

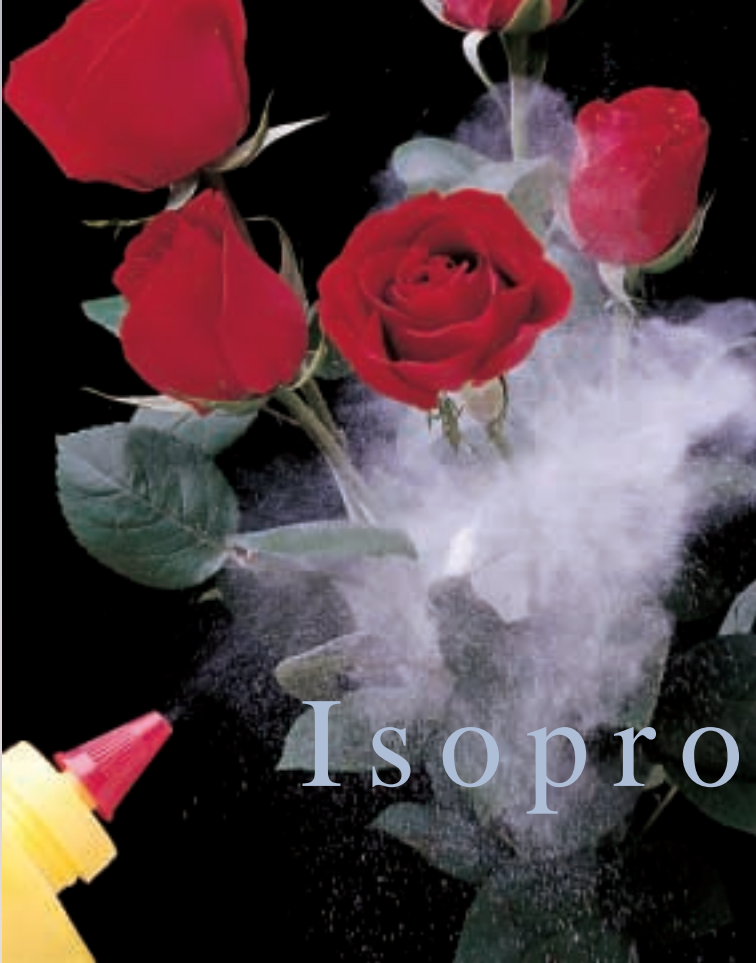


THE SPECIFIER'S GUIDE TO BUYING AND APPLYING

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# Isopropanolamines





# Isopropanolamin

*MIPA, DIPA and TIPA are used in cosmetics and personal care products to provide neutralization of acidic components, the proper pH, and the desired surfactant properties.*



## The Right Supplier Can Make a Difference

Because they are reactive, readily available, and offer good toxicological profiles, isopropanolamine products from The Dow Chemical Company are used in a wide variety of consumer and industrial applications. Dow isopropanolamines promote the functionality of the molecule through reactivity, serving as emulsifiers, antistats, hardeners, stabilizers, chemical intermediates, neutralizers and grinding aids. It is no wonder, then, that Dow isopropanolamines are essential ingredients in metalworking fluids, personal care products, dyes and pigments, polyurethane, polyethylene, rubber, agricultural and gas treating operations.

Since isopropanolamines play such a key role in your manufacturing process, it is important you rely on a source that assures consistent product quality, timely delivery and comprehensive technical support for optimal performance. As the only U.S. producer of isopropanolamines with a strong manufacturing/distribution presence throughout the world, The Dow Chemical Company is uniquely positioned to meet and exceed our customers' requirements.

And to better meet these challenges, The Dow Chemical Company created the Global Specialty Alkanolamines Business unit, which brings together resources and capabilities of the Technology Group for Dow Gas Treating Products and Services and the alkanolamines portion of the ethylene oxide and derivatives business. The mission of this business unit is to leverage the combined expertise of the company's trained sales force and skilled technical staffs to provide value-added customer service and technical support for users of isopropanolamines.

This guide is designed to provide an overview of the advantages you receive when dealing with the one single-source global supplier committed to meeting all of your isopropanolamine product needs—The Dow Chemical Company.

## Dow Offers a Full Line of Isopropanolamine Products

Isopropanolamines offer considerable application flexibility because they may be used as primary, secondary or tertiary amines. In fact, many users employ a variety of isopropanolamines in their processes and products rather than rely on a single formulation. To provide just the right chemistry for your application, Dow offers a family of nine different isopropanolamines, including low freezing grades for easier handling under low temperature extremes.

## Reliable Supply Is a Dow Hallmark

As a major producer of propylene oxide and its derivatives, Dow holds a superior raw material position and commitment to isopropanolamine production. Backed by years of production experience, state-of-the-art quality, statistical process control, storage and transportation know-how, your access to the highest quality product is assured worldwide.<sup>†</sup>

All Dow isopropanolamine plants follow stringent Corporate Quality Assurance standards and procedures that employ computer controlled processes, routine testing, calibration of lab instruments, analysis of all production lots, and quality checking via Capillary GC. In addition to these safeguards, Dow uses dedicated, temperature-controlled, nitrogen-padded tanks for direct shipment from the production site.

<sup>†</sup> Due to export restrictions, the complete line of DOW isopropanolamine products may not be available in all countries worldwide.



*Gas treating plants use isopropanolamines for acid gas scrubbing operations.*

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## Knowledgeable People

When it comes to the selection and application of isopropanolamines, Dow sales people are not order takers, they're problem solvers. That's because they are drawing upon more than a half century of experience in the development and application of isopropanolamines. They understand the selection criteria and keys to the successful operation inherent in your industry. In addition, they are backed by a seasoned, global Technical Service and Development staff that is unmatched in the industry.



*Isopropanolamines offer corrosion protection and reduced friction in buffing, cutting and cleaning fluids for the metalworking industry.*

*Because isopropanolamines are good emulsifying and wetting agents, they act as foam stabilizers and "rinse improvers" in detergents.*

## Product Stewardship

Dow is an industry leader in the field of product stewardship. As a participant in the Responsible Care® initiative, Dow provides all the latest information on an array of topics regarding worker health/safety and environmental issues. In fact, the information Dow provides about the proper handling and storage of isopropanolamines is well beyond that included in traditional industry Material Safety Data Sheet literature.

Printed stewardship materials are available, including detailed technical handbooks, published safety guidelines, and Material Safety Data Sheets. Dow also encourages its customers to review their applications of Dow products from the standpoint of human health and environmental quality. And to help ensure that Dow products are not used in ways for which they are not intended or tested, Dow personnel will assist customers in dealing with ecological and product safety considerations.

® Responsible Care is a registered service mark of The American Chemistry Council.

### Isopropanolamines are widely accepted for the following applications:

**Cosmetics and personal care products:** skin cream, lotions, hair sprays and shampoos

**Textiles:** scouring agents, wetting agents, lubricating agents

**Metalworking Compounds:** buffing, cutting, cleaning fluids

**Agricultural Sprays (Powder and Liquid):** herbicides, algaecides, fungicides, pesticides

**Pharmaceuticals:** antihistamines, antibiotics, local anesthetics

**Gas Treating:** acid gas scrubbing

**Polymer manufacturing:** urethanes, rubber and polyolefins

# The Dow Family of Isopropanolamines

Dow isopropanolamines are intermediate alternatives of the same high quality as Dow ethanolamines. The unique reaction capabilities of Dow isopropanolamines provide performance not available from other intermediates when an application requires specialized properties such as superior oil solubility or high heat stability. And because isopropanolamines remain stable when stored at room temperature, you will also benefit from the ability to generate many reactions at room temperature.

Isopropanolamines are basic chemicals that are used in many applications to achieve basicity, buffering and alkalinity objectives. These amines are typically used to neutralize fatty acids and sulfonic acid-based surfactants in the manufacture of soaps and salts. Isopropanolamines are also used in oven cleaners because they are good solubilizers of oil and fat. A comparison of the basicity of isopropanolamines and that of ammonia is shown in Table 1.

Table 1—Basic Chemicals

pKa's of Isopropanolamines	0.1 N Solutions at 20°C
MIPA	9.66
DIPA	9.10
TIPA	8.06
NH <sub>3</sub>	9.24

Dow monoisopropanolamine is a liquid at room temperature, while diisopropanolamine and triisopropanolamine are white solids. All of the amines, except for monoisopropanolamine, are available in low freezing grades to facilitate handling. Low freezing grades (LFG) contain deionized water (usually 15% by weight). The freezing points of isopropanolamines and their low freezing grades are shown in the physical properties chart (Table 2).

**NOTE:** *Low freezing grades of isopropanolamines to be heated above 60°C should not be stored in the presence of aluminum, due to the possibility of excessive corrosion and potential chemical reaction releasing flammable hydrogen gas. They should be stored in mild steel; or if iron or color are important, stainless steel is recommended.*

## Isopropanolamine Profiles:

**MIPA**—Commercial grade monoisopropanolamine has the lowest molecular weight of the three standard isopropanolamines. Use of MIPA is growing for titanium dioxide dispersion in paints, plastics and paper.

**DIPA**—This commercial grade isopropanolamine is a secondary amine. Major applications include personal care, metalworking and gas treating products.

**DIPA LFG 90**—This isopropanolamine is a low freeze grade (LFG) variation of DIPA for easier handling in colder ambient temperatures (freezing point: 23°C/73.4°F). It is a blend of 90% DIPA and 10% deionized water.



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*In textile processes, DIPA contributes to improved heat resistance, better durable press characteristics and improved water absorbency.*

**DIPA LFG 85**—This isopropanolamine is a low freeze grade (LFG) variation of DIPA for easier handling in colder ambient temperatures (freezing point: 13°C/55.4°F). It is a blend of 85% DIPA and 15% deionized water.

**TIPA 99**—Commercial grade triisopropanolamine is a tertiary amine. It is used as a cross-linker in special niche water-based coating applications. The cement and concrete industries use TIPA as a grinding aid, and it is used in concrete admixtures. TIPA is used as a neutralizing agent in agricultural products and water borne coatings.

**TIPA LFG**—This isopropanolamine is a low freeze grade (LFG) variation of TIPA for easier handling in colder ambient temperatures (freezing point: 5°C/41°F). It is a blend of 85% TIPA and 15% deionized water.



*Isopropanolamines from Dow are used to formulate a wide range of products including paint, ink, adhesives and cutting fluids for the metalworking industry.*



**TIPA 101**—This isopropanolamine is the non-prime product from the process. It is a blend of 90% TIPA and 10% deionized water, with a freezing point of 17.2°C/62.6°F.

**Isopropanolamine Mixture**—This trio of 12% MIPA, 44% DIPA and 44% TIPA is used in manufacturing flexible foams. It is a unique mixture that is also used in an array of specialty applications, including hand cleaner formulations.

**Isopropanolamine Blend**—This trio of 18% DIPA, 66% TIPA and 16% deionized water is used in construction industry specialty applications.

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# Isopropanolamines Physical Properties

Isopropanolamine-based formulations can offer better color and heat stability, improved oil solubility and lower formulation costs than conventional ethanolamines. Dow offers this product line to complement its ethanolamine product line and to provide alternative alkanolamines for new product development.

Table 2—Isopropanolamines Physical Properties<sup>†</sup>

Isopropanolamine	Chemical Name	CAS Number	Structural Formula	Physical Form, 25°C	Grade Explanation	Molecular Weight
MIPA	1-Amino-2-propanol (Monoisopropanolamine)	78-96-6	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{NH}_2$	Liquid	Commercial	75.11
DIPA	1,1'-Iminodi-2-propanol (Diisopropanolamine)	110-97-4	$[\text{CH}_3\text{CH}(\text{OH})\text{CH}_2]_2\text{NH}$	Solid	Commercial	133.19
DIPA LFG 90		110-97-4 7732-18-5 <sup>1</sup>		Liquid	Low Freeze, 10% H <sub>2</sub> O	
DIPA LFG 85		110-97-4 7732-18-5 <sup>1</sup>		Liquid	Low Freeze, 15% H <sub>2</sub> O	
TIPA 99	1,1',1''-Nitrilotri-2-propanol (Triisopropanolamine)	122-20-3	$[\text{CH}_3\text{CH}(\text{OH})\text{CH}_2]_3\text{N}$	Solid	Commercial	191.27
TIPA LFG		122-20-3 7732-18-5 <sup>1</sup>		Liquid	Low Freeze 15% H <sub>2</sub> O	
TIPA 101		122-20-3 7732-18-5 <sup>1</sup>		Liquid	Low Freeze 10% H <sub>2</sub> O	
Isopropanolamine Mixture	1-Amino-2-propanol 1,1'-Iminodi-2-propanol 1,1',1''-Nitrilotri-2-propanol	78-96-6 110-97-4 122-20-3		Liquid	12% MIPA, 44% DIPA, 44% TIPA	
Isopropanolamine Blend	1,1'-Iminodi-2-propanol 1,1',1''-Nitrilotri-2-propanol	110-97-4 122-20-3 7732-18-5 <sup>1</sup>		Liquid	18% DIPA, 66% TIPA, 16% H <sub>2</sub> O	

<sup>†</sup> The physical property data shown are to be considered typical properties, not specifications.

<sup>1</sup> H<sub>2</sub>O

<sup>2</sup> Supercools: freezing point results show variation

<sup>3</sup> Tag Closed Cup

<sup>4</sup> H.T. Setflash

<sup>5</sup> L.T. Setflash

<sup>6</sup> No flashpoint observed up to the boiling point. See flashpoint of parent isopropanolamine.

<sup>7</sup> Cleveland Open Cup (No. F.P. via Closed Cup methods)

<sup>8</sup> Pensky-Martin Closed Cup

<sup>9</sup> 20/4°C

<sup>10</sup> 40/4°C

<sup>11</sup> 70/4°C

<sup>12</sup> 40°C

<sup>13</sup> 70°C

<sup>14</sup> 30°C

<sup>15</sup> 54°C

<sup>16</sup> 20°C

<sup>17</sup> 50°C

<sup>18</sup> 60°C







Vapor Pressure, mm Hg	Boiling Point, °C (°F) 760 mm Hg	Freezing Point, °C (°F)	Flash Point, °C (°F)	Specific Gravity, 25/4°C	Pounds per Gallon, 25°C	Viscosity, cps		Solubility, gm/100gm, 25°C			
						25°C	60°C	ACE	MEOH	ETH	H <sub>2</sub> O
0.53 <sup>16</sup>	159 (318)	3 <sup>2</sup> (37.4)	73 (163) <sup>3</sup>	0.960 <sup>9</sup>	7.95	23	6.0 <sup>15</sup>	CM	CM	(Slow) CM	CM
0.035 <sup>17</sup>	249 (480)	44 <sup>2</sup> (111.2)	135.5 (276) <sup>4</sup>	0.992 <sup>10</sup>	8.27 <sup>12</sup>	870 <sup>14</sup>	86 <sup>15</sup>	810	670	9	1200
	116 (241)	23 <sup>2</sup> (73.4)	None <sup>5,6</sup>	1.015	8.46	790	50 <sup>15</sup>				
	111 (232)	13 <sup>2</sup> (55.4)	None <sup>5,6</sup>	1.019	8.50	450	38 <sup>15</sup>				
0.004 <sup>18</sup>	306 (583)	44 <sup>2</sup> (111.2)	160 (320) <sup>7</sup>	0.988 <sup>11</sup>	8.24 <sup>13</sup>		100	450	>500	365	>500
	104 (219)	5 <sup>2</sup> (41)	None <sup>6,7</sup>	1.027	8.56	240	25 <sup>15</sup>				
	107 (225)	17 <sup>2</sup> (62.6)	None <sup>4,6</sup>	1.025	8.55	420	37 <sup>15</sup>				
	214 (417)	24 <sup>2</sup> (75.2)	109.5 (229) <sup>8</sup>	1.003	8.36	950	68 <sup>15</sup>	CM	CM	(Slow) CM	CM
	111 (232)		None <sup>2</sup>	1.0	8.36						

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# Selecting Isopropanolamines for Specific Applications

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The following is a general selection guideline for common isopropanolamine applications. To obtain the most effective and economical solution for your specific needs, contact your Dow representative for more detailed information.

Table 3—Isopropanolamines Applications

Application	Function	Isopropanolamine		
		MIPA	DIPA	TIPA
<b>Adhesives</b>	Asphalt to aggregate.	•		
<b>Alkalinity Contribution</b>	Provides basicity.	•	•	•
<b>Antistat Agents for Polymers</b>	Provides soil release properties in addition to antistat to carpets.			•
<b>Coatings</b> (complexing agents, resin neutralizers, catalysts for hardening, corrosion inhibition, resin modifiers [cross-linking aid])	Helps in solubilizing the resin, complexing metals, adhesion, curing the resin, storage stability, water resistance. (See Water-Borne Coatings, Pigment Dispersants, Cross-Linker.)		•	•
<b>Corrosion Inhibitor</b>	Good filming inhibitors, good hydrolytic stability, broader range of solubilities over nitrites. (See Lubricants.)	•		•
<b>Cosmetics/Personal Care Products</b> (hair sprays, hair wave lotions, i.e., permanents, shampoos, liquid soaps, skin lotions, moisturizers)	Neutralization of acidic components, pH contribution, surfactant properties. (See Surfactants.)	•	•	•
<b>Cross-Linker for Coatings</b>	Improves the strength and stability of the coating, part of the polymerization process. (See Coatings, Water-Borne Coatings, Urethanes.)			•
<b>Drug Intermediates/Pharmaceuticals</b> (antihistamine, antimalarial, antitussive, antibiotic, local anesthetic, antidepressant, muscle relaxant, etc.)	Derivatives	•		
<b>Electrodeposition/Electrocoating</b>	Forms metal complexes. Replacement for cyanide-based electrolytes. Increases bath stability. Allows rapid cure times, good coating properties.		•	•
<b>Gas Conditioning</b>	Removal of acid gases.		•	
<b>Herbicides/Algaecides/Fungicides/Pesticides</b>	Neutralizes acidic herbicides and other acidic components. Good water solubility, freeze stability. TORDON 101 herbicide.	•	•	•
<b>Lubricants</b> (tall oil amides for water-based metalworking fluids)	Offers some corrosion protection, improved lubricity, foam suppression, and also reduces friction. (See Corrosion Inhibitors.)	•	•	•
<b>Neutralizing Agents</b>	Offers pH control, neutralizes acids, buffers.	•	•	•
<b>Paint Strippers</b>	Penetrates the paint and lifts it from the substrate.	•	•	

DOW MIPA serves as a drug intermediate in the production of antihistamine, antimalarial, antitussive, antibiotic and other pharmaceuticals.



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Application	Function	Isopropanolamine		
		MIPA	DIPA	TIPA
<b>Paper/Paperboard</b> (Amides) •	Controls pulp absorbency, defoaming agents.			•
<b>Photographic Intermediates</b>	Neutralization of acids, buffer, alkalinity contribution.		•	
<b>Pigment Dispersant</b>	Reduces the amount of pigment used. Improves dispersing to a uniform distribution. Reduces pigment agglomeration on storing. •			•
<b>Plastics/Polymers</b>	Thermal and oxidative stability, cross-linking aids, various property improvements.	•	•	•
<b>Polyurethane Additive</b> (fire retardant) •		(See Urethanes.) • •		
<b>Reaction Intermediates</b> (melamine transamination, use in polyurethane foams)	Improves compressive strengths, flame retardancy, and reduces friability (crumbling). Hydroperoxide decomposers, secondary antioxidants, improves hydrolytic stability. •	•	•	•
<b>Rubber Curing</b> (chain terminator in isoprene polymerization)	Improves polymer properties. Increases thermal and color stability. Prevents corrosion. Aids in lubricity during rubber molding.			•
<b>Surfactants/Amides</b> (foam stabilizers and rinse improvers in detergents) •	Contributes cleaning, lubrication, viscosity builder.	Good emulsifying agents, wetting agents. • •		
<b>Textile Processes</b>	Contributes heat resistance, durable press, improves water absorbency, adds special finishes, lubricity.		•	
<b>TiO<sub>2</sub>/Mineral Dispersant</b>	Gives thixotropic properties in water-emulsion paints. Use as catalysts in chemical reactions. Produces titanates used to cross-link guar gum for suspending gels. Useful in breaking oil-in-water emulsions. Improves polymer films in emulsion paints. Gives higher gel strengths. (See Coatings.)	•		•
<b>Urethanes</b>	Used as a triol in the manufacture of flexible foams. Provides higher tensile and tear strength, shortens the pot time of the elastomer. Aids in high temperature resistance of foams, curing agents. Contributes fire retardancy.	•	•	•



## More Resources From Dow

With over a half century of experience in the development and production of isopropanolamines, Dow provides a unique combination of product mix, stewardship, technical expertise and reliability of global supply unmatched in the industry. We are committed to providing a range of readily available isopropanolamines, plus the package of technical support services that will add value to your products and processes.

For more information, assistance, product samples or the appropriate MSDS, visit us online at [www.dow.com/alkanolamines](http://www.dow.com/alkanolamines), or you can reach a Dow representative at the following numbers:

### **In United States and Canada**

Phone: 1-800-447-4369

Fax: 1-989-832-1465

### **In Europe**

Toll Free: +800 3 694 6367

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Phone: 55 11 5188 9259

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Phone: 65 835 3773 (Singapore)

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### **Other Global Areas**

Phone: 989-832-1542 (United States)

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