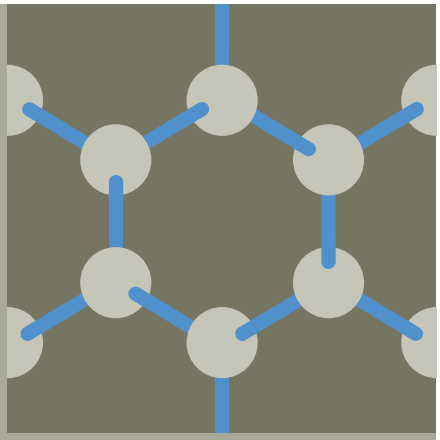
Product Bulletin

HEXION™
Specialty Chemicals

Cardura E10P
Low Viscosity Diol and Triol Polyesters



Cardura™ Glycidyl Ester E10P

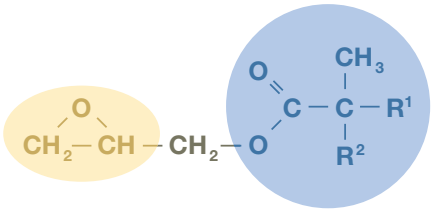
Cardura E10P is the glycidyl ester of *Versatic*™ acid 10, a highly branched carboxylic acid containing 10 carbon atoms.

Characteristics:
Carbon Durable Glycidyl Ester with 10 carbon atoms backbone:

- Epoxy group content approximately: 4170 mmol / kg
- Boiling range: 251 – 278 °C (5 – 95 %)
- Low viscosity (23 °C): 7 mPa·s
- High flame / flash point
- Low colour
- Low vapour pressure
- EINECS and TSCA listed

Structural Features:
- Epoxy group

Performance Characteristics:
- Highly reactive towards amines, acids, alcohols
- Enhanced metal adhesion



Glycidyl Ester **of Versatic 10**
$R^1 + R^2 =$
7 carbon atoms

Structural Features:
- Sterically protected ester group
- Bulky structure

Performance Characteristics:
- Excellent compatibility with polar solvents
- Excellent acid and alkali resistance
- Superior outdoor durability
- Improved gloss
- Improved pigment utilization
- Low solution viscosity
- High solid resins
- Improved polar solvent resistance
- Excellent solubility in aliphatic solvents

Polyol Preparation Procedure

Cardura E10P can be used as a building block for producing polyester polyols having two hydroxyl groups at the end of the chain. This is done by first reacting a dicarboxylic acid compound with *Cardura E10P*, the resulting diol is then reacted with anhydrides yielding carboxylic acid groups which, in turn, are again reacted with *Cardura E10P*.

The epoxy / acid reaction proceeds without liberation of water at a lower temperature than that of a conventional esterification reaction (around 130 °C).

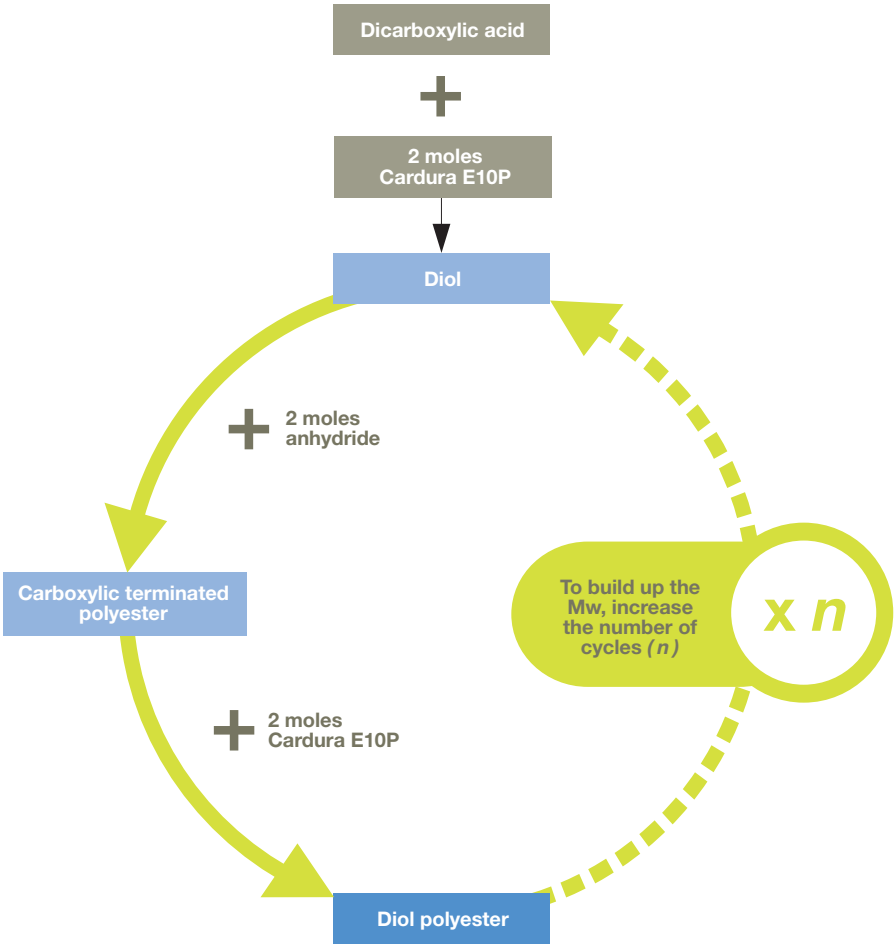
The opening of the epoxy group of *Cardura E10P* generates a hydroxyl group which can be used either for further advancing the resin or as a functional group for the cross-linking reaction with melamine formaldehyde or polyisocyanate curing agents.

This polymerisation can be carried out in mass. However, solvents such as xylene or butyl acetate can also be used. No catalyst is needed, unless a lower reaction temperature and / or time is required.

Process Advantages:
- Tailored made Mw
- Low reaction temperature
  –> limited side reactions
- Mass polymerization
  –> higher reactor throughput
- No water generation
- No need for catalyst

Cardura E10P Based Diol Polyesters

Concept:



Application Fields

Cardura E10P based diol/triol polyesters can be used in a wide range of applications such as polyurethane dispersions, solvent borne polyurethane, coil coatings, reactive diluent in acrylic resins and for the synthesis of UV acrylate oligomers.

Versatility:

In this growth process step, a wide range of anhydrides and acids can be selected. This allows for tailored made polymers to be produced such that specific application requirements e.g. flexibility / hardness balance, UV resistance, chemical resistance and others can be achieved.

In the conditions described in this brochure, the diol polyesters can meet the European polymer definition. This means that there is no need for product registration.

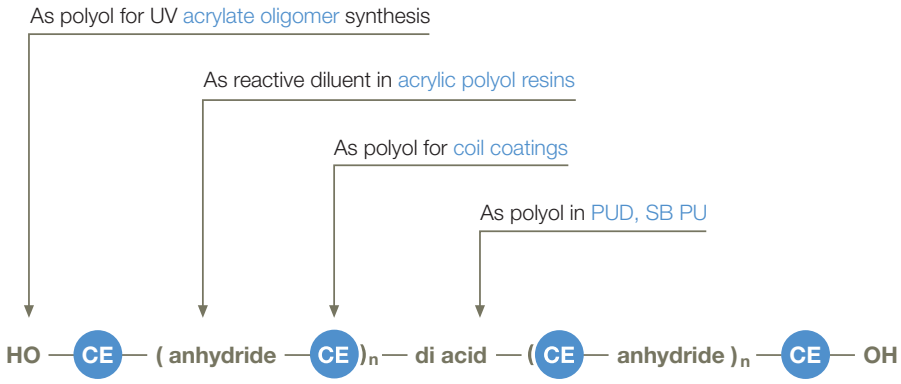
Chemical Resistance:

Cardura E10P improves the chemical resistance of the polyester polyols by reducing the permeability of polar and aggressive chemicals and by the steric protection of its adjacent ester bonds.

Possible Applications

Addes Values:

- Step process
  - –> narrow molecular weight distribution
  - –> polymer with low viscosity
  - –> ideal balance between viscosity and mechanical properties
- Hydroxy function at both ends of the chain
- Considered as a polymer
  - –> no need for EINECS registration
- Hydrophobicity
  - –> Improved chemical and water resistance
  - –> Helps wetting of apolar substrates

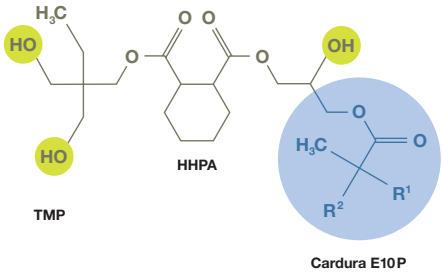


Examples of Diol Polyester			
n factor	**1**	**2**	**3**
Molecular weight	1156	1547	1950
Molecular weight distribution	1.13	1.20	1.27
Viscosity mPa·s at 23 °C	14950	35040	79500
at 31 °C	5120	-	-
at 37 °C	-	1672	5460
at 43 °C	1000	-	3470
at 50 °C	-	330	-

Diol polyesters based on adipic acid, succinic anhydride and Cardura E10P.

Cardura E10P based triol polyesters can also be synthesised. As an example, the TMP / HHPA / CE adduct is presented in this brochure. This adduct also provides the same advantages as listed for the diol polyesters. This adduct is listed in Canada, China and Korea; bonafide is needed in the USA.

Cardura Based Triol Polyesters



Ratio TMP / HHPA / Cardura: 1 / 1 / 1
(Other ratio possible e.g. 1/3/ 3 or 1/2/1.5)

HHPA = Hexa hydrophtalic anhydride
TMP = Trimethylolpropane

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