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ISO 9001 BUREAU VERITAS Certification

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ISO 14001 BUREAU VERITAS Certification

Tosoh Corporation Nanyo Complex is ISO14001 certified for its Environment Management System.

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Vol 1: Jun. 2004
Vol 2: Sep. 2005
Vol 3: May. 2010
Vol 4: Mar. 2012
Vol 5: Mar. 2015

TOSOH

TEDA®
TOYOCAT®
RZETA®

TERTIARY AMINE CATALYSTS

TOSOH CORPORATION

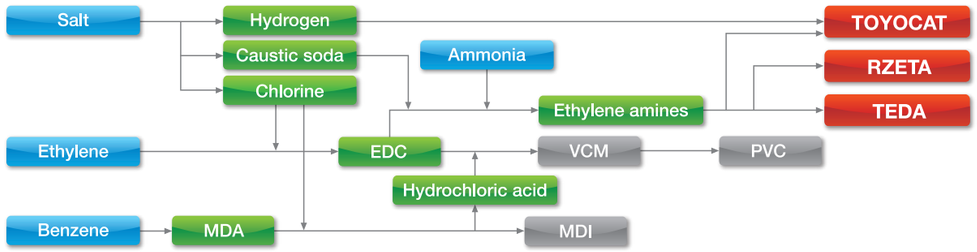
Vol 5: Mar. 2015

TEDA TOYOCAT RZETA

TERTIARY AMINE CATALYSTS

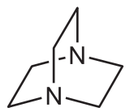
Tosoh Corporation

- Founded : February 11, 1935
- Group Companies : 130 (including over 30 overseas)
- Workforce : Over 11,000 globally
- Main Products : Basic chemicals, petrochemicals and specialty materials
- Headquarters : Tokyo, Japan
- Main Plants : Yamaguchi and Mie Prefectures, Japan
- R&D : Yamaguchi, Mie, and Kanagawa Prefectures, Japan
- Production Process Flow Chart :



TEDA

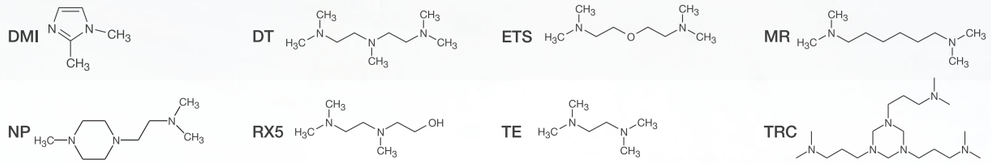
- TEDA : Triethylenediamine 1,4-Diazabicyclo[2.2.2]octane
- Functionality : Strong gelling
- Applications : Flexible, semi-rigid and rigid polyurethane foams, elastomers and adhesives
- Available Types : Crystaline powder and dilution grades (diluents include: dipropyleneglycol; ethyleneglycol; 1,4-butanediol, propyleneglycol)



Chemical Structure

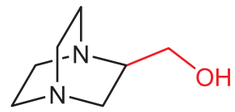
TOYOCAT

- TOYOCAT : Trade name of Tosoh's specialty amine catalysts for polyurethanes
- Functionality : Conventional, reactive, delayed action, and trimerization catalysts
- Applications : Automotive, polyisocyanurates, spray, CASE, etc.
- Available Types : Dilution grades
- Typical Chemical Structure :



RZETA

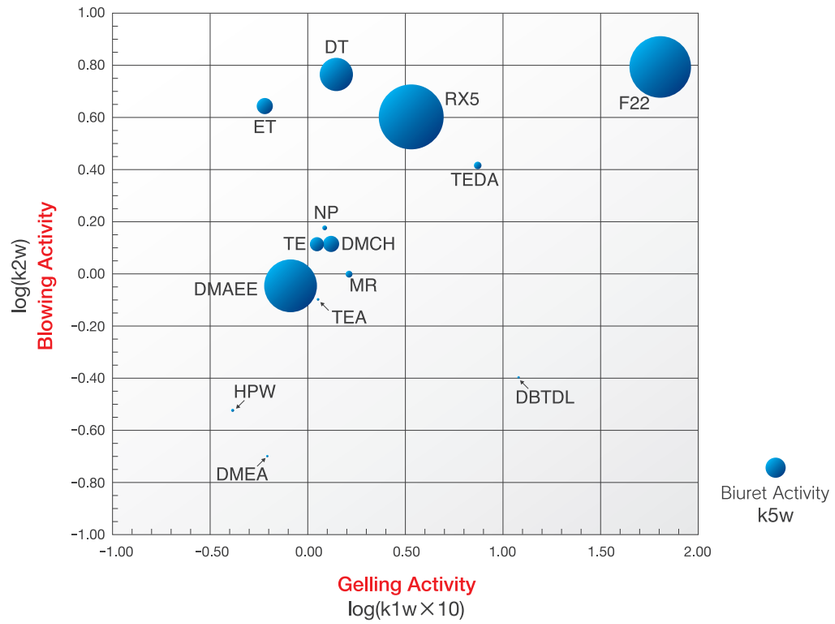
- RZETA : Reactive Zero Emission Tosoh Amine
- Functionality : Strong gelling, low emission, low toxicity, low odor, less PVC staining
- Applications : Flexible and semi-rigid foam, CASE
- Available Types : Dilution in dipropyleneglycol



Chemical Structure

Catalytic Activity

(PhNCO-BuOH-H_2O model reaction in Acetonitrile)
(Polyurethanes world congress 1993, P473, 1993)



Catalyst Application and Properties

Product Name	Description	Typical Application					Properties			
		Flexible		Semi-rigid	Rigid	CASE Footwear	Gelling	Balanced	Blowing	Cross-linking
		Slab	Molded							
Standard Catalyst										
TEDA	Triethylenediamine, White crystalline powder			●	●	●	✓			
TEDA-L33	33% TEDA, 67% Dipropyleneglycol(DPG)	●	●	●	●	●	✓			
TEDA-L33E	33% TEDA, 67% Ethyleneglycol(EG)			●	●	●	✓			
TEDA-L25B	25% TEDA, 75% 1,4-Butanediol(BDO)			●		●	✓			
TEDA-L33PG	33% TEDA, 67% Propyleneglycol(PG)	●	●	●	●	●	✓			
DMI	1,2-Dimethylimidazole	●	●	●	●	●	✓			
DT	N,N,N',N'',N''-Pentamethyl diethylenetriamine	●	●		●				✓	
ET	70% Bis(dimethylaminoethyl)ether 30% Dipropyleneglycol(DPG)	●	●	●	●				✓	
ETS	Bis(dimethylaminoethyl)ether	●	●	●	●				✓	
MR	N,N,N',N'-Tetramethylhexanediamine	●	●	●	●	●		✓		
NP	N,N'',N''-Trimethylaminoethylpiperazine	●	●	●	●	●		✓		
RX5	N,N,N'-Trimethylaminoethylethanolamine		●	●	●				✓	✓
TE	N,N,N',N'-Tetramethylethylenediamine		●	●	●			✓		
TRC	N,N',N''-Tris(3-dimethylaminopropyl) -hexahydrotriazine				●				✓	✓
Reactive Catalyst										
RZETA	Strong gelling activity with ultra low amine emission Reduction in aldehyde emission	●	●	●	●	●	✓			
HX35W	Reactive amine blend for molded foam Blowing catalyst for ISF or semi-rigid foam		●	●					✓	
HX63	Low PVC discoloration		●	●				✓		
RH2	Low emission with balanced activity		●	●	●			✓		
RX4	Low emission with gelling activity	●	●	●	●		✓			
RX20	Reactive amine blend for molded foam Balanced activity		●	●	●			✓		
RX21	Reactive amine blend for molded foam Designed to improve foam tightness		●	●	●				✓	
RX24	Reactive amine blend for molded foam Designed to improve foam cure		●	●	●		✓			
RX210	Reactive amine blend for PC degradation Designed for ISF or semi-rigid foams		●	●		●	✓			
RX7*	Low emission with strong blowing activity Mainly for water blown rigid spray foam			●	●				✓	

*Registered only in MITI

Catalyst Application and Properties

Product Name	Description	Typical Application					Properties			
		Flexible		Semi-rigid	Rigid	CASE Footwear	Gelling	Balanced	Blowing	Cross-linking
		Slab	Molded							
Delayed Action Catalyst										
CX20	Especially low corrosive type Significant delayed action effect		●	●			✓			
ETF	Standard blowing catalyst Acid-blocked type		●	●	●				✓	
NCE	Low corrosive type blowing catalyst		●	●	●				✓	
NCT	Low corrosive type gelling catalyst		●	●	●	●	✓			
TF	Standard gelling catalyst Acid-blocked type		●	●	●	●	✓			
TMF	Provide fine cell Acid-blocked type		●		●				✓	
Trimerization Catalyst (, Quaternary Ammonium Salt Based)										
TR20*	Mainly for discontinuous panel Improve reaction profile				●					✓
TRX	Mainly for block, lamination and spray foam Improve fire performance				●					✓
TRV	For lamination panel Smooth profile with higher trimerization				●					✓
Specialty Catalyst										
B41	Thermo-sensitive Improve internal cure		●	●	●		✓			
B51	Improve flowability & thermal conductivity				●			✓		
CX40	Less thermo-sensitive type Improve moldability & surface cure	●	●	●	●			✓		
CX60	Strong gelling activity with improved foam tightness for flexible molded foam		●	●			✓			
D60	Less thermo-sensitive balanced catalyst Improve surface cure		●	●	●			✓		
DB30	High thermo-sensitive type Activated at ca.50°C or higher					●	✓			
DB60	High thermo-sensitive type Activated at 90°C or higher					●	✓			
DM70	70% DMI, 30% EG Improve surface cure and adhesion	●	●	●	●	●	✓			
F10	Imidazole based strong gelling catalyst	●	●	●			✓			
F22	Thermo-sensitive Extended initial reaction with fast cure		●	●		●	✓			
F40	Improve flowability & post-expansion				●				✓	✓
F94	Strong gelling activity Improve surface cure and adhesion				●	●	✓			
M50	Improve surface cure for molded foam		●	●			✓			
MC12	For footwear application Extended cream time with fast cure					●	✓			
S10	For footwear application Improve surface cure					●	✓			
TT	Special strong blowing catalyst for SPF High molecular weight type		●		●				✓	

*Not Registered in EINECS/ELINCS

Physical Properties

Product Name	CAS No.	Specific Gravity D^{20}_{20}	Viscosity (mPa·s) @25℃	Freezing Point (℃)	Boiling Point (℃)	Flash Point (℃)		OHV* (mgKOH/g)	Net Weight 200/20/18L (kg)
						COC	TCC		
Standard Catalyst									
TEDA	280-57-9	-	-	160	174	70		0	25
TEDA-L33	280-57-9 / 25265-71-8	1.03	114	<-20	194-204	101	-	558	200/20/18
TEDA-L33E	280-57-9 / 107-21-1	1.10	61	<-20	184-196	104	-	1205	200/20/18
TEDA-L25B	280-57-9 / 110-63-4	1.03	123	<-2	199-211	102	-	934	200/-/18
TEDA-L33PG	280-57-9 / 57-55-6	1.05	115	<-5	174-187	104	-	983	200/20/18
DMI	1739-84-0	0.99	-	<38	205	-	96	0	180/18/15
DT	3030-47-5	0.83	2	<-20	201	-	75	0	160/15/14
ET	3033-62-3 / 25265-71-8	0.90	5	<-80	170	-	71	251	170/17/15
ETS	3033-62-3	0.86	2	<-80	190	-	67	0	170/16/15
MR	111-18-2	0.80	1	<-70	198	81	-	0	160/15/14
NP	104-19-8	0.88	3	<-20	193-205	92	-	0	170/16/15
RX5	2212-32-0	0.91	5	<-20	116 (7.0kPa)	92	-	384	180/17/15
TE	110-18-9	0.78	1	<-55	120	-	16	0	150/15/13
TRC	15875-13-5	0.92	26	<-70	140 (0.13kPa)	153	-	0	180/17/16
Reactive Catalyst									
RZETA	76950-43-1/25265-71-8	1.06	286	137	>230	137	-	689	200/20/-
HX35W	-	0.96	12	<-10	209-221	102	-	706	190/18/15
HX63	-	0.94	7.5	<-10	130-230	-	35	550	180/18/16
RH2	-	0.82	3	<-50	132-140	-	35	549	160/15/14
RX4	-	0.94	145	<-20	250-270	126	-	515	180/18/16
RX20	-	0.88	6	<0	130-270	-	43	532	170/17/15
RX21	-	0.84	2	<0	130-270	-	39	543	160/16/14
RX24	-	0.90	22	<0	130-270	-	52	523	180/17/-
RX210	-	0.95	79	<0	250-270	127	-	492	190/18/16
RX7	-	0.90	5	<-1	148 (3.7kPa)	123	-	258	180/17/15
Delayed Action Catalyst									
CX20	-	1.20	2250	<0	250-290	147	-	1396	200/20/20
ETF	-	1.05	63	<-20	170-177	-	73	824	200/20/18
NCE	-	0.99	364	<5	190	81	-	260	190/18/16
NCT	-	1.12	154	<0	147-159	124	-	1163	200/20/19
TF	-	1.06	186	<-5	147-159	116	-	659	200/20/18
TMF	-	1.06	96	<-20	101-198	81	-	834	200/20/18
Trimerization Catalyst (, Quaternary Ammonium Salt Based)									
TR20	-	1.01	300	<-20	>100	103	-	643	190/18/17
TRX	-	1.05	92	<0	>100	173	-	854	200/19/17
TRV	-	1.01	74	<0	N/A	102	-	713	190/19/17
Specialty Catalyst									
B41	-	1.12	114	<-20	202-222	82	-	722	200/20/18
B51	-	0.89	5	<-20	184-201	-	76	325	170/16/15
CX40	-	0.82	3	N/A	N/A	-	44	252	170/16/-
CX60	-	1.06	44	<0	108	No flash		2354	200/20/-
D60	-	0.79	39	<-20	250-260	112	-	0	150/15/13
DB30	-	1.12	1520	<0	N/A	141	-	0	200/20/19
DB60	-	1.16	43	<0	N/A	133	-	1080	200/20/-
DM70	1739-84-0 / 107-21-1	1.04	10	<-10	198-205	113	-	542	200/20/18
F10	-	1.02	10	<-10	194-205	95	-	361	200/19/17
F22	-	1.10	160	<-10	188-208	92	-	814	200/20/18
F40	-	0.87	5	<-20	195-205	-	78	0	170/17/15
F94	-	1.00	3	<-7	195-205	82	-	0	190/19/17
M50	-	0.90	7	<-10	190-210	-	74	278	170/17/15
MC12	-	1.09	62	<0	N/A	108	-	1176	200/20/18
S10	-	0.92	5	<-10	184-196	-	79	603	180/-/-
TT	-	0.86	5	<-20	250-269	119	-	0	170/16/15

*Calculated, COC: Cleveland Open Cup, TCC: Tag Closed Cup

Catalytic Activity

Catalytic Activity	Product Name	Description	Gelling Activity x10 k1w	Blowing Activity x10 k2w	Ratio (Blowing/Gelling) $x10^{-1}$	Activation Energies ΔE(kcal/mol)		Crosslinking Activity			
								Allophanate		Biuret	
						Gel	Blow	k3w	k4w	k5w	k6w
Gelling	B41	Special blend catalyst	43.3	0.72	0.17	30	17				
	DB30	Special blend catalyst	66.6	1.51	0.23						
	DB60	Special blend catalyst	19.6	0.44	0.23						
	DBTDL*	Dibutyltindilaurate	14.4	0.48	0.30			0	0	0	0
	F22	Special blend catalyst	26.1	0.83	0.32	25	15	1460	160	310	24
	NEM*	N-ethylmorpholine	0.22	0.01	0.47	4.5	6.8				
	DM70	70%1,2-Dimethylimidazole, 30%Ethyleneglycol	2.67	0.20	0.77	5.8	7.5				
	DAEM*	N-(N',N',-2-dimethylaminoethyl)morpholine	0.93	0.08	0.81						
	F10	Imidazole besed amine catalyst	3.80	0.39	1.03	5.6	7.0				
	F94	Special blend catalyst	3.54	0.39	1.10						
	HX63	Reactive amine blend	2.36	0.27	1.14						
	DMEA*	N,N-dimethylaminoethanol	2.91	0.36	1.23	2.6	3.9	0.12	0.01	0.1	<0.1
	CX60	Special blend catalyst	3.62	0.48	1.32						
	NCT	Acid-blocked catalyst	2.83	0.38	1.33						
	CX20	Special blend catalyst	2.26	0.30	1.34						
	MC12	Special blend catalyst	3.44	0.46	1.34						
	L33	Triethylenediamine 33% in DPG	3.63	0.48	1.34	5.3	5.8	0.11	0.16	0.7	<0.1
	TF	Acid-blocked gelling catalyst	3.40	0.46	1.35						
	RZETA**	Reactive gelling catalyst	8.00	1.20	1.45						
	RX4	Reactive amine catalyst	1.59	0.26	1.63						
	CX40	Special blend catalyst	1.61	0.28	1.71						
	M50	Special blend catalyst	3.30	0.66	2.00						
	S10	Special blend catalyst	3.30	0.66	2.01						
	TE	N,N,N',N'-Tetramethylethylenediamine	4.19	1.14	2.72			0.69	0.17	3.8	<0.1
	MR	N,N,N',N'-Tetramethylhexanediamine	2.95	0.84	2.85	3.2	3.0	0.37	0.12	1.8	<0.1
	D60	High molecular weight catalyst	0.75	0.22	3.00	4.2	1.0				
	PMA*	N,N,N',N'',N''-Pentamethyldipropylenetriamine	3.80	1.16	3.05						
	TRC	N,N',N''-Tris(3-dimethylaminopropyl) -hexahydro-s-triazine	3.00	1.12	3.72						
	DMCH*	N,N-dimethylcyclohexylamine	2.22	0.83	3.76	4.6	4.8	0.79	0.08	4.3	<0.1
	NP	N,N'',N''-Trimethylaminoethylpiperazine	1.71	0.78	4.44	6.4	4.5	0.27	0.06	1.5	<0.1
	TEA*	Triethylamine	1.16	0.60	5.18			0.72	0.10	1.2	<0.1
	RX210	Reactive amine blend	1.78	1.28	7.22						
	DMAEE	N,N-dimethylaminoethoxyethanol	1.84	2.55	13.90			530	110	150	3.8
	RX5	N,N,N'-trimethylaminoethylethanolamine	2.89	4.33	15.00			380	48	410	21
	RX7	Reactive amine catalyst	3.26	6.07	18.60						
	B51	Special blend catalyst	3.70	7.22	19.52						
	TT	High molecular weight catalyst	4.09	8.48	20.70						
	F40	Special blend catalyst	3.63	8.51	23.44						
	HX35W	Reactive amine blend	1.16	3.10	26.70						
	HEAE*	N,N,N'-trimethyl-N'-hydroxyethyl-bisaminoethylether	3.44	10.47	30.40						
	TMF	Acid-blocked catalyst	1.92	7.00	36.50						
	DT	N,N,N',N'',N''-Pentamethyldiethylenetriamine	4.26	15.90	37.30	3.2	1.6	5.0	0.81	24.0	0.46
	NCE	Acid-blocked catalyst	1.59	6.21	39.13						
	ET	Bis(dimethylaminoethyl)ether 70% in DPG	2.09	8.19	39.00	3.7	1.6	0.43	0.08	3.2	<0.1
Blowing	ETF	Acid-blocked catalyst	1.59	6.21	39.10						

*Not sold by TOSOH, **Not containing solvent
See also figure in p3.