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Eastman™ resin intermediates for interior can coatings

Polyester resins are increasingly seen as viable substitutions for epoxy resins for interior can coatings. There are two key performance criteria for interior can coatings — chemical resistance and flexibility. Unfortunately, common flexibilizing intermediates such as adipic acid and 1,6-hexanediol imparts poor chemical resistance to the final can coating.

Cycloaliphatic performance

Cycloaliphatic intermediates, such as Eastman™ CHDA and CHDM, possess an excellent balance of flexibility and hardness. Because of these unique properties, these materials are able to provide flexibility to an interior can coating without sacrificing chemical resistance.

As shown in Table 1, Eastman™ CHDA offers a distinct performance advantage in hardness/flexibility, balance, and chemical resistance over traditional intermediates such as adipic acid or isophthalic acid.

Table 1

Comparison of AD, Eastman™ 1,4-CHDA and PIA in a polyester-melamine enamel[a]

	AD	1,4-CHDA	PIA
Flexibility/hardness			
Impact resistance			
Direct, in.-lb	>160	156	76
Reverse, in.-lb	>160	96	64
Pencil hardness to mar[b]	HB	2H	4H
Stain and chemical resistance[c]			
Iodine after 30 min	M	N	N
Mustard after 24 h	VS	N	N
50% NaOH after 9 h	N	N	N
50% H_2SO_4 after 9 h	M	N	N
Corrosion resistance			
Detergent resistance after 10 days			
Creepage, in. (mm)	0.75 (19.05)	0.13 (3.18)	0.06 (1.59)
% Gloss retention at 60°	30	99	96
% Gloss retention at 20°	16	90	86
Blistering	S	M	VS
Cracking	N	N	N

[a]*Resin: NPG/TMP/Diacid/PIA (1.97/0.30/1.00/1.00); Polyester: Cymel 303 ratio = 79.21*

[b]*Pencil hardness scale from least to most hard: HB, F, H, 2H, 3H, etc.*

[c]*Effect scale: N = none, VS =very slight, S = slight, and M = moderate*

A combination of Eastman™ 1,4-CHDA and CHDM can be used to prepare a coating with a good balance of hardness and flexibility while maintaining chemical resistance as demonstrated by the coil coating formulation shown in Table 2.

Hydrolytic stability

Another distinct performance advantage offered by cycloaliphatic intermediates is hydrolytic stability. As shown in Figure 1, a CHDA diester is more resistant to hydrolysis under acid or base conditions than the corresponding adipic acid diester.

Figure 1

Hydrolysis of NPG glycol diesters at 120°C

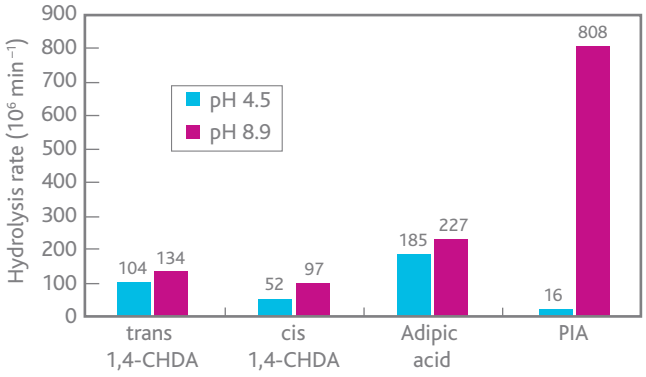

Table 2

Eastman™ 1,4-CHDA and CHDM modified polyester-melamine coating[a]

Initial film properties	
Film thickness, mils (microns)	0.75 (19)
Flexibility hardness	
T-bends	**With grain/against grain**
Initial	1T/0T
Overbake, 30 sec @ 260°C (500°F)	3T/2T
Wet heat, 30 sec in boiling water	2T/2T
Reverse impact resistance @ 40 in.-lb (4.5 N-m), % pass	100
Pencil hardness to mar[b]	
Initial	2H
30 min boiling water test, min to recovery	15
Stain and chemical resistance[c]	**Covered/uncovered**
Iodine after 30 min	3/4
Mustard after 24 h	4/5
Ketchup after 24 h	5/5
Grape juice after 24 h	5/5
Etch resistance after 8 h	
50% NaOH	5/5
50% H_2SO_4	5/5
Corrosion resistance	
Detergent resistance @ 74°C (165°F)	**5 days/10 days**
Creepage detected	none/none
% Gloss retention at 60°	96/69
% Gloss retention at 20°	74/24
Blister size[d]	8/6
Blister frequency[d]	4/2
Cracking[c]	5/5

[a] *Resin: NPG/CHDM/AD/PIA/PTA/Eastman™ CHDA (molar ratio: 6.36/4.24/1.00/2.00/2.00/5.00)*
Polyester: Cymel 301 ratio = 90:10

[b] *Pencil hardness scale from least to most hard: HB, F, H, 2H, 3H, etc.*

[c] *Effect scale: 5 = no effect, 1 = severe effect*

[d] *ASTM Method D 714, evaluating degree of blistering of paint*
Blister size rating: 10 = no blisters; 2 = large blisters
Blister frequency: 5 = none; 1 = dense

Regulatory status

In the United States, under regulations administered by the U.S. Food and Drug Administration, Eastman™ 1,4-CHDA and CHDM may lawfully be used for the manufacture of polyester resins to be used in food contact coatings as described in 21 CFR 175.300. The use of CHDM for this purpose is based on Food Contact Notification FCN 87.

In Europe, CHDM is listed in Directive 2002/72/EC as Ref. No. 13390 (1,4-bis(hydroxymethyl)cyclohexane) with no specific migration limit for the manufacture of food contact plastic articles. Eastman™ 1,4-CHDA is listed as Ref. No.14876 (1,4-cyclohexanedicarboxylic acid) in Directive 2002/72/EC with a specific migration limit of 5 mg/kg food, and it is restricted to be used only for the manufacture of polyesters used for food contact plastic articles.

For additional information, please contact your Eastman sales representative or visit our website at www.eastman.com.

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