

PROXITOL GLYCOL ETHERS



Shell Chemicals

PROXITOL* GLYCOL ETHERS ARE USED IN A VARIETY OF APPLICATIONS INCLUDING:

Coatings

- Automotive
- Industrial Maintenance
- Architectural
- Aerospace
- Speciality Paints

Cleaners & Inks

- All-Purpose
- Oven
- Industrial
- Household
- Flexographic
- Screen Printing

Electronics

- Copper Clad Laminating
- Laminates
- Photoresistors

Other

- Adhesives
- Pharmaceuticals
- Cosmetics
- Industrial Processes
- Oil Field Chemicals
- Mining Chemicals
- Agricultural Chemicals
- Textile & Leather Dyes

IF YOU WANT TO KNOW WHERE WE CAN TAKE YOU, LOOK AT WHERE WE'VE BEEN

Shell Chemicals began over 80 years ago. We have a reputation for a broad product range, business consulting, technical expertise and manufacturing excellence. We are one of the largest petrochemical concerns in the world, with manufacturing facilities in 13 countries and marketing hubs in three global regions with customer service covering 55 countries.

We have been manufacturing and supplying solvents since the 1920s and are continually developing new products, often as alternatives for solvents that are under specific regulatory

pressure. These solvents provide opportunities for solvent substitution, offering both cost effectiveness and equivalent performance.

We are able to draw upon our years of experience in the solvents business, providing assistance and information to customers regarding solvent selection, solvent regulations and general health, safety and environmental issues. It is this commitment and customer focus that has allowed us to become and remain an industry leader.

WE'RE PROVIDING YOU WITH ALTERNATIVE SOLVENTS

PROXITOL* Glycol Ethers

Shell Chemicals produce propylene glycol and three glycol ether derivatives in Europe at Pernis, NL, which are commercially available on a global basis. These propylene glycol ethers provide alternatives to the ethers of ethylene glycols, which are under regulatory pressures around the world.

Technical Equivalency

Methyl PROXITOL glycol ether is the methyl ether of propylene glycol (PM), and Methyl PROXITOL glycol ether acetate is the acetate of the methyl ether of propylene glycol (PMA). The chemical structures and the names of technically equivalent products for these PROXITOL glycol ether solvents are given in Figure 1. Shell Chemicals PROXITOL glycol ether solvents meet or exceed competitor and industry specifications for these products, including ASTM Specification D4837 for PM and ASTM Specification D4835 for PMA.

* PROXITOL is a trademark of the Royal Dutch/Shell Group of companies



FIGURE 1

Names of Technically Equivalent Products

Shell	Methyl PROXITOL* Glycol Ether	Methyl DiPROXITOL* Glycol Ether	Methyl PROXITOL* Glycol Ether Acetate	Ethyl PROXITOL* Glycol Ether
Abbreviation	PM	DPM	PMA	EP or PE
Common Chemical Name	Propylene glycol Monomethyl ether	Di-Propylene glycol Monomethyl ether	Propylene glycol Monomethyl ether acetate	Propylene glycol monoethyl ether
Scientific Name	1-methoxy-2-propanol	1-(2-methoxy-1-methylethoxy)-2-propanol	1-methoxy-2-propanol acetate	1-ethoxy-2-propanol
Dow	DOWANOL® PM	DOWANOL® DPM	DOWANOL® PMA	DOWANOL® EP
LyondellBasell	ARCOSOLV® PM	ARCOSOLV® DPM	ARCOSOLV® PMA	ARCOSOLV® PE
Eastman	EKTASOLVE® PM or EASTMAN® PM	n/a	EKTASOLVE® PMA or EASTMAN® PMA	EKTASOLVE® EP or EASTMAN® EP
Chemical Structure	$\text{CH}_3\text{-O-CH}_2\text{-CH(OH)-CH}_3$	$\text{CH}_3\text{O}[\text{CH}_2\text{CH}(\text{CH}_3)\text{O}]_2\text{H}$	$\text{CH}_3\text{-O-CH}_2\text{-CH(O-CH}_3\text{)-C(=O)-CH}_3$	$\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH(OH)-CH}_3$

SAFETY AND REGULATORY ADVANTAGES

As shown in Figure 2, unlike the ethers of ethylene glycol, the PROXITOL glycol ether solvents are not listed as 'Hazardous Air Pollutants' (HAPS) under the US Federal Clean Air Act of 1990 and its subsequent amendments. They are not reportable under SARA Title 313, nor are they included in California's Proposition 65 lists of chemicals. In addition, they have higher workplace exposure limits than equivalent ethylene glycol ethers. These regulatory advantages for propylene glycol ethers have contributed to their significant market growth in the US.

FIGURE 2

Health, Safety and Environment Comparison

	HAP	SARA 313	CA PROP. 65	ACGIH [†] TLV PPM
Propylene Glycol Monomethyl Ether (PM)	No	No	No	100
Propylene Glycol Monomethyl Ether Acetate (PMA)	No	No	No	NE
Dipropylene Glycol Monomethyl Ether (DPM)	No	No	No	100
Ethylene Glycol Monomethyl Ether (EM)	Yes	Yes	Yes	5
Ethylene Glycol Monoethyl Ether (EE)	Yes	Yes	Yes	5
Ethylene Glycol Monoethyl Ether Acetate (EEA)	Yes	Yes	Yes	5
Ethylene Glycol Monobutyl Ether (EB)	No	Yes	No	20
Ethylene Glycol Monobutyl Ether Acetate (EBA)	Yes	Yes	Yes	25
Diethylene Glycol Monobutyl Ether (DB)	No	Yes	No	NE

[†] ACGIH – American Conference of Governmental Industrial Hygienists

COATINGS APPLICATIONS

The primary market for PROXITOL glycol ethers is within the coatings industry. The variety of coatings end uses, as well as other markets for PROXITOL glycol ethers are shown in Figure 3. The PROXITOL glycol ethers solvents have high solvencies and are slow evaporating solvents. PROXITOL glycol ethers solvents have properties similar to the methyl (EM) and ethyl (EE) ethers of ethylene glycol and to the acetate of EE (EEA) (Figure 4). Although the PROXITOL glycol ethers evaporate slightly faster (Figure 5), in most applications PM and DPM can be used to substitute for EM or EE, and DPM and PMAc can be substituted for EEA; PM and DPM is compatible with a variety of resins, including epoxies and polyesters, and PMA is also used extensively with acrylic and urethane resins.

FIGURE 3

Proxitol Glycol Ethers have multiple end uses

Coatings	Automotive, Industrial Maintenance, Coil, Appliance & Equipment, Lacquer & Stains, Architectural, Marine, Aerospace, Plastic Primer, Resin Formulations, Colorants, Thinners, Speciality Paints
Cleaners & Inks	All-Purpose, Glass, Oven, Industrial, Household, Gravure, Flexographic, Screen Printing, Offset Printing
Electronics	Copper Clad Laminating, Laminates, Photoresistors
Other	Adhesives, Intermediates, Fuel Additives, Pharmaceuticals, Cosmetics, Industrial Processes, Oil Field Chemicals, Mining Chemicals, Agricultural Chemicals, Textile & Leather Dyes

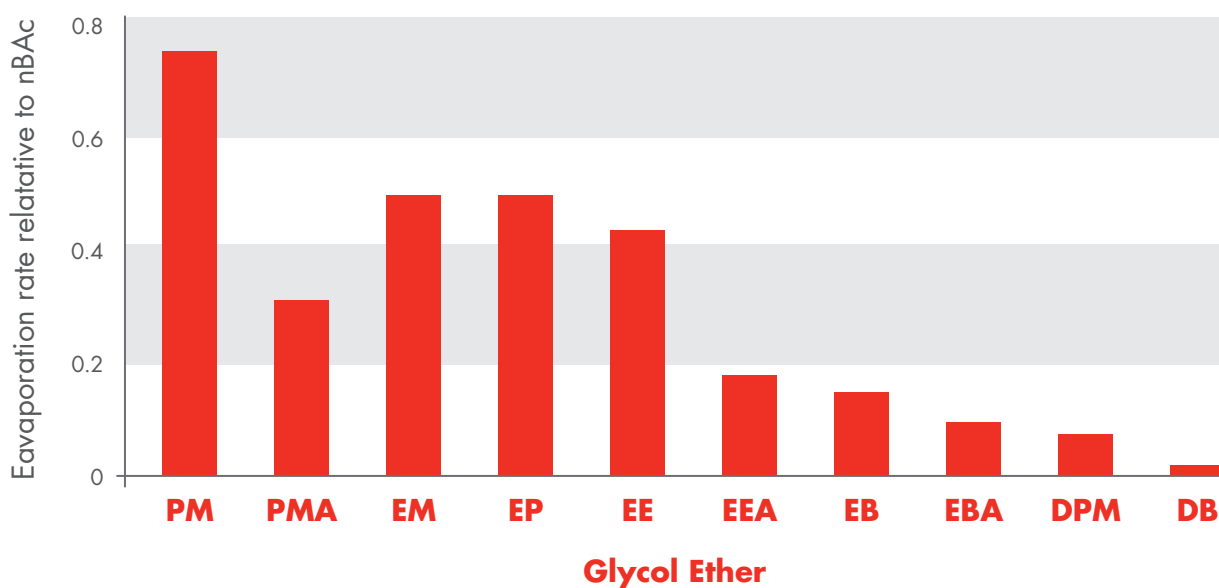
FIGURE 4

Comparison of Typical Properties

	MW	Boiling Pt. °C (°F)	Flash Pt. °C (°F)	Evap. Rate (BuAc = 1)	Evap. Time, seconds	Density Kg/1 (Lb/gal.) @ 20°C
PM	90	120 (248)	30 (86)	0.75	600	0.921 (7.69)
PMA	132	146 (295)	45 (113)	0.33	1,410	0.967 (8.07)
DPM	148	191 (376)	79 (174)	0.04	13,000	0.953 (7.95)
EM	76	123 (253)	38 (101)	0.53	884	0.963 (8.04)
EP	104	132 (270)	42 (108)	0.49	960	0.896 (7.48)
EE	90	135 (275)	43 (109)	0.38	1,213	0.929 (7.75)
EEA	132	153 (307)	52 (126)	0.20	2,533	0.972 (8.11)
EB	118	171 (340)	61 (142)	0.08	6,750	0.900 (7.51)
EBA	160	186 (367)	160 (320)	0.03	14,310	0.939 (7.84)
DB	162	230 (446)	110 (230)	<0.01	132,000	0.955 (7.969)

FIGURE 5

Comparison of relative evaporation rates data by ASTM D3539 Shell Thin Film Evaporometer



CHEMICAL PROPERTIES

PM is completely water-soluble and is also compatible with many greases, oils and waxes, which makes PM an excellent coupling agent. The manner in which PM partitions between an organic and water phase, as shown in Figure 6, can be significant in cleaning applications.

FIGURE 6

Comparison of Solvency Properties

	Hildebrand Solubility Parameter (cal/cm ³) ^{1/2}	Fractional Polarity	Solubility in Water @ 20°C	Partition Coefficient ^{††} K
PM	9.5	0.110	Complete	0.17
PMA	8.5	0.090	23%	–
DPM	8.7	0.050	Complete	0.064
EM	10.8	0.126	Complete	0.001
EP	9.0	0.080	Complete	–
EE	9.9	0.086	Complete	0.01
EEA	8.7	0.073	25%	–
EB	9.1	0.048	Complete	1.15
EBA	8.2	0.060	1% (25°C)	–
DB	8.9	0.0028	Complete	–

^{††}Partition Coefficients in a cyclohexane/water mixture @ 25°C, K = (organic)/(water)

For further information on PROXITOL Glycol Ethers or any other Shell Chemicals product, including product technical data sheets, Safety Data Sheets, and contact information, please visit our website at www.shell.com/chemicals .

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