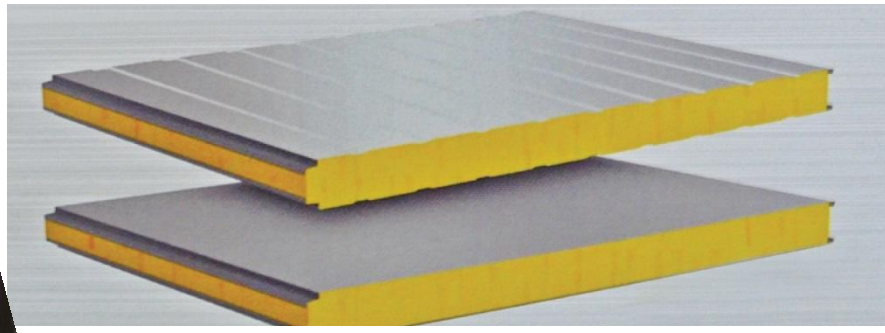

PUR, PIR and Polyol Catalysts

LPR GLOBAL

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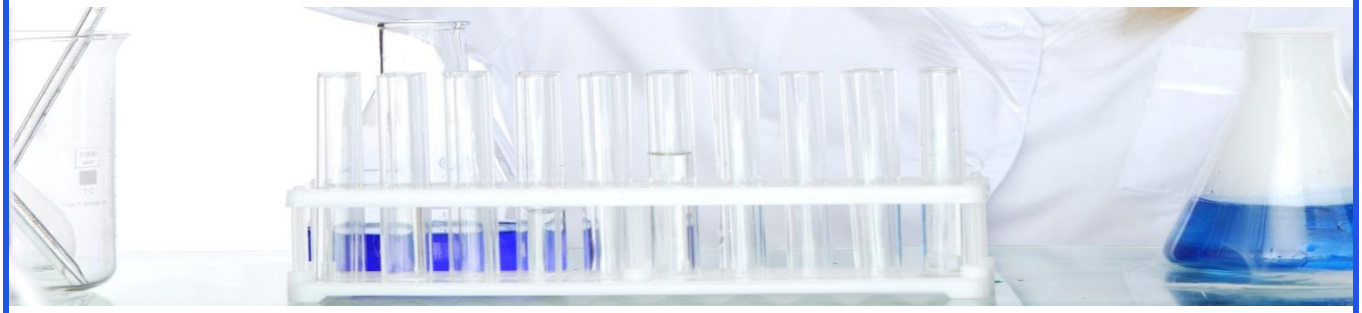
ES CAT® is a non-toxic, environment-friendly organometallic catalyst family for efficient polyurethane production.

Comparison of toxicity characteristics

Product	Toxicity	Organotin substances	Reactivity	Applications
ES CAT-100E	Non-toxic	MOT, DOT detected	Slower than T-12	PU catalyst, epoxy resin curing agent
ES CAT-180b	Non-toxic	Not detected	Same as T-12	Catalyst
ES CAT-100Ag-1822	Non-toxic	Not detected		High temperature catalyst
ES CAT-100Ag-18Kmn	Non-toxic	Not detected	Slower than T-12	Catalyst and curing agent
ES CAT-320-25d	Non-toxic	Not detected	Same as T-12	Silicone resin curing agent, PU catalyst
ES CAT-B-75	Non-toxic	Not detected		PU catalyst
ES CAT-B-90N	Non-toxic	Not detected		PU catalyst
ES CAT-K-90	Non-toxic	Not detected		High temperature catalyst
ES CAT-5500	Low-toxicity	MBT detected		Polyesterification Catalyst

※ 8 toxic substances: **MBT, DBT, TBT, TeBT, MOT, DOT, TcyT, TPhT**



Toxicity Test Report Example – ES CAT-100Ag-18Kmn

SGS

Test Report No. F880101/LF-CTSAYSA16-00824 Issued Date: 2015. 02. 04 Page 1 of 3

The following sample(s) was/were submitted and identified by/on beh

SGS File No.	:	AYSA15-00824
Sample Description	:	ES CAT-100Ag-18KMN(141103)
Color	:	N/A
Style no./item no.	:	N/A
Order No.	:	N/A
Country of Origin	:	N/A
Country of Destination	:	N/A
Received Date	:	2015. 01. 13
Test Period	:	2015. 01. 14 to 2015. 02. 04
Purpose of Test Report	:	For Reference
Test Method	:	Please refer to next page(s).
Test Results	:	Please refer to next page(s).
Test Performed	:	This test report contains result(s) p with the client. The result(s) is/are
Result summary	:	Selected test(s) as requested by cl

SGS

Test Report No. F880101/LF-CTSAYSA16-00824 Issued Date: 2015. 02. 04 Page 2 of 3

Test Results :

Sample No.	Material No.	Component	Material	Color
/	1	Liquid	Liquid	Transparent

Organotins(#)

Test Method: With reference to ISO 17353:2004. Analysis was performed by GC-MS.

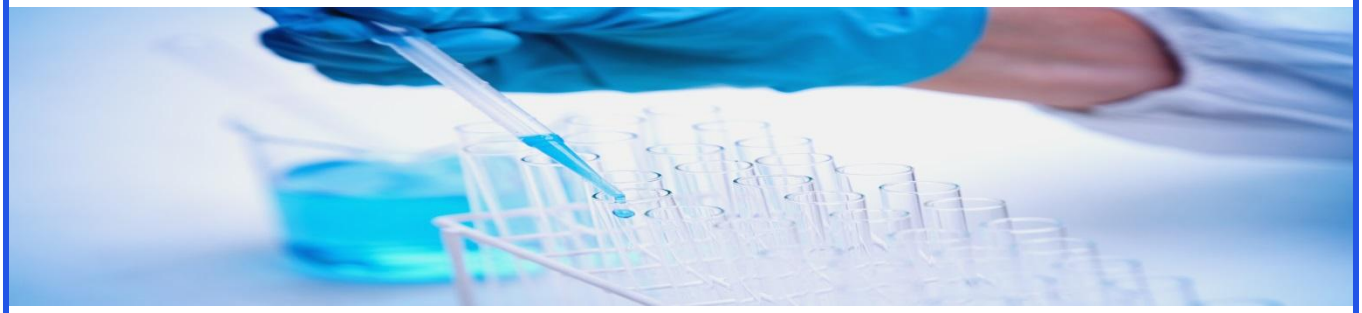
	CAS-No.	Result 1
Dibutyltin (DBT)	–	n.d.
Dioctyltin (DOT)	–	n.d.
Tributyltin (TBT)	–	n.d.
Triphenyltin (TPhT)	–	n.d.
Conclusion	–	**PASS**
Monobutyltin (MBT)	–	n.d.
Monooctyltin (MOT)	–	n.d.
Dimethyltin (DMT)	–	n.d.
Trimethyltin (TMT)	–	n.d.
Tripropyltin (TPT)	–	n.d.
Trioctyltin (TOT)	–	n.d.
Tricyclohexyltin (TCyT)	–	n.d.
Tetrabutyltin (TeBT)	–	n.d.
Tetraoctyltin (TeOT)	–	n.d.
Conclusion	–	**N.A.**

Note: n.d. = not detected
mg/kg = ppm
N.A. = Not applicable
" = exceed the limit
Detection limit = 0.03 mg/kg (for individual compound)

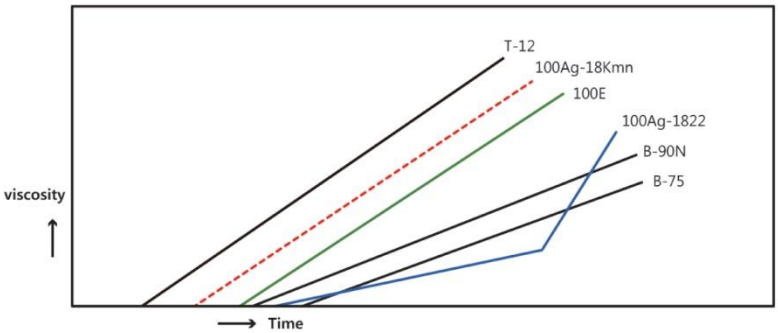
Recommended Max. Limit:

Tributyltin (TBT)	**0.5 mg/kg**
Dibutyltin (DBT)	**1.0 mg/kg**
Triphenyltin (TPhT)	**0.5 mg/kg**
Dioctyltin (DOT)	**1.0 mg/kg**
Other	**Not applicable**

Remark: " = Exceeds the relevant requirement of the 2/3-composite mix. Detected substance(s) may come from one or more component(s) in composite testing. Individual testing of mixed components is highly recommended.



Reactivity comparisons of ES CAT® organometallic catalyst family



※ Based on products of Seho Tech

Characteristics of ES CAT® organometallic catalyst family

1. ES CAT compound catalysts are based on silver, bismuth, and zinc, which prevent the growth of fungi. These catalysts replace mercury and lead-based catalysts; they are tin-free and non-toxic.
2. These non-toxic, environment-friendly catalysts are utilized for PU synthesis by a global shoe manufacturer for insole coatings. Silver acts as an anti-bacterial agent and metallic bismuth acts as a hardener with the ability to form a smooth gel.
3. The organometallic composites can be customized upon your request.

Benefits of ES CAT® organometallic catalyst family

1. These catalysts can be used with DBTDL in identical amounts.(as their reactions are adjusted).
2. These catalysts are formulated to promote NCO/OH reactions with high hydrolytic-stability.
3. These catalysts allow the coordination of amines rather than catalyzing NCO/H_2O reactions in one component PU.
4. These catalysts can be used alone or in combination with additives and other organometallic compounds.

ES CAT® polyurethane catalysts are used in the following applications:

Product	Epoxy Resin	Adhesives	TPU	Elastomers	Paints	Silicone	PU Rigid
ES CAT-100E	○	○	○	○			
ES CAT-180b	○	○		○			
ES CAT-100Ag-1822			○				○
ES CAT-100Ag-18Kmn	○	○	○	○			
ES CAT-320-25d	○	○				○	
ES CAT-B-75	○	○	○	○			
ES CAT-B-90N	○	○	○	○			
ES CAT-K-90			○				○
ES CAT-5500	○				○		

Recommended Recipes

1. PU Resin: Recommended catalyst is ES CAT-100E or ES CAT-100Ag-18kmn.
   Add 0.05-0.5% organometallic catalyst.
2. Polyurethane Adhesives: Recommended catalyst is ES CAT-100E, ES CAT-320-25d or
   ES CAT-100Ag-18kmn.
   Add catalyst mentioned in 1) and 2) for each polyol (%).
3. Silicone Sealants: Recommended catalyst is 0.05-0.5% ES CAT-320-25d.
4. Polyurethane elastomers: Recommended catalyst is ES CAT-100E, ES CAT-180b,
   ES CAT-100Ag-18kmn or ES CAT-B-75 or ES CAT-B-90N. Add 0.05-0.5% catalyst for each polyols (%).

Manufacturing Capacity

- Metal and amine catalysts and their derivatives : 6,000Metric Tons/year.
- Curing Accelerator for Resin of INK : 3,000Metric Tons/year.
- Special Organic Metal Compounds : 2,000Metric Tons/year.
- Polyester Polyol : 20,000 Tons/year.
- Rigid Foam System House: 20,000 Tons/year.

ES CAT-5500

ES CAT-5500 is a highly active esterification catalyst at temperatures in the range of 200℃ - 230℃. It is a white solid, which dissolves upon reaction with carboxylic acids. The active catalyst product is soluble in systems such as phthalate or isophthalate esters.

The use of ES CAT-5500 minimizes the dehydration and oxidative degradation of alcohols. ES CAT-5500 is a highly selective catalyst, which results in higher product purity by minimizing byproducts.

Corrosion, odor and color problems can be eliminated, which are commonly encountered with the use of acid catalysts. Neutralization and washing is not required. In addition, excess alcohol can be recovered and reused without expensive purification processes.

Typical Physical Properties

Formula BuSnOOH 90%
Physical Form Amorphous white Powder
Specific Gravity(@25℃) 1.46
Solubility insoluble in most organic solvents : dissolves upon reaction with carboxylic acids

Recommended Uses

Esterification trans-esterification and polycondensation reactions

- ▶Unsaturated polyester especially isophthalates
- ▶Powder coatings
- ▶Terephthalates
- ▶Polyester polyols
- ▶Specialty enamels
- ▶Coil coatings
- ▶Adipates
- ▶Phthalates
- ▶Alkyd resins

Normal concentrations are 0.05% to 25% by weight based on total charge.
A reaction temperature near 220℃ is recommended. ES CAT-5500 is soluble in most ester products.

Rapid esterification of isophthalic acid with Propylene glycol is obtained using ES CAT-5500 at the reflux temperature (190℃ to 220℃). The recommended catalyst level is 0.1% of total charge in order to obtain an acid value of 5mg KOH/g after five hours.

Performance data for the preparation of Bis(2-hydroxypropyl) isophthalate are generated for each application.

ES CAT-100Ag-18kmn

Chemical name & Specification

- Chemical name : organic metal compound
- Degree of purity (%) : 99.0min

Properties

- Appearance : yellowish & clear
- Specific Gravity(@25℃) : 1,060

General Descriptions

This catalyst belongs to the family of Organic Metal compounds. It is used in Polyurethane Composite reactions and as a hardening accelerator. It has superior qualities not only for toxicity but also for performance as a thermal stabilizer compared to other metallic catalysts. Specifically, it has outstanding effectiveness in polymerization of Urethane resins, esters and polyols.

- This is a substitute for DBTDL (Dibutyltin dilaurate)
- Tin-free & free of MBT, DBT, TBT, TeBT, MOT, DOT, TOT, TchT, TPT
- Higher activity than Escat-100E in reaction

Application

- Catalyst for polyurethane synthesis
- Tin-free & Non-toxic accelerator for synthetic leather, fiber and shoes
- Hardening accelerator for silicone resin and silicone sealant

Package Description :

16kg net
180kg net

ES CAT-180B

Product

Organic metal Compound

Properties

- Appearance : Yellowish colored liquid
- Specific Gravity (@25℃) : 0.92
- Degree of purity(%) : 99.0min
- Viscosity : below 100cps

Package Description :

20kg net
200kg net

General Descriptions

This is a metal Mercaptide catalyst. It is used as a Polyurethane Composite reaction catalyst and as a hardening accelerator. It has superior qualities not only for toxicity but also for performance as a thermal stabilizer compared to other metallic catalysts. Specifically, it has outstanding effectiveness in the polymerization of Urethane resins, esters and polyols.

- This is substitute for DBTDL (Dibutyltin dilaurate)
- Free of MBT, DBT, TBT, TeBT, MOT, DOT, TehT, TPT
- Higher activity than ESCAT-100E in reaction

Recommended Use

- Catalyst for Polyurethane Resin Composition
- Polyol Polymerization reaction catalyst
- Hardening catalyst : For wet & Dry Process
- Stabilizer-Resin, Ester reaction

Innocuousness Approval Institution & Number :

FDA (21CFR178.2020)	Max. 2.0%
BGD (ILA, 4C)	Max. 1.2%
JHPA (C-8-(10)-1)	Max. 2PHR%

ES CAT-100L

Product

Dioctyltin Dilaurate

Properties

- Appearance : Yellowish & clear.
- Specific Gravity (@25℃) : 1.55
- Degree of Purity(%) : 99.0min
- Sn content(%) : 15.2

Application

- Catalyst for polyurethane resins
- Non-toxic accelerator for synthetic leather, fiber, and shoes
- Hardening accelerator for silicone and sealant

Package Description :

18kg net
200kg net

- This is substitute for DBTDL (Dibutyltin dilaurate)
- Free of MBT,DBT,TBT,TeBT,TcyT,TPhT

ES CAT-100Ag-1822

Chemical name & Specification

- Chemical name : organic metal compound
- Degree of purity (%) : 99.0min

Properties

- Appearance : yellowish & clear
- Specific Gravity(@25℃) : 1,150

General Descriptions

This catalyst belongs to the family of Organic Metal compounds and is used in Polyurethane Composite reactions and as a hardening accelerator. It has superior qualities not only for toxicity but also for performance as a thermal stabilizer, compared to other metallic catalysts. Specifically, it has outstanding effectiveness in polymerization of Urethane resins, esters and polyols.

- This is substitute for DBTDL (Dibutyltin dilaurate)
- Tin-free & free of MBT, DBT, TBT, TeBT, MOT, DOT, TOT, TchT, TPT

Application

- Catalyst for polyurethane synthesis
- Tin-free & Non-toxic accelerator for synthetic leather, fiber, and shoes
- Hardening accelerator for silicone resin and silicone sealant

Package Description :

16kg net
180kg net

ES CAT-100E

Chemical name & Specification

- Chemical name : organic metal compound
- Color(Gardner) : 2Max
- Degree of purity(%) : 99.0min
- Metal content(%) : 18.8

Properties

- Appearance : yellowish & clear
- Specific Gravity (@25℃) : 0.990

Application

- Catalyst for polyurethane resins
- Non-toxic accelerator for synthetic leather, fiber and shoes
- Hardening accelerator for silicone and sealant

Package Description :

18kg net
200kg net

- The different physical properties of ES CAT-100E can be produced at request
- This is substitute for DBTDL (Dibutyltin dilaurate)
- Free of MBT, DBT, TBT, TeBT, TchT, TPT

ES CAT-230ND

Chemical name & Specification

- Chemical name : organic metal compound
- Color (Gardner) : 2Max
- Degree of purity (%) : 99.0min
- Metal content (%) : 23±1

Properties

- Appearance : yellowish & clear
- Specific Gravity (@25℃) : 1.125

Application

- Catalyst for polyurethane resins
- Accelerator for synthetic leather, fiber, and shoes
- Hardening accelerator for silicone and sealant

Package Description :

20kg net
200kg net

- This is substitute for DBTDL (Dibutyltin dilaurate)
- Free of MBT, DBT, TBT, TeBT, TchT, TPT, MOT, DOT

ES CAT-T-1

Product

Dibutyltin diacetate

Properties

- Colored liquid.
- Soluble in hydrocarbon-type solvents.
- Approximate Density 1.010
- Flash Point 204℃, PMCC Method
- Sn content(%) : 33.0

Package Description :

25kg net
250kg net

Handling

- Avoid contact with eyes and skin
- Protect from moisture or open flame
- See MSDS for further information

ES CAT-K-15

Chemical name & Specification

- Chemical name : Potassium Octoate
- Color (Gardner) : 2Max
- Purity(%) : 99.0min

Properties

- Appearance : yellowish & clear
- Specific Gravity (@25℃) : 1.10±0.03
- Flash Point (℃) : 137

Handling

- Dryer for paint
- Catalyst for polyurethane spray
- Catalyst for polyisocyanurate foam

Package Description :

18kg net
200kg net

ES CAT-B-75

Product

Bismuth Octoate
$Bi(OOCC_7H_{15})_3$

Properties

- Straw colored liquid
- Soluble in hydrocarbon solvents
- Approximate Density : 1.05
- Degree of purity(%) : 99.0min

Package Description :

18kg net
200kg net

Handling

- Avoid contact with eyes and skin
- Protect from moisture or open flame
- See MSDS for further information

ES CAT-B-90N

Product

Bismuth Neodecanoate (CAS #34364-26-6).

Properties

- Appearance : Light Yellowish Liquid
- Viscosity(25℃) : <5,000
- Flash point(‘C) : >110
- Density(g/ml@25’C) : 1.05-1.15
- Boiling point(‘C) : 300

Application

- Effective catalyst for Silicone Sealants
- Bismuth-based catalyst for a good balance in pot life and cure
- Good non-tin alternative to DBTL for polyurethane coatings, adhesive/sealants, and elastomer systems

Handling

- Should be stored in the original packaging at moderate temperature
- Prevent from freezing
- Close tightly after each use to maximize shelf life. Package Description: 18kg net, 200kg net.

Package Description :

18kg net
200kg net

TEDA(TRI ETHYLENE DIAMINE), ES CAT L-33, L33E

TEDA is a solid, white and crystalline tertiary amine compound.

TEDA is extensively used as a catalyst to promote both gelling and blowing activities in the production of flexible, semi-rigid, and rigid polyurethane foams, as well as elastomers.
It is also available in a solution of dipropylene glycol (ESCAT-33) and ethylene glycol (ESCAT-33E)

Properties

- Degree of purity (%) : 99.5min
- Freezing point (℃) : 159.9
- Boiling point (℃) : 174

Package Description : 25kg net

Application

- Dryer for paint
- Catalyst for polyurethane spray
- Catalyst for polyisocyanurate foam

ES CAT-L-33

ES CAT L-33 is mixed with Triethylene diamine and 67% Dipropylene glycol.
ES CAT L-33 is extensively used as liquid for promoting both galling and blowing activities in the production of flexible, semi-rigid, and rigid polyurethane foams, and elastomers.

It is easily soluble in water, acetone, benzene, alcohol, and straight chain hydrocarbons like pentane, hexane, and heptane. When exposed to air, it absorbs moisture, deliquesces, and agglomerates in lumps. It also absorbs CO_2 in air and turns yellow.

Properties

- Chemical name : Triethylene diamine with Dipropylene glycol
- Molecular weight : 112.18
- Degree of Purity : 33.3%
- Moisture : 1.0%
- Boiling point : 220℃

Package Description : 18kg net, 200kg net

Handling

- Avoid contact with eyes and skin
- Keep away from moisture and open flame

ES CAT-L-33E

ES CAT L-33E is mixed with Triethylene diamine 33% and 67% Ethylene glycol.
ES CAT L-33E is extensively used as a catalyst for promoting both galling and blowing activities in the production of flexible, semi-rigid, and rigid polyurethane foams as well as elastomers.

It is easily soluble in water, acetone, benzene, alcohol, and straight chain hydrocarbon like pentane, hexane, and heptane. When exposed to air, it absorbs moisture, deliquesces, and agglomerates in lumps. It also absorbs CO_2 in air and turns yellow.

Properties

- Chemical name : Triethylene diamine with Ethylene glycol
- Molecular weight : 112.18
- Degree of Purity : 33.3%
- Moisture : 1.0%
- Boiling point : 220℃

Package Description : 18kg net, 200kg net

Handling

- Avoid contact with eyes and skin
- Keep away from moisture and open flame

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ES CAT-TB400

Product

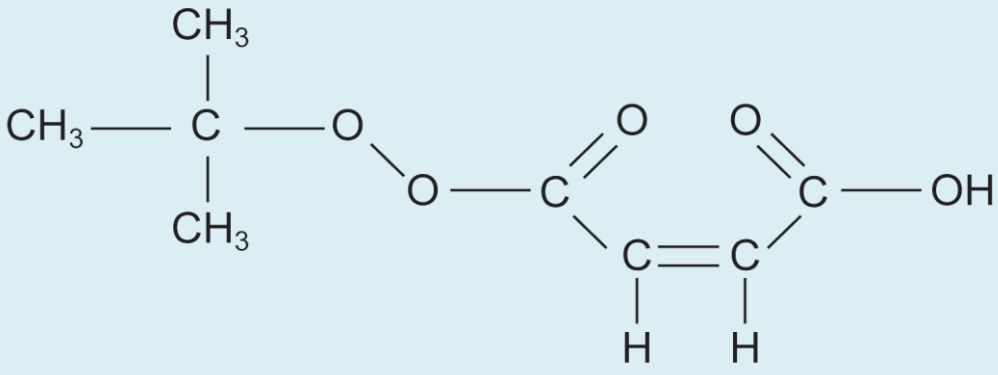
Tert-butyl Monoperoxymaleate, Paste

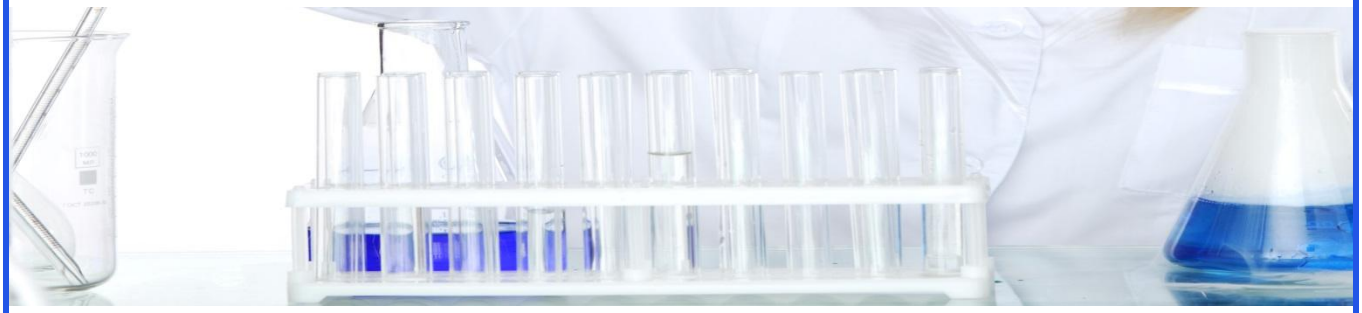
Properties

- Appearance : White Paste
- Specific Gravity : 1.035
- Active Oxygen : 2.29 ~ 2.82 wt%
- Purity : 38.0 ~ 41.0 wt%
- Molecular Weight : 188.2
- UN No. : 3103
- C.A.S. Registry No. : 1931-62-0)

Applications

ES CAT-TB400 is usable as a hardener for artificial marble. Artificial marble can be manufactured in various shapes and is mainly used for manufacturing kitchenware and bathroom items. ES CAT TB-400M can be also used as a hardener for MMA resin.





POLYESTER POLYOL SERIES

Grade	Appearance	Viscosity (25C cps)	OH Value	Water (max %)	Application	Characteristics
SP-150	Clear Brown	60,000± 10,000	150 ±10	1.0	• PIR/PUR Applications	
SP-190	Clear Brown	3,000± 500	200 ±10	1.0	• PIR/PUR Applications	
SP-200	Clear Brown	30,000± 10,000	200 ±10	1.0	• PIR/PUR Applications	
SP-240Y	Clear Brown	5,000± 500	240 ±20	1.0	• PIR/PUR Applications	
SP-240P	Clear Brown	8,500± 1,000	245 ±10	1.0 (0.37)	• Laminate boards, metal panels	
SP-240SA	Clear Brown	3,500± 700	240 ±10	1.0	• Laminate boards, metal panels, appliances	• Provides good flow & improved HC & HFC stability
SP-250Y	Clear Brown	5,000± 500	240 ±20	1.0	• Metal panels, spray foams, appliances, pour-in-place	• Improves thermal resistance
SP-320GA	Clear Brown	3,000± 500	320 ±20	1.0	• Spray foam, bunstock, pour-in-place	• Improves thermal resistance
SP-320N	Clear Brown	3,300± 500	320 ±20	1.0	• Spray foam, bunstock, pour-in-place	• High stability with HC & HFC
SP-330AP	Clear Brown	8,000± 2,000	320 ±20	1.0	• Metal panels, spray foam, appliances, bunnstock, pour-in-place	• Improves green strength & thermal resistance

POLY ESTER POLYOL SP-240

Product name : SP-240

Description

SP-240 is a modified Terephthalic acid (TPA)

Applications

Rigid polyisocyanurate boardstock blown with HCFC-141b/water, or blown with hydrocarbons; extender for polyurethane foams.

Features

SP-240 can used for production of polyisocyanurate board stock meeting industry requirements for commercial roofing and residential sheathing applications. Its high aromatic content contributes to polymer rigidity and heat resistance. As a result of its pure raw material base, this polyol offers low viscosity and consistent performance.

Specifications and Properties

“Hydroxyl number, mg KOH/g : 240”
Water(%) : Max1.0
“Acid-Value, mg KOH/g : MAX 1.0”
Specific Gravity(@25C) : 1.21
“Viscosity(@25C) : 1,200”
Appearance : Pale yellow liquid

POLY ESTER POLYOL SP-320GA

Product name : SP-320GA

Description

SP-320GA is a diethylene glycol terephthalic acid based polyester polyol.

Applications

Rigid isocyanurate boardstocks, or low density for pour and spray, or high density for packaging polyurethane foams. It can also be used in formulating urethane coatings, adhesives, sealants, and elastomers.

Features

SP-320GA exhibits excellent hydrolysis resistance, very good thermal stability, and primary hydroxyl advantage. It may promote adhesion to a variety of metal and plastic substrates. This product has low viscosity for ease of blending and high aromatic content.

Specifications and Properties

“Hydroxyl number, mg KOH/g : 320”
Water(%) : Max1.0
“Acid-Value, mg KOH/g : 2.0 MAX”
Specific Gravity(@25C) : 1.21
“Viscosity(@25C) : 2,500”
Appearance : Pale yellow liquid.

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