DMSO, 1-Butanol, and Dimethyl Glutarate. Coupons cleaned with Benzyl Alcohol, Ethylene Glycol and Propylene Carbonate were still wet following the drying step.

Negative percent removals observed in the data table indicate that the solvent is being absorbed by the elastic coupon. Percent removals over 100 indicate potential stripping and damage to the coupon that is not visible at 10 minutes of cleaning. Next steps would be to work with senior lab staff to develop optimized HSPiP testing.

Summary:

Conclusion: Ethyl Acetate, Methanol, Ethanol, 1-Propanol, and Thiophene were the most effective solvents removing the resin without damaging the substrate. Next steps would be to work with senior lab staff to develop optimized HSPiP testing.