

# Eastman performance solvents—technical tip

## A non-HAP replacement for xylene in solventborne coatings

### Introduction

Eastman *n*-propyl propionate is the newest addition to Eastman’s broad line of performance solvents. It is a low odor, medium evaporating, non-HAP ester solvent with good solvent activity and versatility. Since *n*-propyl propionate is not listed as a Hazardous Air Pollutant (HAP) by the EPA, it is useful as a replacement for commonly used aromatic hydrocarbon solvents such as xylene.

### Key attributes

- Low MIR value: Useful for formulating aerosol coatings for the California market
- Good solvent activity: Dissolves a wide range of polymers
- Medium evaporation rate: Provides good flow and leveling in air dry and thermoset coatings
- Mild odor: Useful in coating applications where solvent odor is a concern
- Low surface tension: Improves atomization, wetting, flow, and leveling
- Low water solubility: Minimizes water pick-up during storage
- Urethane grade: Suitable for use with moisture sensitive polymers
- High electrical resistance: Helpful when formulating electrostatically applied coatings with good transfer efficiency
- Non-HAP: Not regulated as a HAP under Title III of the Clean Air Act (CAA)

### Application/uses

- Coatings—OEM (original equipment manufacturer) and special purpose
- Process solvent for high-solids acrylic resins
- Industrial cleaners
- Industrial printing inks
- Automotive refinish
- Appliance coatings

The information in this technical tip was developed to assist formulators in replacing xylene with Eastman *n*-propyl propionate in selected solventborne coatings.

Table 1 Physical properties of Eastman *n*-propyl propionate

Properties	Eastman <i>n</i> -propyl propionate
Evaporation rate ( <i>n</i> -BuOAc = 1)	1.2
Specific gravity @ 20°/20°C	0.881
Weight/volume @ 20°C, kg/L (lb/gal)	0.88 (7.34)
Odor	Ester
Boiling range @ 760 mmHg, °C	118.8–124
Flash point setaflash, °F	71.6
Solubility, in water @ 20°C, wt%	0.5
Hansen solubility parameters	
Nonpolar	7.6
Polar	1.8
Hydrogen bonding	3.6
Total	8.6
Electrical resistance, megohms	>20
MIR value (maximum incremental reactivity) <sup>a</sup>	0.93
HAP <sup>b</sup>	No

<sup>a</sup>Reference—“Regulation for Reducing the Ozone Formed from Aerosol Coating Product Emissions” (subchapter 8.6)

<sup>b</sup>Hazardous Air Pollutant—Environmental Protection Agency

## Replacing xylene in a polyester/melamine clearcoat system

Initial evaluations were conducted to determine whether Eastman *n*-propyl propionate could be used to replace xylene in a polyester/melamine clearcoat. Using Eastman's Solvent Reformulation Wizard, physical properties of the control solvent blend were generated. A replacement blend was developed by substituting *n*-propyl propionate for xylene and adjusting the overall blend composition to obtain an evaporation rate similar to the control. While developing a replacement solvent blend with similar evaporation rate characteristics is important, it is crucial that the replacement blend also have similar activity. The solvents in the replacement blend must dissolve the resin(s) in the coating to achieve the desired application and film properties.

Table 2 Polyester/melamine clearcoat formulations

Component	Control wt%	Reformulation wt%
Polyester resin solution (85% NV)	48.30	48.30
Melamine resin (75% NV)	23.97	23.97
Surface additive	0.50	0.50
Catalyst	0.22	0.22
Eastman <i>n</i> -butanol ( <i>n</i> -butyl alcohol)	13.34	10.90
<b>Xylene</b>	<b>11.71</b>	—
Aromatic 150	1.96	1.96
<b>Eastman <i>n</i>-propyl propionate</b>	—	<b>14.15</b>

Table 3 Solvent blend properties

Component	Control	Reformulation
Evaporation rate ( <i>n</i> -BuOAc = 1)	0.8	0.8
Hansen solubility parameters		
Nonpolar	8.20	7.76
Polar	1.66	2.12
Hydrogen bonding	4.62	5.14
Total	9.55	9.55
Weight/volume, lb/gal	7.00	7.11

Table 4 Formulation constants

Component	Control	Reformulation
% NV weight (calculated)	58.6	58.6
Polyester:melamine ratio	70:30	70:30
Viscosity, #4 Ford cup, sec <sup>a</sup>	32	30
HAP content, wt% (calculated)	<b>20.05</b>	<b>8.34</b>

<sup>a</sup>ASTM D1200—Ford cup viscosity

Table 5 Typical cured film properties

Component	Control	Reformulation
Dry film thickness (mils) <sup>a</sup>	1.4	1.5
Pendulum hardness, osc <sup>b</sup>	124	124
Tukon hardness, knoop <sup>c</sup>	10	10
Impact—direct/reverse (in./lb) <sup>d</sup>	150+/37	150+/41
DOI <sup>e</sup>	92	92
Gloss (60°/20°) <sup>f</sup>	93/97	94/97

<sup>a</sup>ETG (Electronic Thickness Gauge)—Pro Motorcar Products

<sup>b</sup>ASTM D4366—König Pendulum Hardness Tester

<sup>c</sup>ASTM D1474—Tukon Microhardness Tester

<sup>d</sup>ASTM D2794—Universal Impact Tester

<sup>e</sup>Wave-Scan DOI—BYK Gardner

<sup>f</sup>ASTM D523—Gardco Statistical Novo-Gloss

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### A non-HAP replacement for xylene in solventborne coatings *(Continued)*

## Conclusion

When the control and reformulated coatings were applied at similar film thickness and allowed to cure, the formulations yielded coatings with comparable physical properties and performance. In-house lab evaluations show *n*-propyl propionate can be used to replace xylene in selected solventborne coatings. With good solvent activity, Eastman *n*-propyl propionate is compatible with a wide range of polymers, yielding high-solids coatings with appropriate application viscosity. The difference in evaporation rate of *n*-propyl propionate and xylene, 1.2 and 0.7 respectively, may require the addition of a slower evaporating solvent to achieve the desired evaporation rate characteristics.

Eastman *n*-propyl propionate is a low odor, non-HAP option for replacing aromatic hydrocarbon solvents. It provides a viable alternative for coatings formulators challenged to meet regulatory requirements. Eastman *n*-propyl propionate is one of the many formulating options offered by Eastman's broad line of performance solvents.

Table 6 Regulatory status

Regulation	Eastman <i>n</i> -propyl propionate
HAP (Hazardous Air Pollutant)	No
ODS <sup>a</sup>	No
SNAP acceptable (Significant New Alternative Program)	Yes
SARA 313 (Superfund Amendments and Reauthorization Act), Title III, Section 313 <sup>b</sup>	No

<sup>a</sup>Low environmental impact-zero ODS, therefore not subject to phase-out under the Montreal Protocol as amended.

<sup>b</sup>Also known as Emergency Planning and Community Right-to-Know Act (EPCRA).

Note: Users should consider this regulatory information provided only as a supplement to other information, such as the Safety Data Sheet. It is the responsibility of our customers to determine that their use of our product(s) is safe, lawful, and technically suitable in their intended applications. For additional information about this product, please contact your Eastman representative or visit our website at [www.eastman.com](http://www.eastman.com).



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