

### THE JEFFAMINE® POLYOXYALKYLENEAMINES

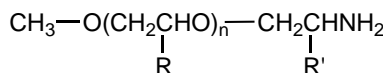
The JEFFAMINE® brand polyoxyalkyleneamines are a part of an ever-expanding family of Huntsman products. They contain primary amino groups attached to the terminus of a polyether backbone. They are thus “polyether amines.” The polyether backbone is based either on propylene oxide (PO), ethylene oxide (EO), or mixed EO/PO. The JEFFAMINE® product family consists of monoamines, diamines, and triamines, which are available in a variety of molecular weights, ranging up to 5,000. The wide range of molecular weights, amine functionality, oxide type and distribution provides flexibility in synthetic design of compounds made from JEFFAMINE® products. For the most part, JEFFAMINE® products undergo typical amine reactions and are low viscosity liquids, exhibiting low vapor pressure.

#### JEFFAMINE® MONOAMINES

The JEFFAMINE® monoamines are designated as the JEFFAMINE® M series. The M is representative of the fact that they are Monoamines. The number designation after the letter M represents the approximate molecular weight.

#### JEFFAMINE® M Series

JEFFAMINE® M-series products are prepared by reaction of a monohydric alcohol initiator with ethylene and/or propylene oxide, followed by conversion of the resulting terminal hydroxyl group to an amine. M-series products have the structure:



Product	Mol. Ratio	Approx.
	PO/EO	Mol. Wt.
XTJ-505 (M-600)	9/1	600
XTJ-506 (M-1000)	3/19	1,000
XTJ-507 (M-2005)	29/6	2,000
JEFFAMINE® M-2070	10/31	2,000

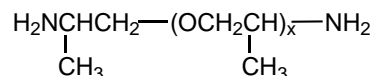
XTJ-505 and XTJ-507 products are predominately PO based, whereas XTJ-506 and JEFFAMINE® M-2070 products are predominately EO based and are therefore more hydrophilic.

#### JEFFAMINE® DIAMINES

The JEFFAMINE® diamines are the D series and the ED series.

#### JEFFAMINE® D Series

The D-series products are amine-terminated polyoxypropylene diols. They have the structure:



JEFFAMINE® Product	X	Approx. Mol. Wt.
D-230	2-3	230
D-400	5-6	400
D-2000	33 (Avg.)	2,000
XTJ-510 (D-4000)	68 (Avg.)	4,000*

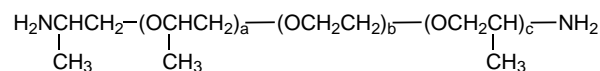
\*Calculated by assuming product is all diamine. However, product is a mix of 86/14 diamine/aminoalcohol.

**Warning:** Polyurethane products manufactured from these chemicals may present a fire hazard if improperly used. Each manufacturer or user of such products should determine whether there is potential hazard in a specific application and take the necessary precautions.

Huntsman Corporation warrants only that its products meet the specifications stated herein. Typical properties, where stated, are to be considered as representative of current production and should not be treated as specifications. While all the information presented in this document is believed to be reliable and to represent the best available data on these products, NO GUARANTEE, WARRANTY, OR REPRESENTATION IS MADE, INTENDED, OR IMPLIED AS TO THE CORRECTNESS OR SUFFICIENCY OF ANY INFORMATION, OR AS TO THE SUITABILITY OF ANY CHEMICAL COMPOUNDS FOR ANY PARTICULAR USE, OR THAT ANY CHEMICAL COMPOUNDS OR USE THEREOF ARE NOT SUBJECT TO A CLAIM BY A THIRD PARTY FOR INFRINGEMENT OF ANY PATENT OR OTHER INTELLECTUAL PROPERTY RIGHT. EACH USER SHOULD CONDUCT A SUFFICIENT INVESTIGATION TO ESTABLISH THE SUITABILITY OF ANY PRODUCT FOR ITS INTENDED USE. Products may be toxic and require special precautions in handling. For all products listed, user should obtain detailed information on toxicity, together with proper shipping, handling, and storage procedures, and comply with all applicable safety and environmental standards.

### JEFFAMINE® ED Series

The JEFFAMINE® ED-series products are polyether diamines based on a predominantly polyethylene oxide backbone. This imparts complete water solubility to each of the members of this series. The JEFFAMINE® ED-series products have the structure:



Product	Approx. Value b	Approx. Value a + c	Approx. Mol. Wt.
JEFFAMINE®			
HK-511 (XTJ-511)	2.0	2.0	220
XTJ-500 (ED-600)	9.0	3.6	600
XTJ-502 (ED-2003)	38.7	6.0	2,000

The added hydrophilicity of the ED-series products has particular utility.

### JEFFAMINE® TRIAMINES

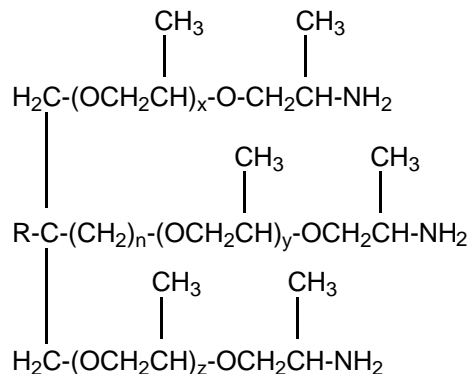
Currently there are three JEFFAMINE® T-series products—JEFFAMINE® T-403, XTJ-509 (T-3000), and JEFFAMINE® T-5000 triamines.

### JEFFAMINE® T Series

The T-series products are propylene oxide-based triamines and are prepared by reaction of PO with a triol initiator, followed by amination of the terminal hydroxyl groups. They are exemplified by the following structure:

JEFFAMINE® Product	R	n	Base	Moles PO
T-403	R = C <sub>2</sub> H <sub>5</sub>	n = 1	TMP-based	5-6
T-5000	R = H	n = 0	Glycerin-based	85
XTJ-509 (T-3000)	R = H	n = 0	Glycerin-based	50

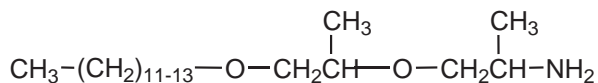
TMP: trimethylolpropane; 2,2-bis(hydroxymethyl)-1-butanol



### SURFONAMINE™ MONOAMINE SERIES

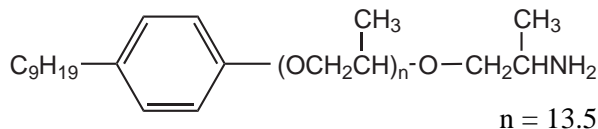
The SURFONAMINE™ products are mono-functional amines similar to the M-series. They are oleophilic and not water soluble.

### SURFONAMINE™ ML-300 Chemical Intermediate



SURFONAMINE™ ML-300 is a monoamine derived from a propylene oxide adduct of a C<sub>12-14</sub> alcohol. Use of this product is restricted solely to use as a chemical intermediate. More regulatory details are available on the technical bulletin (#1147).

### SURFONAMINE™ MNPA-1000



SURFONAMINE™ MNPA-1000 is a 1000 molecular weight, nonylphenol initiated, polyoxypropyleneglycol derived monoamine.

## TYPICAL PROPERTIES OF JEFFAMINE® PRODUCTS

JEFFAMINE® Product	Color Pt-Co	Total Acetylatables, meq/g	Total Amine, meq/g	Primary Amine, meq/g	Water, wt. %	Melting Pt, °C
<b>Monoamines</b>						
XTJ-505 (M-600)*	20	1.7	1.65	1.62	<0.2	-40
XTJ-506 (M-1000)*	40	1.0	0.97	0.95	<0.2	29
XTJ-507 (M-2005)*	30	0.52	0.49	0.47	<0.2	-36
M-2070	20	0.50	0.46	0.44	<0.2	17
<b>Diamines</b>						
D-230	30	8.75	8.45	8.3	0.10	—
D-400	50	4.6	4.4	4.3	0.10	—
D-2000	100	1.05	1.0	0.97	0.10	—
HK-511 (XTJ-511)	20	8.7	8.2	7.9	0.10	—
XTJ-510 (D-4000)*	40	0.50	0.48	0.47	0.10	—
XTJ-500 (ED-600)*	40	3.23	3.19	3.13	0.10	-10
XTJ-502 (ED-2003)*	50 (Est.)	1.0	0.95	0.93	0.10	43
<b>Triamines</b>						
T-403	30	6.8	6.4	6.1	0.10	—
XTJ-509 (T-3000)*	50	1.02	0.95	0.94	0.10	—
T-5000	50	0.60	0.53	0.52	0.10	—

\*XTJ products are commercial development items. Stock quantities may be limited and lead time may be required for filling large orders.

## TYPICAL PROPERTIES OF SURFONAMINE™ PRODUCTS

SURFONAMINE™ Product	Color Pt-Co	Total Acetylatables, meq/g	Primary Amine, % of total amine	Amine Conversion* %	Water wt. %
ML-300 Intermediate	50	3.11	98	96	0.4
MNPA-1000	50	1.02	98	98	0.05

\*  $\frac{\text{Total amine}}{\text{Total acetylatables}} \times 100$

Please refer to appropriate Material Safety Data Sheets for toxicity information.

Sales specifications are available upon request.

## CHEMICAL REACTIONS

JEFFAMINE® polyoxyalkyleneamines undergo *reactions typical of primary amines*.

General reactions which have proven to be useful include those listed below in the form:

JEFFAMINE® Amine + Reactant → Product.

	Reactant	→	Product
<p><b>Epoxy reactions</b> occur by the non-catalyzed addition of epoxides to JEFFAMINE® amines. This alkoxyates each NH functionality to produce aminoalcohols.</p>	$\begin{array}{c}   &   \\ -C & -C- \\ / \quad \backslash \\ & O \end{array}$ <p>Epoxydes ("epoxy resins")</p>	→	$\begin{array}{c}   &   \\ RN-CH & -CHOH \\   \\ H \end{array}$ <p>Aminoalcohols ("epoxies")</p>
<p><b>Polyurea linkages</b> are formed from the rapid, uncatalyzed reaction of JEFFAMINE® amines with polyisocyanates. When applied to a RIM or spray process, this reaction has found great commercial utility in a variety of applications including castings, coatings, and sealants.</p>	$OCN-R'$ <p>Isocyanates</p>	→	$\begin{array}{c} O \\    \\ R-N-C-N-R' \\   \quad   \\ H \quad H \end{array}$ <p>Ureas</p>
<p>The <b>Michael addition</b> of an activated double bond compound to a JEFFAMINE® amine is a reversible reaction<sup>1</sup>.</p>	$H_2C=CH-CN$ <p>Acrylonitrile</p>	↔	$\begin{array}{c} RN-CH_2-CH_2-CN \\   \\ H \end{array}$ <p>Cyanoethylated amines</p>
<p><b>Substituted ureas</b> are formed by heating JEFFAMINE® amines with urea at temperatures of 125-175°C, while removing ammonia. This will result in mono- and di-substituted ureas.</p>	$\begin{array}{c} O \\    \\ H_2N-C-NH_2 \end{array}$ <p>Urea</p>	→	$\begin{array}{c} O \\    \\ R-N-C-NH_2 \\   \\ H \end{array} + NH_3$ <p>Substituted ureas</p>
<p><b>Amides</b> can be formed from the JEFFAMINE® amine by an acid-catalyzed reaction with carboxylic acids, lactams, or anhydrides, or by ester-amide interchange reactions.</p>	$HO-C(=O)-R'$ <p>Carboxylic acids (or esters, anhydrides, etc.)</p>	→	$\begin{array}{c} O \\    \\ R-N-C-R' \\   \\ H \end{array} + H_2O$ <p>Amides</p>
<p><b>Imines</b>, or Schiff bases, are formed by reacting the JEFFAMINE® amines with aldehydes or ketones, at elevated temperature, while removing water.</p>	$R'-C(=O)-R''$ <p>Aldehydes or ketones</p>	→	$R-N=C \begin{array}{l} / R' \\ \backslash R'' \end{array} + H_2O$ <p>Imines</p>
<p><b>Salts</b> of JEFFAMINE® amines may be readily formed with a variety of organic and inorganic acids.</p>	$H^+X^-$ <p>Acids</p>	→	$RNH_3^+X^-$ <p>Salts</p>

<sup>1</sup>Acrylonitrile addition leads to a cyanoethylated product that can be catalytically hydrogenated to a non-reversible and stable aminopropylated polyetheramine.



## THE JEFFAMINE® POLYOXYALKYLENEAMINES

### Storage and Handling

#### MATERIALS OF CONSTRUCTION

##### At temperatures up to 100°F

Tanks	Carbon steel
Lines, valves	Carbon steel
Pumps	Carbon steel
Heat exchange surfaces	Stainless steel
Hoses	Stainless steel, polyethylene, polypropylene, Teflon
Gaskets, packing	Polypropylene or Teflon <sup>1</sup> — elastomers such as neoprene, Buna N, and Viton <sup>2</sup> should be avoided
Atmosphere	Nitrogen or dry air

##### At temperatures above 100°F

Tanks	Stainless steel or aluminum
Lines, valves	Stainless steel
Pumps	Stainless steel or Carpenter 20 equivalent
Atmosphere	Nitrogen

While the JEFFAMINE® polyoxyalkyleneamines may be stored under air at ambient temperatures for extended periods, a nitrogen blanket is suggested for all storage in case of accidental high temperatures. It should be noted that pronounced discoloration is likely to occur at temperatures above 140°F, whatever the gaseous pad.

Clean-out of lines and equipment containing the JEFFAMINE® polyoxyalkyleneamines is easy; warm water and steam are all that is required.

In the event of spillage of this product, the area may be flushed with water. The proper method of disposal of waste material is by incineration with strict observance of all federal, state, and local regulations.

<sup>1,2</sup> Trademarks of DuPont

# FOR MORE LITERATURE OR INFORMATION

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### **Emergency Assistance**

For transportation emergencies only,  
call CHEMTREC 1-800-424-9300.

For all other emergencies, call 409-  
722-8381, our 24-hour emergency  
number in Port Neches, Texas.