PRIAM
DELTECH
CORPORATION

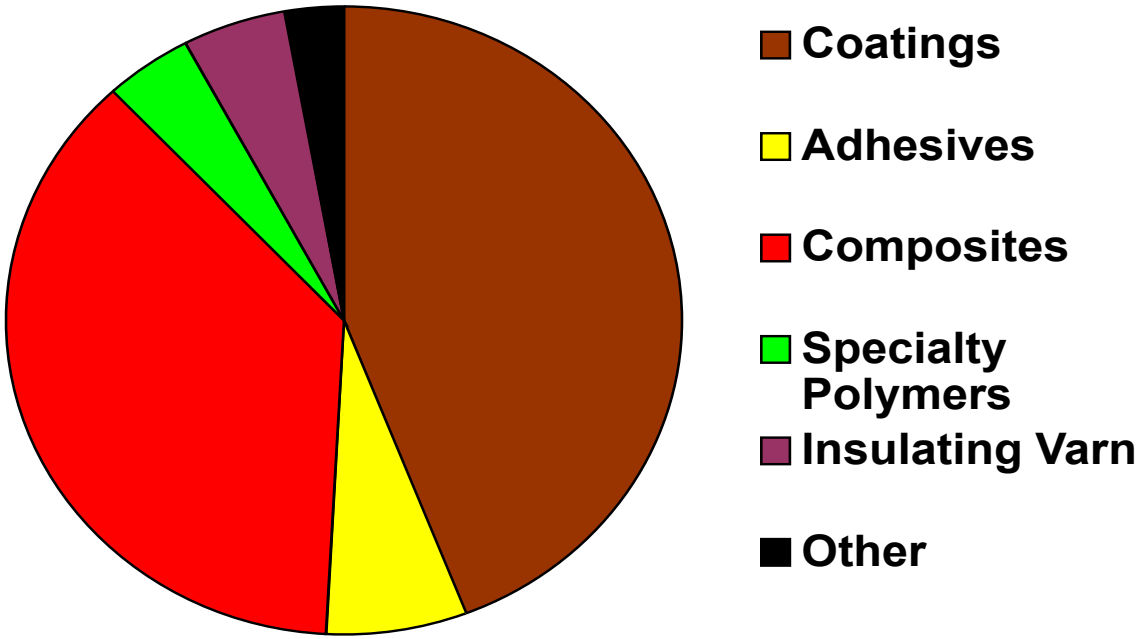
DELTECH CORPORATION
Baton Rouge USA, Monomers

PRIAM DELTECH CORPORATION

DELTECH CORPORATION

Methyl Styrenes

Applications



PRIAM DELTECH CORPORATION

PROCESS CAPABILITIES

- **Alkylation**
- **Dehydrogenation**
- **Fractionation**
- **Pilot Plant**
- **R&D**

PRIAM DELTECH CORPORATION

PRODUCTS

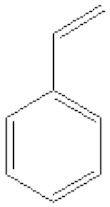
- Monomers
  - Methylstyrenes - VT pMS
  - t-BS
  - Divinylbenzene
  - Process Styrene
  - m-DiPEB
- Alkylated Aromatics
  - Ethyltoluene
  - p-Ethyltoluene
  - others
- Custom Manufactured Products

PRIAM DELTECH CORPORATION

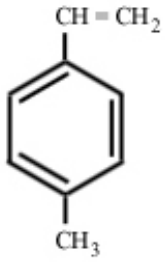
Deltech

Products

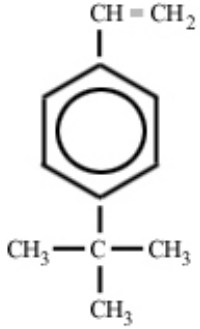
VT
VINYL TOLUENE
CAS No. 25013-15-14



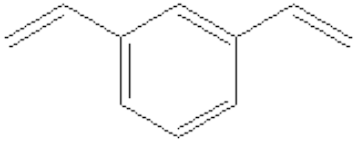
STYRENE
CAS No.
100-42-5



PMS
PARA METYL STYRENE
CAS No.
622-97-9



TBS
TERTIARY BUTYL STYRENE **CAS No.** 1746-23-2



DVB
DIVINYL BENZENE
CAS No. 1321-74-0

PRIAM DELTECH CORPORATION

Major Applications

Coatings

- Alkyd
- Acrylic
- Urethane
- UV Cure

Unsaturated Polyester composites

- Closed Mold - BMC/SMC
- Open Mold – Non - atomized Mechanical spray applications

PRIAM DELTECH CORPORATION

VINYL TOLUENE

VT – COMPARISON TO STYRENE

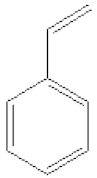
- Higher Boling Point
  - 168^{0}C versus 145^{0}C (styrene)
- Molecular Weight
  - 118 versus 104 (styrene)
- Similar Reactivity
- Monomers Value Q Value E
  - Styrene 1.00 -0.80
  - VT 1.06 -0.78
- TG °C
  - 88°C versus 98°C (styrene)
- Lower heat of polymerization
  - 14.6kcal/mol (VT) versus 17kcal/mol (styrene)

PRIAM DELTECH CORPORATION

VINYL TOLUENE

ADVANTAGES OF VINYL TOLUENE IN COMPARISON TO STYRENE

- Higher affinity to aliphatic solvents.
- Higher affinity to oils.
- Better resistance to water in copolymers.
- Improved flow and DOI in copolymers.
- Lower volatility – lower vapor concentration during the application and drying processes.
- Higher molar volume when combined with resins and oils in general – faster drying time.
- Higher operation temperature – lower exotherm – higher productivity.



STYRENE

VINYL TOLUENE

PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

VINYL TOLUENE MODIFIED OILS AND ALKYD RESINS

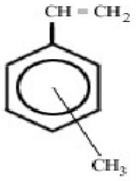
✓Vinyl Toluene has been used to modify alkyd resins for many years.

✓Unlike most fast dry systems, the addition of Vinyl Toluene provides compatibility with both aliphatic and aromatic solvents giving the paint formulator a great deal of flexibility in formulating paints.

✓Vinyl Toluene modified resins have good chemical resistance, durability, excellent color solution and color retention properties.

✓Addition of Vinyl Toluene allows for making higher solids resins with excellent gloss, hardness and moisture resistance.

✓Typically the level of VT modification of alkyd resins is between 15% and 40% VT by weight on resin solid content.

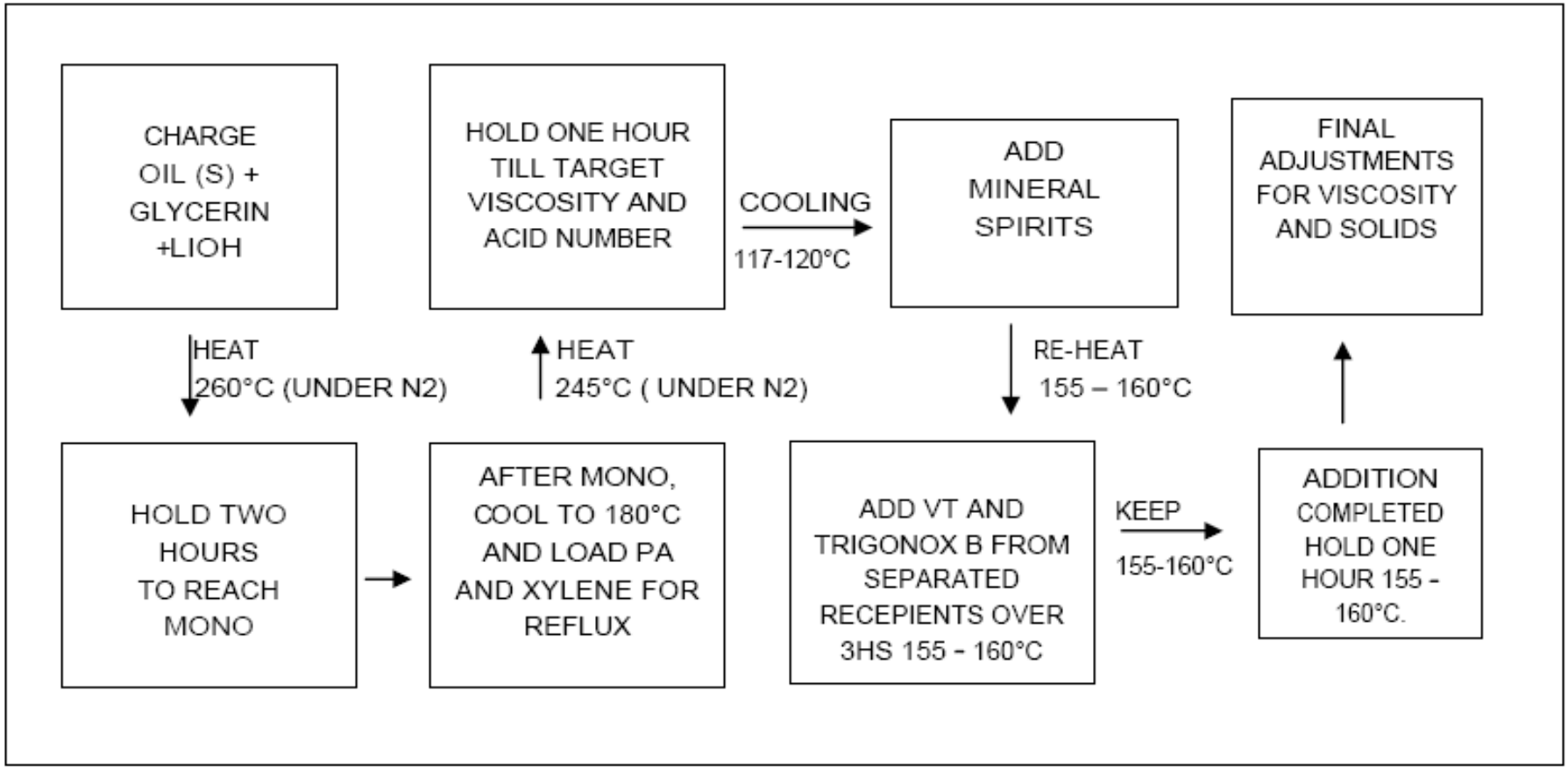


PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

VINYL TOLUENE MODIFIED OILS AND ALKYD RESINS

Process for VT Alkyd (Post-Process) :



PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

VINYL TOLUENE MODIFIED OILS AND ALKYD RESINS

VT Alkyd (Post-Process)

COMPOSITION	% ON WEIGHT
Soya	14,183
DCO	14,183
Glycerin	8,007
LIOH	0,006
Phthalic Anhydride	15,035
Xylene	1,567
Mineral Spirits	27,373
Vinyl Toluene	20,080
Trigonox B (*)	0,403
Mineral Spirits	1,090
Loss	-1,927
Total	100,000

SPECIFICATION	VALUES
% Solids	70
Specific Weight	0,96+-0,02
Oil Length (%)	41
Vinyl Toluene Content (%)	29
Volatile	MSp
Viscosity	Z5 - Z6
Acid Number	Max 12
Color	Max 8

(*) DI-TERT-BUTYL PEROXIDE

PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

SPECIALTIES ALKYDS

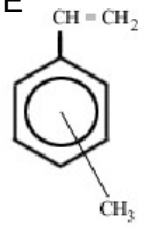
Alkyd Vinyl Acrylate Resin (Post-Process)

COMPOSITION	% ON WEIGHT
Soya	21,799
Glycerin	11,418
Neocat Lithium	0,102
Phthalic Anhydride	20,596
Xylene reflux	2,373
Xylene	26,758
Vinyl Toluene	8,271
IBM	8,271
Trigonox 21 (**)	0,153
Trigonox C (***)	0,259
Total	100,000

SPECIFICATION	VALUES
% Solids	70
Oil Length (%)	30,76
VT/IBM Content(%)	23,34
Volatile	Xylene
Viscosity	Z - Z1
Acid Number	Max 8
Color	Max 6 -7

(**) TERT-BUTYL PEROXY-2-ETHYL HEXANOATE

(***) TERT-BUTYL PEROXY BENZOATE



PRIAM DELTECH CORPORATION

Applications

- Aerosols
- Sanding sealers, primers and pre-finishing
- Implement Enamels
- Metal Furniture
- Machinery enamels and hammer finishes
- Ink varnishes and VT oils for paper coatings
- Fast dry maintenance enamels
- Stain blocking paints
- Intumescent paints

HAMMER FINISH

DRY FALL PAINTS

DTM COATINGS

PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS
VINYL TOLUENE MODIFIED OILS AND ALKYD RESINS

Paints formulated with a VT alkyds exhibit:

- ✓Aliphatic solubility
  - ✓VM&P naphtha
  - ✓Mineral spirits
- ✓Isobutane / propane solubility for aerosols
- ✓Soluble / compatible with most other paint solvents
- ✓Fast drying with typically 5 –10 minutes set to touch.
- ✓VT alkyds can be used as blending resins in other alkyd systems to speed drying times and develop early hardness.
- ✓Higher flash point, lower vapor pressure, lower HAP emissions, and lower odor.
- ✓VT alkyd coatings can be brushed, rolled, dipped or spray applied.
- ✓Aliphatic versions exhibit extremely flexible recoat and touchup schedules (open time).

PRIAM DELTECH CORPORATION

Typical Products

- Modified Oils Compatible with LOA
- Conventional Solids Medium VT/Alkyds
- High Solids Medium VT/Alkyd Co Polymers Compatible with MOA

PRIAM DELTECH CORPORATION

Paint Formulation Property Comparison

	VT/VM&P	SOA/Xylene
Low odor	+++	--
Recoat ability	++	--
Fast dry	++	+
Cure	+++	+

PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

URETHANE VT OIL

Pre-Vinylated Process (Oil Vinylate).

Urethane VT Oil – Pre-Process	
Composition	**% on weight**
(1) Soya	37,55%
(2) Vinyl Toluene	21,85%
(3) Trigonox B (*)	0,89%
(4) Glycerin	3,14%
(5) Neocat Lithium	0,27%
(6) TDI 80/20	8,80%
(7) Mineral Spirits	27,49%
Total	**100,00%**
SPECIFICATION	**VALUES**
Solids	72,10%
Viscosity	Z5
Excess OH	0,0

Process for OIL/VT/TDI
Charge (1). Heat to 160°C under N2
Add (2) and (3) from separated recipients over 3 hours.
Hold one hour at 155° - 160°C until reach viscosity (Z1 – Z2).
Heat to 240° C.
Hold 30 minutes until reach viscosity (Z4 – Z5)
Cool to +- 220°C add (4) and (5).
Heat to 250°C.
Hold temperature until reach the mono. Hold + 30 minutes
Drop the temperature to 82°C through the addition of MSp (7).
Add 30% of (6).
Keep the temperature under control (82°C - 93°C).
Charge the second part of TDI (6).
Final Procedure.

(*) DI-TERT-BUTYL PEROXIDE

PRIAM DELTECH CORPORATION

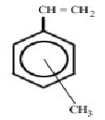
MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

URETHANE VT OIL

Traditional Urethane Oil versus Urethane VT Oil

Traditional Urethane Oil	
Composition	**% on weight**
Soya	46,4502%
Glycerin	6,6479%
Neocat Lithium	0,0328%
TDI 80/20	18,1467%
Mineral Spirits	28,7224%
Total	**100,00%**
SPECIFICATION	**VALUES**
Solids	71,27%
Viscosity	Z6
Excess OH	2,8

Urethane VT Oil – Pre-Process	
Composition	**% on weight**
(1) Soya	37,55%
(2) Vinyl Toluene	21,85%
(3) Trigonox B (*)	0,89%
(4) Glycerin	3,14%
(5) Neocat Lithium	0,27%
(6) TDI 80/20	8,80%
(7) Mineral Spirits	27,49%
Total	**100,00%**
SPECIFICATION	**VALUES**
Solids	72,10%
Viscosity	Z5
Excess OH	0,0

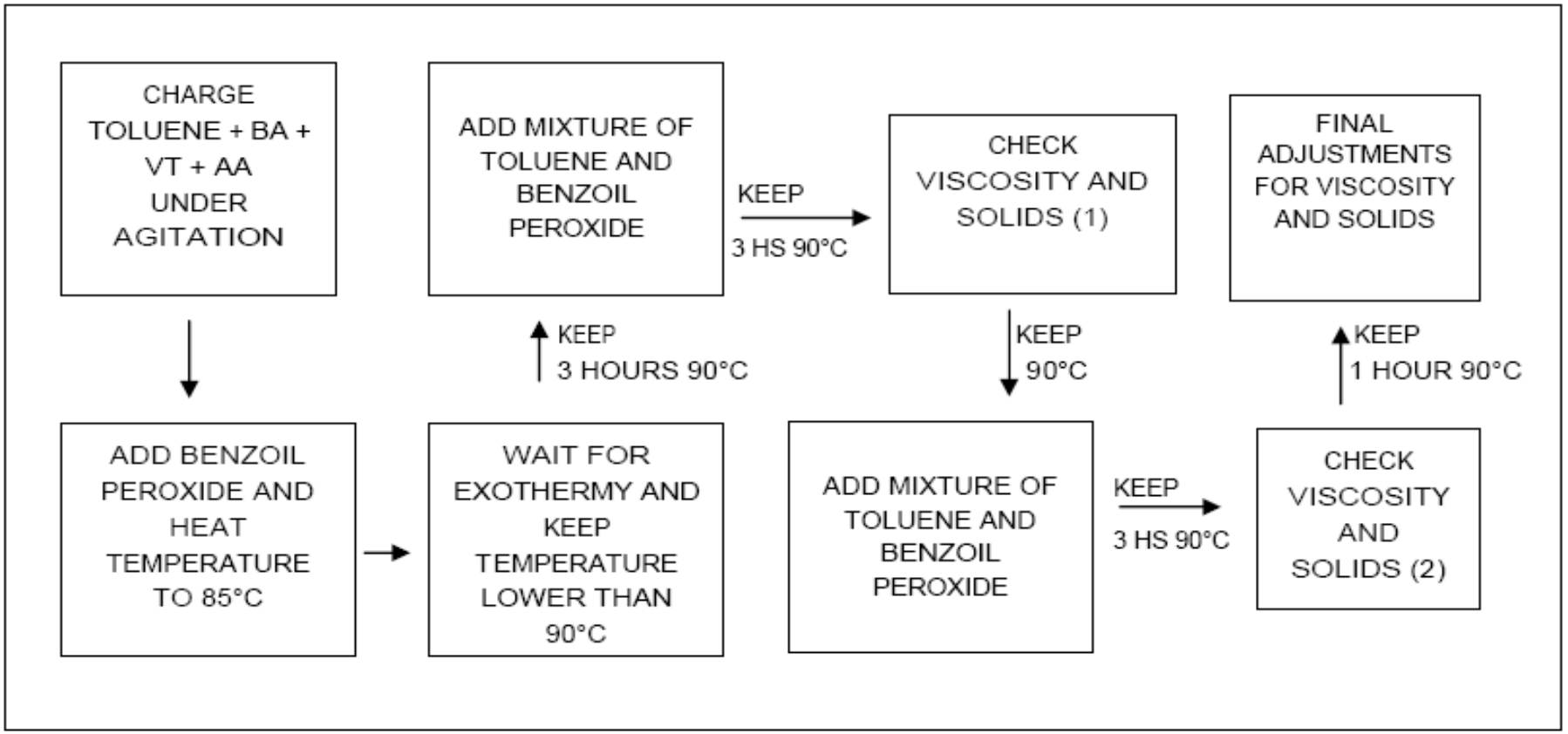


PRIAM DELTECH CORPORATION

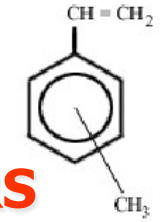
MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

ACRYLICS

Process for Thermoplastic Acrylic Resin :



PRIAM DELTECH CORPORATION



MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

THERMO-PLASTIC ACRYLIC RESIN

Bulk Process –Road Signs, Varnish for Stone and Concrete

COMPOSITION	% ON WEIGHT
Toluene	33,00
BA	12,00
VT	47,00
AA	1,40
Benzoil Peroxide	0,56
Toluene	2,30
Benzoil Peroxide	0,07
Toluene	2,30
Benzoil Peroxide	0,07
Toluene	1,30
Total	100,000

SPECITICATION	VALUES
% Solids	60
Volatile	Toluene
Viscosity	Z5 - Z6
Acid Number	Max 13
High solubility in aliphatic solvents	

US Patent 3,897,378

- Alkylstyrene-Alkyl acrylate- Butadiene graft polymers are suitable for use in blends with alkyd resins to prepare binders for traffic paint formulations.
- Fast dry - 15 mil thick paint can dry in less than 5 minutes.
- Improved adhesion to fillers & reflective glass beads
- Wear properties.

PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

THERMO-CURABLE ACRYLIC

Bulk Process –Car Refinish – 2 Compounds – Aliphatic Isocyanate

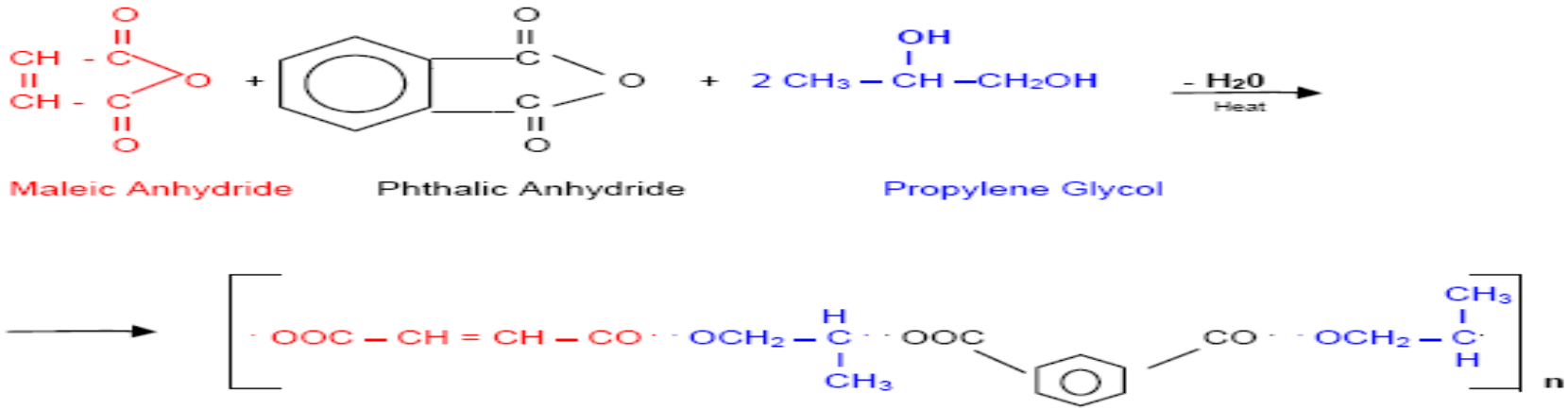
COMPOSITION	% ON WEIGHT
Xylene	50,00
BA	4,9
VT	9,8
AA	0,98
HEMA	2,45
MMA	30,87
Benzoil Peroxide	1,0
Total	100,000

SPECIFICATION	VALUES
% Solids	50
Volatile	Xileno
Viscosity	W - Y
Acid Number	Máximo 15
% OH on resin in solution	0,32
Better DOI and FLOW	

PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

UNSATURATED POLYESTER RESIN FOR UV

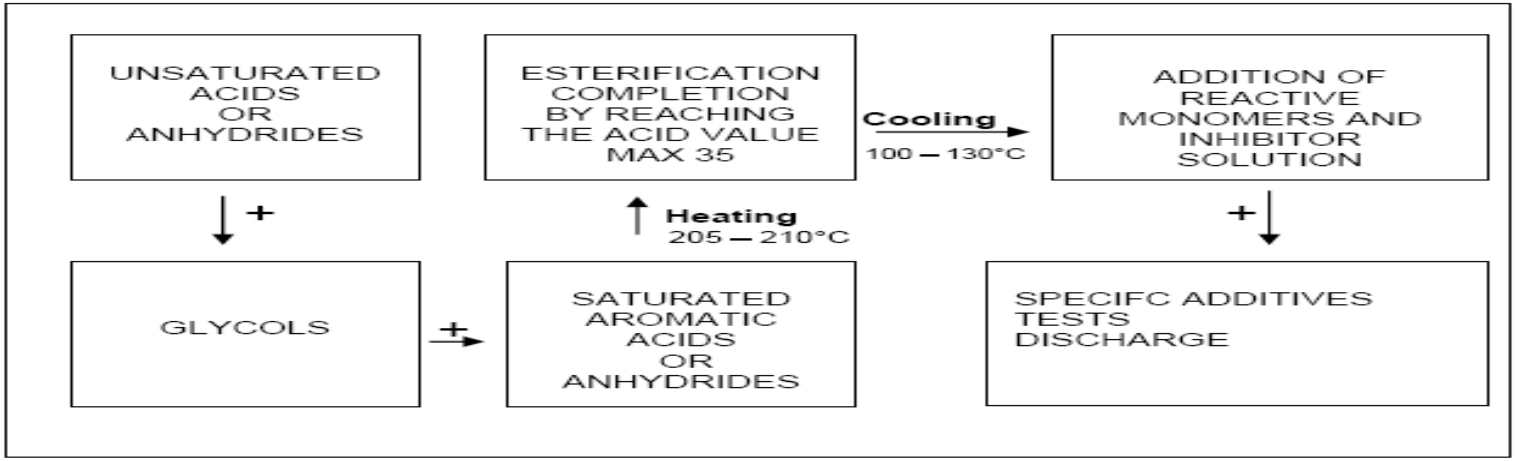


UNSATURATED POLYESTER FOR UV	% on weight
✓ Propylene Glycol	26,992
✓ Phthalic Anhydride	11,932
✓ Maleic Anhydride	23,655
✓ HQ solution (10% of HQ in Ethyl Alcohol)	0,291
✓ Reactive Diluent (TMPTA/VT 1:1)	37,130
✓ TOTAL	100,000

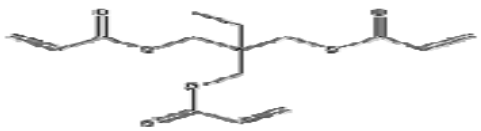
PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

PROCESS TO PRODUCE AN UNSATURATED POLYESTER FOR UV

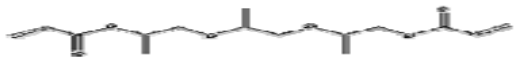


- Reactive Reducers (unsaturated monomers)

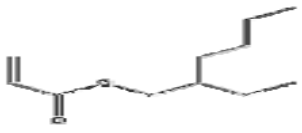


Trimethylolpropane triacrylate (TMPTA)

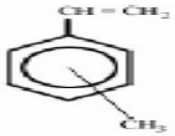
Neopentylglycol diacrilate (NPGDA)



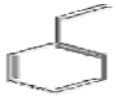
Tripropyleneglycol diacrylate (TPGDA)



2 ethyl hexyl Acrylate



Vinyl Toluene (VT)



Styrene (STY)

Hexanediol diacrylate (HDODA)

PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

VINYL ESTER RESIN FOR UV

✓Vinylester resins are usually terminated by carboxylate or hydroxyl groups at the end of molecules, along with several internal C=C double bonds in each molecule to react with crosslinking monomer, forming three-dimensional structure.

✓Vinylester resins are produced by esterification of a polyfunctional epoxy resin with an unsaturated mono-carboxylic acid, usually methacrylic, and acrylic acid. The typical structure of a vinylester resin is shown in Figure 1.1.

✓The reactive unsaturation is presented as terminal groups in the polymer (structoterminal), and can be cross-linked by vinyl monomers (unsaturated monomers) in the same way as conventional polyester.

✓The outstanding physical properties are attributed to the higher reactivity of terminal unsaturation and its regular distribution through the network.

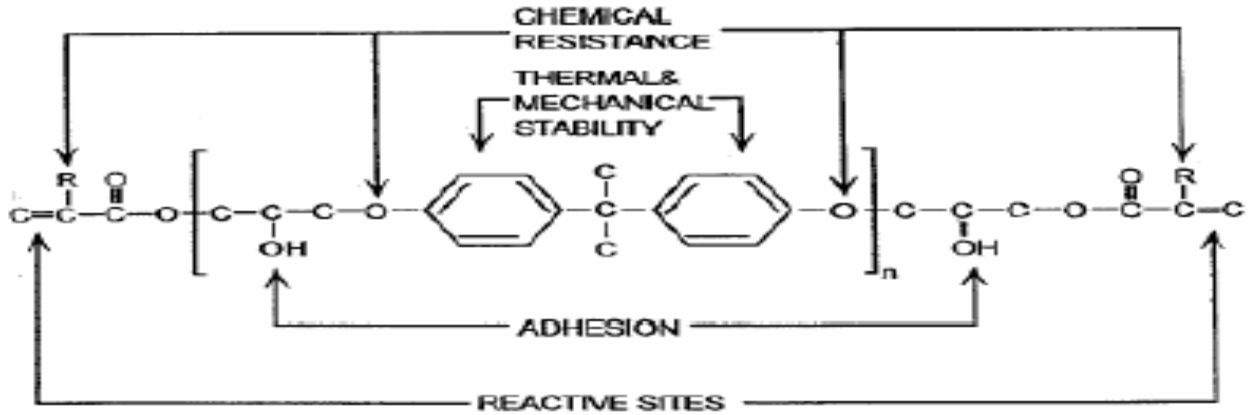


Figura 1.1 – Estrutura Molecular da Resina Epóxi-Acrílica (Young, 1976)

PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

VINYL ESTER RESIN FOR UV

Basic Process:

- ✓ Load the epoxy resin, acrylic acid, reaction initiator, and first part of inhibitor solution to the reactor.
- ✓ Heat the reactor to 100 – 115°C.
- ✓ Reaction completion is determined by testing acid value to desired end point (MAX 7).
- ✓ The product then is diluted with VT and the second part f inhibitor solution is added

PRIAM DELTECH CORPORATION

MODIFICATION OF RESINS, MONOMERS AND OLIGOMERS

VINYL ESTER RESIN FOR UV

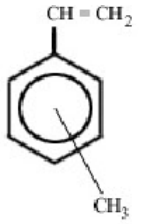
MAIN CHARACTHERISTICS OF THE LOW COST VINYLESTER RESIN - (VINYLESTER-VT)

- Vinyl Toluene when used as a reactive reducer for vinylester resins doesn' t show the inconvenience of strong-odor of styrene during the application and drying processes.

- The main reason for such characteristic is due to its faster curving cure avoiding by consequence a higher emission of active material in the air.

- Low cost vinylester resin (VINYLESTER-VT) when combined with other reactive monomers such as TMPTA, TPGDA, HDDA, and DPGDA, etc. yield products with a broad variation of chemical and physical properties.

- The use of VT in vinylester resins provides a great opportunity to cost reduction mainly when comparing the cost/ benefit between VT and other unsaturated monomers available intothe market place.



PRIAM
DELTECH
CORPORATION

For further assistance on products and applications, please contact:

DELTECH PRIAM Chemicals India Pvt Ltd
401-406, 'K' Buliding, Ballard Estate,
CST Mumbai 400 001.
Email: amantri@deltechcorp.com
Tel./Mbl.:+91-9820802094 / 9029988760
CIN: U24233MH2012FTC235069