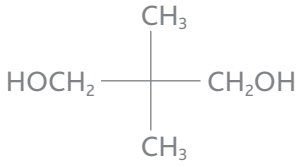
Eastman NPG™ glycol

High-clarity panel resins for exterior durability



Eastman NPG glycol
(2,2-dimethyl-1,3-propanediol)
CAS: 126-30-7

Eastman NPG™ glycol is commonly used as the glycol component for high quality panel resins in which high clarity and long-term exterior durability are required. This publication provides a comparison of NPG glycol with propylene glycol (PG) in panel resins. Resin compositions and their preparation are included, along with the preparation of test panels and the results of weathering in South Florida for 5 years.

Performance benefits

- Fast reaction with common diacids
- Excellent weatherability—5-year data vs. PG
  - Gloss retention
  - Resistance to yellowing
- Excellent hydrolytic stability
- Excellent thermal stability

Fiberglass-reinforced plastic applications

- Greenhouse glazing
- Corrugated siding and awnings
- Exterior decorative trim
- Patio furniture

Resin synthesis

Conventional laboratory processing techniques were used to synthesize the resins in a two-stage process with a maximum temperature of 200°C (392°F). After cooling to 130°C (266°F), the resins were diluted with a 55/45 solution of styrene/methyl methacrylate. Stabilization was provided by adding 0.01% Eastman mono-tertiary-butylhydroquinone (MTBHQ) based on the total weight of resin and monomer. The composition of the resins is shown in Table 1.

Table 1. Comparison of synthesis and physical differences of unsaturated polyester resins prepared with Eastman NPG™ glycol and PG

Resin synthesis parameters and physical properties	NPG[a]/PIA[b]//MA[c]	PG[d]/PIA[b]//MA[c]
Glycol excess, %	5.0	10.0
Saturated/unsaturated diacid ratio	1/1	1/1
Acid value	11	11
Molecular weight, M_n	2,600	1,850
Reaction time, h	11.5	14.0
Viscosity, 38% monomer, cP[e]	510	310
Gardner color, 38% monomer[e]	1	1

[a] *NPG—neopentyl glycol*
[b] *PIA—purified isophthalic acid*
[c] *MA—maleic anhydride (double slash indicates first and second stages)*
[d] *PG—propylene glycol*
[e] *55/45 styrene/methyl methacrylate by weight*

Preparation of test panels

One-ply fiberglass laminates were prepared using 42.5 g (1.5 oz) of M-911 chopped-strand mat (Owens-Corning Fiberglass). All resins were cured with 0.5% solid benzoyl peroxide initiator. A vacuum was drawn on each resin to remove trapped air bubbles before preparing the laminates. A 254- x 330-mm (10- x 13-in.) section of fiberglass was placed within a glass plate mold formed with 1.6-mm (0.0625-in.) strips of Teflon® (DuPont), and the fiberglass was saturated with the resin. Any excess resin was squeezed out with a hand roller, and the laminate was covered with a sheet of polyester film. The laminate package was placed in an oven and cured for 3 hours at 80°C (176°F), 1 hour at 100°C (212°F), and 1 hour at 120°C (248°F). Each laminate contained approximately 16% by weight of fiberglass.

Weathering study

A series of four test panels was prepared from each resin. One test panel was retained as a control; the remaining panels were weathered for 1 year, 3 years, or 5 years in South Florida and mounted at a 45° angle facing south. Figure 1 and Figure 2 summarize results of these exposures.

Figure 1. Percent 20° gloss retention vs. exposure time in South Florida

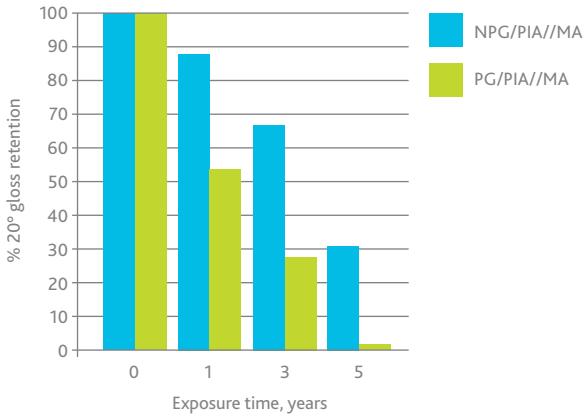
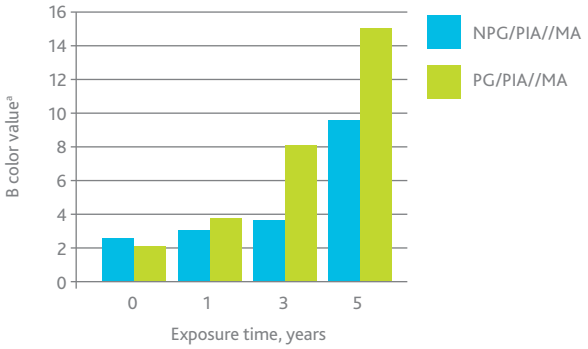


Figure 2. Change in B color values vs. exposure time in South Florida



[a]*Higher values indicate greater yellowing.*

Conclusion

These results clearly demonstrate the performance advantages of using Eastman NPG™ glycol in panel resins for exterior applications. The 20° gloss retention was significantly higher for the panels based on NPG glycol, while the increase in yellowing was noticeably less than for those based on propylene glycol. This ability to provide panel clarity over prolonged exposure periods has established NPG as the glycol of choice for panel resin applications. Products that may require these properties include fiberglass-reinforced construction panels for greenhouse glazing, corrugated siding and awnings, exterior decorative trim, and patio furniture.

Raw material suppliers	
NPG glycol	Eastman
Purified isophthalic acid (PIA)	Eastman
Propylene glycol	Dow
Maleic anhydride	Ashland
Styrene	BP
Methyl methacrylate	Rohm and Haas
MTBHQ	Eastman
M-911 fiberglass chopped-strand mat	Owens-Corning Fiberglass
Teflon®	DuPont

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Eastman Chemical Company
Corporate Headquarters
P.O. Box 431
Kingsport, TN 37662-5280 U.S.A.

U.S.A. and Canada, 800-EASTMAN (800-327-8626)
Other Locations, +(1) 423-229-2000

www.eastman.com/locations