



EASTMAN

Eastman solvents
Delivering performance in cleaners

General industrial // Purge and equipment lines // Transportation // Household and institutional // Printing inks

Eastman

solvents

Solvents are essential components in both aqueous and nonaqueous cleaner formulations. While no single solvent is optimal for all cleaning processes or products, Eastman's extensive range of oxygenated solvents offers formulators the ability to develop customized, high quality cleaners that meet or exceed customers' expectations.

- Solvents promote the removal of contaminants from surfaces.
- The ability to blend solvents provides tremendous versatility in formulating customized cleaning solutions for multiple end uses.
- An important solvent property for estimating cleaning efficacy is the Hansen solubility parameter (HSP). To improve contaminant removal effectiveness, the solvent of choice and the contaminant should have similar HSP values. Other key physical properties to consider are volatility (evaporation rate) and surface tension. A lower surface tension is better.
- Identifying the right solvent(s) is dependent on specific cleaning parameters: technical performance (contaminants to be removed), compatibility with surface type (metal, plastic, etc.), environmental constraints, occupational risks (health and safety), and costs.

Regardless of your performance or regulatory targets, our technical staff can help you achieve your application-specific goals while maintaining compliance with appropriate regulations.





General industrial market

Solvents are used in a variety of cleaners in industrial facilities, shop environments, and equipment maintenance applications.

Many processes in the industrial fabrication of metal parts for aircraft, automotive, medical equipment, and many other segments require a cleaning process before, during, and/or after assembly. Clean surfaces are extremely important for the proper application and adhesion of coatings and sealants. Specific industrial environments require cleaners that clean effectively and dry quickly without leaving residues.

Eastman's glycol ethers provide extensive formulating latitude for both aqueous and nonaqueous cleaners designed for the general industrial market.

Useful glycol ether properties include:

- A range of water miscibility to meet specific application needs
- Excellent activity on a broad range of contaminants
- The ability to effectively couple water/oil phases
- Range of volatility to engineer the required evaporation rate
- Low surface tension

Each of these properties assists in the effective solubilization and removal of soils from a surface. Often, blends of glycol ethers and surfactants are used to optimize cleaning performance. Eastman EB solvent (ethylene glycol monobutyl ether) is an industry standard that offers an excellent combination of performance and cost.

For nonaqueous cleaners, Eastman offers a broad range of ester and ketone solvents for industrial cleaning processes as alternatives to aromatic hydrocarbons, some of which are hazardous air pollutants (HAPs), and chlorinated solvents, many of which were phased out under the 1987 Montreal Protocol.

For more demanding industrial applications requiring a neutral pH cleaner, Eastman Omnia™ high-performance solvent was introduced in 2014. This product is an environmentally friendly, safer solvent with superior cleaning efficacy on a wide range of contaminants when compared to traditional cleaning solvents. See www.eastman.com/OmniaProperties for additional technical information.



Purge solvents and equipment line cleaners

Purge solvents are used to clean spray equipment (guns, hoses, etc.); other spray booth components, such as floor grates and conveyors; and paint production and transfer equipment. These products are often mixtures of either reclaimed solvents or customized solvent blends. Solvent choice is dictated by speed and efficiency in removing wet and semidried paints, inks, and adhesives (i.e., high activity for the type of residue to be removed; compliance with health, safety, and regulatory requirements; and cost-effectiveness). Higher efficacy equates to less solvent used, fewer emissions, and less waste to dispose.

Spray equipment guns, hoses, and transfer lines for paints must be purged quickly, especially in cross-linking systems, to prevent material from drying or hardening too rapidly and to facilitate color changes. Solvent activity for purge blends that are predominately based on hydrocarbons can be improved significantly through the addition of oxygenated solvents. Eastman IBIB solvent and Eastman C-11 ketone, two cost-effective solvents, can be added to hydrocarbon-based, reclaimed, or customized purge blends to improve the rate of paint flushing from spray paint equipment. Waterborne purge cleaners are often based on butyl-type glycol ethers, such as Eastman EB and DB solvents, as well as alcohols.

Low-VOC purge cleaners are increasingly required in many paint flushing applications. Eastman methyl acetate has very high solvent activity and is classified as a VOC-exempt solvent by the U.S. EPA.



Transportation industry

Eastman solvents deliver performance across a wide range of applications for the transportation industry, including the automotive and aerospace markets.

Automotive

Oxygenated solvents provide exceptional cleaning efficacy for a variety of automotive applications, such as vehicle parts cleaning, windshield wiper cleaner formulations, wiping solvents in automotive shops, and other associated cleaning processes. In many applications, customized blends of hydrocarbon and oxygenated solvents provide the correct balance of effective contaminant removal and drying speed, which improves the quality of the finished product.

When lower-VOC automotive cleaners are desired, Eastman methyl acetate is a good option, as it is excluded from the definition of VOC. Similar to acetone in volatility, this product is more hydrophobic than acetone and can help minimize defects created by unwanted moisture entrapment during the cleaning process. It can be used in liquid formulations or presaturated wipes and is readily biodegradable. Two grades of Eastman methyl acetate are available. The high-purity grade contains 0.10 wt% maximum methanol, while the industrial grade contains 2.5 wt% maximum methanol. For more information on this VOC-exempt solvent, visit www.eastman.com/MEKreplacements.

Aerospace

Modern commercial and military aircraft require precise surface preparation to ensure the proper application of coatings and sealants. Solvent cleaners must provide the necessary removal of a variety of miscellaneous soils, exhibit compatibility with metal and/or plastic surfaces, dry quickly, leave essentially no residue, and meet a variety of toxicological and environmental requirements.

Eastman oxygenated solvents are suitable for the rigorous cleaning demands of the aerospace industry. For example, Eastman MPK (methyl *n*-propyl ketone) provides excellent solvency for oils, greases, and adhesive residues, facilitating efficient removal. This product is a readily biodegradable solvent with a FEMA GRAS (Flavor and Extracts Manufacturers Association—Generally Regarded As Safe) designation by the U.S. Food and Drug Administration. Eastman MPK is available for hand wipe cleaning purposes for both military and commercial aircraft applications, and it meets the NESHAP composite vapor pressure requirement of ≤ 45 mm Hg @ 20°C. It evaporates slower than MEK, thus delivering extended wipe efficacy and life span. These features of Eastman MPK enable formulators to develop cleaners with a proper balance of performance and environmental characteristics required by the aerospace industry.

Household and commercial markets

Clean surfaces are important for proper maintenance of homes, businesses, and institutions. Eastman solvents can be incorporated into liquid formulations to help achieve exceptional cleaning performance.

Eastman Omnia™ high-performance solvent offers an exceptional combination of performance, safety, and value. Effective in a variety of light- and heavy-duty cleaners formulated at neutral pH, Omnia solvent works on a wide range of soils—from greasy dirt and tar to soap scum. Omnia-based cleaners formulated at neutral pH work by effectively penetrating and dissolving soil and grease without saponification. Because of its high dilution ratio, Omnia interacts with the oil, dissolves it, and can effectively and easily be rinsed away without the negative issues associated with extreme pH systems.

Glycol ethers such as Eastman EB, DB, EP, DP, DE, and EEH solvents are used to enhance cleaning performance in aqueous systems. These glycol ethers enable formulators to control cleaner volatility and contact time with the contaminant to promote efficient removal. Glycol ethers are also very effective in reducing the surface tension of aqueous cleaners, thereby enhancing surface wetting and soil removal.

Butyl glycol ethers are preferred by many cleaning product manufacturers due to their excellent coupling action (the ability to couple water/oil mixtures using relatively low concentrations of the solvent) and superb cleaning efficacy.





Printing ink industry

Eastman solvents are very effective in customized blends for cleaning and removing excess ink from rollers, presses, and screens. Commercial printing processes cover a wide range of ink types and substrates. No one solvent can meet all requirements to effectively clean ink application equipment both during and after the printing process. The cleaner must effectively remove ink from plates, cylinders, rollers, screens, wells, and machinery equipment screens in a reasonable time period and should be environmentally friendly with minimal risk to workers.

Cleaners for inks are designed based on their activity for the respective polymer/resin composition as well as the ability to satisfy safety and environmental concerns. Some desired features for solvents in ink cleaners include low odor, efficient removal of both wet and dry ink from equipment, compliance with health and safety guidelines, and the ability to meet VOC emission regulations.

Esters and alcohols are especially useful in rotogravure solvent-based ink cleaner systems. Eastman ethyl acetate, *n*-propyl acetate, and isopropyl acetate are often combined with various alcohols such as ethanol, isopropanol, and Eastman *n*-propanol to dissolve ink from printing components and assist in their removal. In screen ink printing processes, printers use solvent cleaners to remove excess ink from screens. Traditional oxygenated and hydrocarbon solvents are used during this process and virtually all are VOCs. For low-VOC alternatives, Eastman methyl acetate can be blended with other materials in the U.S. due to its exempt status to effectively and quickly remove solventborne inks from screens and associated application equipment. Eastman Omnia™ high-performance solvent has also exhibited effectiveness as an ink cleaner.



LVP solvents

Solvents are very effective components in consumer cleaners for removing institutional and household soils. However, federal and state regulatory restrictions on VOC emissions from cleaners used in consumer products have required the development of low- or no-VOC cleaners.

One approach for meeting increasingly stringent VOC limits for cleaners in consumer products (household/institutional cleaners and other consumer-related products) has been to use solvents that meet current LVP-VOC exemption criteria.¹

Eastman's portfolio includes oxygenated solvents that meet LVP-VOC exemption under various states and the EPA's Consumer Product Regulation, enabling formulators to develop effective and compliant cleaning products for use in household and institutional applications. One example that meets the LVP-VOC exemption criteria is Eastman EEH solvent. This solvent has low water miscibility which enables it to be used as an emulsifying and compatibilizing agent in aqueous and nonaqueous cleaner formulations. Eastman Omnia™ high-performance solvent also meets the LVP-VOC exemption criteria. A complete list and description of LVP-VOC products is available at www.eastman.com/LVPVOCsolvents.

¹States, multistate organizations, and the U.S. EPA's National Volatile Organic Compound Emission Standards for Consumer Products (9/11/1998) regulate VOCs in consumer products.



Product portfolio

None of Eastman's solvents are classified as an ozone-depleting substance (ODS), enabling formulators to meet other EHS criteria when developing environmentally compliant consumer products. Eastman features solvents that are:

- Readily or inherently biodegradable
- Acceptable in odor
- High-activity solvents
- Excellent coupling solvents
- Non-HAP
- VOC exempt
- LVP-VOC exempt
- High-purity products for use in the electronics industry, characterized by extremely low trace metals content (ppb).

See the table on page 11 for product attributes and respective technical/regulatory information. For more detailed information on each solvent, view product listings at www.eastman.com/solvents.







Product attributes

Solvent	Evaporation rate	Solubility @ 20°C wt%		Surface tension, dynes/cm		Hansen solubility parameters ^a				Readily biodegradable	Non-SARA	Non-HAP	VOC exempt ^b	LVP-VOC ^b
	<i>n</i> -BuOAc = 1	In water	Water in	Value	Temp.	Total	Nonpolar	Polar	Hydrogen bonding					
Eastman DB solvent	0.003	Complete	Complete	30	20°C	20.5	16	7	10.6	✓	—	—	—	✓
Eastman DE solvent	0.02	Complete	Complete	32.2	20°C	21.9	16.2	7.8	12.7	✓	—	—	—	✓
Eastman DP solvent	0.01	Complete	Complete	32.3	20°C	20.9	16	7.2	11.3	✓ ^c	—	—	—	✓
Eastman EB solvent	0.09	Complete	Complete	26.6	20°C	20.9	16	5.1	12.3	✓	—	✓	—	—
Eastman EEH solvent	0.003	< 0.2	5.1	27.6	20°C	17.4	16	4.1	5.1	✓	✓	✓	—	✓
Eastman EEP	0.12	2.9	2.2	27	23°C	18.6	16.2	3.3	8.8	✓	✓	✓	—	—
Eastman EP solvent	0.2	Complete	Complete	27.9	25°C	22.7	16.2	8.6	13.5	✓ ^c	—	—	—	—
Eastman ethyl acetate, urethane grade	4.1	7.4	3.3	23.9	20°C	18	15.8	5.3	7.2	✓	✓	✓	—	—
Eastman 2-ethylhexanol	0.01	0.1	2.6	28.7	20°C	20.3	16.0	3.3	11.9	✓	✓	✓	—	✓
Eastman methyl acetate	6.0	22.0	7.3	25.8	20°C	18.8	15.5	7.2	7.6	✓	✓ ^d	✓ ^d	✓	—
Eastman MPK (methyl <i>n</i> -propyl ketone)	2.3	3.1	4.2	26.6	20°C	18.2	16	7.6	4.7	✓	✓ ^e	✓ ^e	—	—
Eastman <i>n</i> -butyl propionate	0.5	0.4	0.7	25.3	20°C	17.2	15.3	3.3	6.8	✓	✓	✓	—	—
Eastman Omnia™ high-performance solvent	0.01	7.9	10.3	25.7	22°C	20.7	16.1	6.4	11.6	✓	✓	✓	—	✓

^aValues estimated by Dr. Charles Hansen are shown as SI units (MPa^{1/2})—to convert to [cal/cm²]^{1/2}, simply divide the corresponding value by 2.0455. ^bApplies in the U.S. only ^cModeled using The Estimation Programs Interface (EPI) Suite™ (EPA), BIOWIN v4.10 module ^dThis product contains ≤ 2.5 wt% methanol, which is a HAP, VOC, and California Prop 65 chemical ^eMPK is not on EPA's HAP or SARA list or California's Prop 65 list, but it does contain ≤ 10 wt% MIBK, which is on all three lists. Purer grades of MPK are available.



**Eastman Chemical Company
Corporate Headquarters**

P.O. Box 431
Kingsport, TN 37662-5280 U.S.A.

U.S.A. and Canada, 800-EASTMAN (800-327-8626)
Other Locations, +(1) 423-229-2000

www.eastman.com/locations

Although the information and recommendations set forth herein are presented in good faith, Eastman Chemical Company and its subsidiaries make no representations or warranties as to the completeness or accuracy thereof. You must make your own determination of its suitability and completeness for your own use, for the protection of the environment, and for the health and safety of your employees and purchasers of your products. Nothing contained herein is to be construed as a recommendation to use any product, process, equipment, or formulation in conflict with any patent, and we make no representations or warranties, express or implied, that the use thereof will not infringe any patent. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS AND NOTHING HEREIN WAIVES ANY OF THE SELLER'S CONDITIONS OF SALE.

Safety Data Sheets providing safety precautions that should be observed when handling and storing our products are available online or by request. You should obtain and review available material safety information before handling our products. If any materials mentioned are not our products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

© 2016 Eastman Chemical Company. Eastman brands referenced herein are trademarks of Eastman Chemical Company or one of its subsidiaries or are being used under license. The ® symbol denotes registered trademark status in the U.S.; marks may also be registered internationally. Non-Eastman brands referenced herein are trademarks of their respective owners.