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 customer expectations.

Key benefits of solvents

- Promote effective contaminant removal from surfaces
- Blending flexibility for formulation versatility across multiple end uses
- Optimized performance through tailored solvent selection rather than one-size-fits-all formulations

What to consider when choosing a solvent

- **Hansen solubility parameters (HSP):** Match the solvent's HSP to the contaminant for improved removal effectiveness.
- **Volatility (evaporation rate):** Control drying time and processing handling.
- **Surface tension:** Lower surface tension improves wetting and penetration for better cleaning.

Formulation drivers

- Contaminant type and cleaning performance required
- Substrate compatibility (metals, plastics, etc.)
- Environmental and regulatory limits
- Occupational health and safety considerations

Consistent supply and regulatory compliance

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 other segments require cleaning before, during and after assembly. Clean surfaces are extremely important for the proper application and adhesion of coatings and sealants. Specific industrial environments require cleaners that are effective 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.

Purge solvents and equipment line cleaners

Purge solvents are used to clean spray equipment, such as guns and hoses; 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 of.

Spray equipment guns, hoses and transfer lines for paints must be purged quickly, especially in cross-linking systems. Quick purging prevents material from drying or hardening too rapidly and facilitates 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. Environmental Protection Agency.

With increasing safety concerns and regulations of many dipolar aprotic solvents like *N*-methyl pyrrolidone (NMP), TamiSolve™ NxG is a favorable alternative for purge and equipment line cleaning where robust solvency and reduced worker exposure are priorities. TamiSolve NxG's lower evaporation rate and higher flash point improve contact time and reduce fugitive emissions while delivering excellent paint, coating and adhesive flushing performance.

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, including 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 to improve 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 pre-saturated 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.

Alternatively, TamiSolve NxG, with its strong solvency and lower vapor, aids in effective removal of greases, adhesives and polyurethane (PU) residues with reduced inhalation exposure. Its low odor and desirable safety profile make it suitable for parts stripping and cleaning and solvent-based maintenance formulations.

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 (National Emission Standards for Hazardous Air Pollutants) composite vapor pressure requirement of ≤ 45 mm Hg at 20°C. It evaporates slower than MEK, delivering extended wipe efficacy and lifespan. These features of Eastman MPK enable formulators to develop cleaners with the proper balance of performance and environmental characteristics required by the aerospace industry.

Purge solvents and equipment line cleaners

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.

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, 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 single 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 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.

Another option is TamiSolve NxG, which is an effective cosolvent for solvent-based inks and a low-volatility coalescent/wetting aid in water-based flexographic and gravure inks. It also supports overprint varnish (OPV) coalescence and can be used in conductive inks for printed electronics. Performance is formulation dependent; **contact Eastman's technical team** for lab support and regulatory limits.

Low-vapor-pressure (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 in various states and under 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.

[1]*States, 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 environmental, health and safety (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 eastman.com/solvents.

Product attributes

Solvent	Evaporation rate	Solubility at 20°C wt%		Surface tension, dynes/cm		Hansen solubility parameters[a]				Readily biodegradable	Non-SARA	Non-HAP	VOC exempt[b]	LVP-VOC[b]
	n-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 *n*-propyl ketone)	2.3	3.1	4.2	26.6	20°C	18.2	16	7.6	4.7	✓	✓[e]	✓[e]	–	–
Eastman *n*-butyl propionate	0.5	0.4	0.7	25.3	20°C	17.2	15.3	3.3	6.8	✓	✓	✓	–	–
Eastman TamiSolve NxG	0.004	Complete	Complete	33.8	25°C	20.5	17.8	8.2	5.9	✓	✓	✓	–	–

[a]Values estimated by Dr. Charles Hansen are shown as SI units (MPa ½) To convert to [cal/cm³]½ , simply divide the corresponding value by 2.0455.

[b]Applies in the U.S. only

[c]Modeled using The Estimation Programs Interface (EPI) Suite™ (EPA), BIOWIN v4.10 module.

[d]This product contains ≤ 2.5 wt% methanol, which is an HAP, VOC and California Prop 65 chemical.

[e]MPK 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

Eastman 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

eastman.com/locations

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