

Dow oxygenated solvents





Dow Oxygenated Solvents offer a range of solvency, water solubilities and volatilities that present a wide variety of formulating opportunities for the producers of household and industrial/institutional cleaners.

Looking beyond today

You need oxygenated solvents. Your applications depend on them. So you need a supplier who can deliver not only what you need today, but what you'll need for your future growth. That supplier is Dow.

We've been providing solvents for customers for more than 100 years – but we're not resting on our accomplishments. We're continuing to innovate to help customers like you develop differentiated products, stay ahead of changing environmental regulations, maintain low cost to serve and compete in a fast-changing business environment.

Dow's solvents portfolio include a wide selection of alcohols, including esters and ethylene- and propylene-based glycol ethers.



The utilization of a solvent system with the proper balance of solvency, volatility and surface tension properties can significantly improve the application and performance characteristics of coatings.

Front cover: Dow Oxygenated Solvents are ideal solvents for coating applications and can be used in a wide range of other applications such as photoresist formulations, photoresist stripping for precision etching, edge bead removal and cleaning.

Alcohols

Dow's alcohols range from three to eight carbon atoms, from propanol to 2-ethylhexanol. A single hydroxyl group characterizes them, and performance is largely controlled by the related hydrocarbon structure.

The low-molecular weight, water-soluble products are solvents for the manufacture of protective coatings, dyes and inks. These alcohols are also used in producing plastics, perfumes, cosmetics, pharmaceuticals, cleaners and polishes.

The higher molecular weight alcohols are only slightly soluble in water and are used as latent solvents for solvent-based coatings and as coupling agents in waterborne coatings. They help provide the proper balance of desired properties in a formulation, such as viscosity, flow and leveling, and cure rate. The higher molecular weight alcohols are also intermediates for plasticizers, surfactants, lubricants, ore collectors, and pharmaceuticals.

Esters

Our acetate esters have good solvency power for many natural and synthetic resins (e.g., nitrocellulose) and are commonly used in lacquer thinners, wood lacquers and a wide variety of coatings. Isopropyl and butyl acetate are well established as volatile solvents for the manufacture and application of many types of finishes.

Less volatile esters are used as tail solvents for organic coatings and as coalescing aids for latex paints. All the acetate esters are miscible with many common organic solvents. They are used broadly in printing inks, aerosol sprays and personal care products, as solvents for fragrances, cosmetics and personal care, and as a processing solvent in the pharmaceutical industry.

Dow's line of esters, including UCAR™ n-Alkyl propionates and UCAR™ Ester EEP, offers substantial flexibility in formulating coatings. Their linear structures contribute to effective viscosity reduction and to improved solvent diffusion from coating films. They have strong solvency and proper volatility for high solids coatings and printing ink applications. Odor characteristics are significantly more favorable than with other solvents of similar volatility. Their high electrical resistivity properties provide advantages in formulating high solids coatings for electrostatic spray applications.

Propionate esters provide excellent replacement options for oxo-hexyl acetate, methyl n-amyl ketone, and xylene. They are commonly used in automotive refinishes, OEM coatings, appliance coatings, cleaning fluids and printing inks, as solvents for cosmetics/personal care products and fragrances, and as a polymerization solvent for high solids acrylics resins.

UCAR™ Ester EEP and the propionate esters also find use as solvents for the electronics industry.

Solvents: Selection guide for coatings

		Waterborne coatings	High-solids coatings
Alcohols	n-Butanol	•	•
	2-Ethylhexanol	•	
	Isobutanol	•	•
	Isopropanol	•	•
	n-Pentanol	•	•
	n-Propanol	•	•
	2-Methyl Butanol	•	•
Esters	n-Butyl Acetate		•
	DOWANOL™ PGDA		•
	Primary Amyl Acetate		•
	Isobutyl Acetate		•
	Isopropyl Acetate		•
	n-Propyl Acetate		•
	UCAR™ Ester EEP	•	•
	UCAR™ Filmer IBT	•	
	UCAR™ n-Butyl Propionate		•
	UCAR™ n-Pentyl Propionate		•
UCAR™ n-Propyl Propionate		•	
Glycol ethers	PROGLYDE™ DMM Glycol Ether	•	•
	Glycol ether solvents	•	•
	Glycol ether acetates		•

NOTE: Consult the appropriate Material Safety Data Sheet for safety and handling guidelines.

Oxo Acids

Dow offers a broad range of Oxo Acids. Oxo Acids are used in a wide variety of applications such as stabilizers, plasticizers, coatings additives, lubricants, pharmaceuticals, pesticides, perfumes, food additives and chemical intermediates.



The utilization of a solvent system with the proper balance of solvency, volatility and surface tension properties can significantly improve the application and performance characteristics of coatings.

Alcohols, esters, Oxo Acids selection chart

	Product	Structural formula	Molecular weight, g/mol	Boiling point °C at 760mm Hg	Flash point °F / °C	Evaporation rate nBuAc=1	Specific gravity at 20/20°C
Alcohols	Primary amyl alcohol mixed isomers	C ₅ H ₁₁ OH (mixed isomers)	88.15	133.2	113/45	0.30 ^a	0.815
	n-Butanol	C ₄ H ₉ OH	74.12	117.7	97/36	0.44	0.810
	2-Ethylhexanol	CH ₃ (CH ₂) ₃ CH(C ₂ H ₅)CH ₂ OH	130.23	184.6	162/72	0.02	0.833
	Isobutanol	(CH ₃) ₂ CHCH ₂ OH	74.12	107.9	82/28	0.63	0.802
	2-Methyl Butanol	C ₂ H ₅ CH(CH ₃)CH ₂ OH	88.15	128.7	113/45	0.50	0.818
	n-Pentanol	C ₅ H ₁₁ OH	88.15	137.9	119/48	0.30	0.816
	n-Propanol	C ₃ H ₇ OH	60.10	97.2	73/23	0.87	0.816
Esters	Primary Amyl Acetate Mixed Isomers	C ₅ H ₁₁ OC(O)CH ₃ (mixed isomers)	130.19	146.0	77/25 ^b	0.39 ^b	0.876
	n-Butyl Acetate	C ₄ H ₉ OC(O)CH ₃	116.16	126.2	72/22	1.00	0.883
	Isobutyl Acetate	(CH ₃) ₂ CHCH ₂ OC(O)CH ₃	116.16	118.0	64/18	1.52	0.873
	Isopropyl Acetate	(CH ₃) ₂ CHOC(O)CH ₃	102.13	88.5	36/2	3.5	0.869
	n-Propyl Acetate	C ₃ H ₇ OC(O)CH ₃	102.13	101.5	58/14	2.13	0.883
	UCAR™ n-Butyl Propionate	C ₄ H ₉ OC(O)CH ₂ CH ₃	130.19	144.7	100/38	0.45	0.876
	UCAR™ Ester EEP	C ₂ H ₅ OC ₂ H ₄ C(O)OCH ₂ CH ₃	146.19	169.7	138/60	0.12	0.951
	UCAR™ Filmer IBT	(CH ₃) ₂ CHCH(OH)C(CH ₃) ₂ CH ₂ OC(O)CH(CH ₃) ₂	216	255.0	246/120	<0.01	0.948
	UCAR™ n-Pentyl Propionate	C ₅ H ₁₁ OC(O)CH ₂ CH ₃	144.22	165.0	135/57	0.18	0.874
UCAR™ n-Propyl Propionate	C ₃ H ₇ OC(O)CH ₂ CH ₃	116.16	122.4	75/24	1.21	0.881	
Oxo Acids	Propionic Acid	CH ₃ CH ₂ COOH	74.08	140.8	125/52	0.24	0.995
	Valeric Acid	CH ₃ (CH ₂) ₃ COOH	102.13	185.5	183/84	0.02	0.939
	Isopentanoic Acid	C ₄ H ₉ COOH (mixed isomers)	102.13	183.1	171/77	0.04	0.937
	2-Ethylhexoic Acid	CH ₃ (CH ₂) ₃ CH(C ₂ H ₅)COOH	144.21	227.8	256/124	<0.01	0.908

a Based on n-amyl alcohol

b Based on n-amyl acetate

Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III Section 313: No

Hazardous Air Pollutants listed under Title III of the Clean Air Act: No

These properties are typical of the product, but should not be confused with, or regarded as, sales specifications.

Density lb/gal at 20°C	Viscosity cP at 20°C	Vapor pressure, mm Hg at 20°C	CAS number	Surface tension, dynes/cm at 20°C	Hansen solubility parameters (joules/cm ³) ^{1/2}				Solubility wt% at 20°C	
					Dispersion	Polar	H Bonding	Total	In water	Water in
6.79	4.3	2.2	137-32-6 / 71-41-0	23.7	15.9	4.5 ^a	13.9 ^a	21.7 ^a	1.7	9.2
6.75	3.0	4.9	71-36-3	24.8	16.0	5.7	15.8	23.1	7.7	20.1
6.94	10.3	0.09	104-76-7	26.9	15.9	3.3	11.8	20.2	0.07	2.6
6.68	4.0	8.1	78-83-1	23.0	15.1	5.7	15.9	22.7	8.5	15
6.82	5.0	3.8	137-32-6	25.7	16.0	5.1	14.3	21.1	2.2	8.3
6.79	4.0	1.4	71-41-0	25.7	15.9	4.5	13.9	21.7	2	9.5
6.71	2.2	15.2	71-23-8	23.8	16.0	6.8	17.4	24.5	∞	∞
7.29	0.9	4	628-63-7 / 624-41-9	25.8	15.8 ^b	3.3 ^b	6.1 ^b	17.1 ^b	0.2	0.9
7.35	0.7	8.5	123-86-4	25.3	15.8	3.7	6.3	17.4	0.7	1.9
7.26	0.7	13.6	110-19-0	23.4	15.1	3.7	6.3	16.8	0.66	1.1
7.28	0.5	45.7	108-21-4	22.3	14.9	4.5	8.2	17.6	3	1.9
7.39	0.6	25	109-60-4	24.4	15.3	4.3	7.6	18.0	2	2.6
7.30	0.8	3.4	590-01-2	25.3	15.6	5.4	5.3	18.0	0.2	<0.02
7.91	1.3	0.9	763-69-9	28.1	16.2	3.3	8.8	18.6	5.2	2.2
7.89	17.9	<0.01	25265-77-4	30.7	15.1	6.1	9.8	16.8	0.12	2.9
7.28	1.0	1.5	624-54-4	26.4	15.6	5.1	5.1	17.1	<0.05	<0.03
7.34	0.7	10.7	106-36-5	24.7	15.7	5.8	5.7	17.5	0.5	
8.3	1.1	2.4	79-09-4	26.2	14.7	5.3	12.4	18.9	∞	∞
7.84	2.2	<0.1	109-52-4	26.1	15.0	4.1	10.3	18.7	2.4	13
7.82	2.1	0.1	109-52-4 / 116-53-0	25.5	16.4	4.1	10.7	20.0	3.2	
7.58	7.7	<0.01	149-57-5	28.3	15.9	4.4	9.1	18.8	0.1	1.4

Glycol ethers

Dow's glycol ethers portfolio is offered in two product families: E-series ethylene-based, and P-Series propylene-based glycol ethers.

Glycol ethers are excellent solvents for many types of applications. The combination of an alcohol and an ether functional group in the same molecule provides unique solvency characteristics with both polar and non-polar properties. This surfactant-like structure gives glycol ethers the ability to couple unlike liquid phases and be miscible in a broad range of hydrophilic and hydrophobic solvents.

From electronics to coatings and cleaners, glycol ethers offer a wide range of properties to meet the ever-changing needs of the marketplace. Glycol ethers are used in many applications because of their ability to lower surface tension in aqueous systems, as well as to penetrate and soften soils.

In cleaning formulations, they are widely used to aid the removal of greasy soils, to aid in solubilizing other components in the cleaner formulation, and to improve the storage stability of the formulations. In high solids solvent-borne coatings, high solvency allows glycol ethers to be used to reduce viscosity while minimizing VOCs.

Glycol ethers selection chart

	Product	Chemical nomenclature	Structural formula	Molecular weight, g/mol	Boiling point °C at 760mm Hg	Flash point °F / °C
P-Series glycol ethers	DOWANOL™ PM Glycol Ether	Propylene Glycol Methyl Ether	$\text{CH}_3\text{OCH}_2\text{CHOHCH}_3$	90.1	120	88/31 ¹
	DOWANOL™ DPM Glycol Ether	Dipropylene Glycol Methyl Ether	$\text{CH}_3\text{O}[\text{CH}_2\text{CH}(\text{CH}_3)\text{O}]_2\text{H}$	148.2	190	167/75 ¹
	DOWANOL™ TPM Glycol Ether	Tripropylene Glycol Methyl Ether	$\text{CH}_3\text{O}[\text{CH}_2\text{CH}(\text{CH}_3)\text{O}]_3\text{H}$	206.3	243	250/121 ²
	DOWANOL™ PMA Glycol Ether	Propylene Glycol Methyl Ether Acetate	$\text{CH}_3\text{OCH}_2\text{CH}(\text{CH}_3)\text{OOCCH}_3$	132.2	146	108/42 ²
	DOWANOL™ DPMA Glycol Ether	Dipropylene Glycol Methyl Ether Acetate	$\text{CH}_3\text{O}[\text{CH}_2\text{CH}(\text{CH}_3)\text{O}]_2\text{OCCH}_3$	190.2	209	187/86 ²
	DOWANOL™ PnP Glycol Ether	Propylene Glycol n-Propyl Ether	$\text{C}_3\text{H}_7\text{OCH}_2\text{CHOHCH}_3$	118.2	149	118/48 ¹
	DOWANOL™ DPnP Glycol Ether	Dipropylene Glycol n-Propyl Ether	$\text{C}_3\text{H}_7\text{O}[\text{CH}_2\text{CH}(\text{CH}_3)\text{O}]_2\text{H}$	176.2	213	190/88 ¹
	DOWANOL™ PnB Glycol Ether	Propylene Glycol n-Butyl Ether	$\text{C}_4\text{H}_9\text{OCH}_2\text{CHOHCH}_3$	132.2	171	145/63 ¹
	DOWANOL™ DPnB Glycol Ether	Dipropylene Glycol n-Butyl Ether	$\text{C}_4\text{H}_9\text{O}[\text{CH}_2\text{CH}(\text{CH}_3)\text{O}]_2\text{H}$	190.3	230	212/100 ¹
	DOWANOL™ TPnB Glycol Ether	Tripropylene Glycol n-Butyl Ether	$\text{C}_4\text{H}_9\text{O}[\text{CH}_2\text{CH}(\text{CH}_3)\text{O}]_3\text{H}$	248.4	274	259/126 ¹
	DOWANOL™ PPh Glycol Ether	Propylene Glycol Phenyl Ether	$\text{C}_6\text{H}_5\text{OCH}_2\text{CHOHCH}_3$	152.2	243	247/119 ¹
	DOWANOL™ PGDA Glycol Ether	Propylene Glycol Diacetate	$\text{CH}_3\text{COOCH}_2\text{CH}(\text{CH}_3)\text{OOCCH}_3$	160	191	187/86 ²
	PROGLYDE™ DMM Glycol Diether	Dipropylene Glycol Dimethyl Ether	$\text{CH}_3\text{O}[\text{CH}_2\text{CH}(\text{CH}_3)\text{O}]_2\text{CH}_3$	162.2	175	149/65 ¹
	E-Series glycol ethers	Methyl CARBITOL™ Solvent	Diethylene Glycol Methyl Ether	$\text{CH}_3\text{O}(\text{CH}_2\text{CH}_2\text{O})_2\text{H}$	120.1	194.1
Methoxytriglycol		Triethylene Glycol Methyl Ether	$\text{CH}_3\text{O}(\text{CH}_2\text{CH}_2\text{O})_3\text{H}$	164.2	249.2	275/135 ²
CARBITOL™ Solvent		Diethylene Glycol Ethyl Ether	$\text{CH}_3\text{O}(\text{CH}_2\text{CH}_2\text{O})_3\text{H}$	134.2	202	205/96 ²
Ethoxytriglycol		Triethylene Glycol Ethyl Ether	$\text{C}_2\text{H}_5\text{O}(\text{CH}_2\text{CH}_2\text{O})_3\text{H}$	178.2	256.3	265/129 ²
Propyl CELLOSOLVE™ Solvent		Ethylene Glycol Propyl Ether	$\text{C}_3\text{H}_7\text{OCH}_2\text{CH}_2\text{OH}$	104.2	151.3	124/51 ²
Butyl CELLOSOLVE™ Solvent		Ethylene Glycol n-Butyl Ether	$\text{C}_4\text{H}_9\text{OCH}_2\text{CH}_2\text{OH}$	118.2	170.7	149/65 ²
Butyl CARBITOL™ Solvent		Diethylene Glycol n-Butyl Ether	$\text{C}_4\text{H}_9\text{O}(\text{CH}_2\text{CH}_2\text{O})_2\text{H}$	162.2	230.4	210/99 ²
Butoxytriglycol		Triethylene Glycol n-Butyl Ether	$\text{C}_4\text{H}_9\text{O}(\text{CH}_2\text{CH}_2\text{O})_3\text{H}$	206.3	279.7	280/138 ²
Hexyl CELLOSOLVE™ Solvent		Ethylene Glycol Hexyl Ether	$\text{C}_6\text{H}_{13}\text{OCH}_2\text{CH}_2\text{OH}$	146.2	208	195/91 ²
Hexyl CARBITOL™ Solvent		Diethylene Glycol Hexyl Ether	$\text{C}_6\text{H}_{13}\text{O}(\text{CH}_2\text{CH}_2\text{O})_2\text{H}$	190.3	259.1	275/135 ²
DOWANOL™ EPh Glycol Ether		Ethylene Glycol Phenyl Ether	$\text{C}_6\text{H}_5\text{OCH}_2\text{CH}_2\text{OH}$	138.2	244	250/121 ¹
DOWANOL™ DiEPh Glycol Ether		Diethylene Glycol Phenyl Ether	$\text{C}_6\text{H}_5\text{O}(\text{CH}_2\text{CH}_2\text{O})_2\text{H}$ (major)	182.2	282	280/138
DOWANOL™ EPh6-M Glycol Ether		Poly(oxy-1,2-ethanediyl), alpha-phenyl-omega-hydroxy	$\text{C}_6\text{H}_5\text{O}(\text{CH}_2\text{CH}_2\text{O})_6\text{H}$ (average component)	358.4	>350	>300/>149
DOWANOL™ DPH 255 Glycol Ether		Ethylene Glycol Phenyl Ether (major)	$\text{C}_6\text{H}_5\text{OCH}_2\text{CH}_2\text{OH}$ (major)	138.2	254	280/138

These properties are typical of the product, but should not be confused with, or regarded as, sales specifications.

¹ Setflash Method (closed cup)

² Tag Closed Cup (TCC)

∞ Miscible

In waterborne coatings, glycol ethers are excellent coalescent agents, and their unique hydrophobe/lipophobe balance allows for a broad range of coalescent efficiencies for different resins. They are also used as dye carriers in the textile, leather and printing industries and as solvents for insecticides and herbicides. For reactive and more hydrophobic systems, glycol ether esters and methyl capped glycol di-ethers offer stability and high solvency.



DOWANOL™ Glycol Ether products can prevent a component from separating in cosmetic formulations and help maintain its clarity, even when the product is exposed to extreme temperatures.

Evaporation rate nBuAc=1	Specific gravity at 25/25°C	Density lb/gal at 25°C	Density g/cc at 25°C	Viscosity cP at 25°C	Vapor pressure, mm Hg at 20°C	CAS number	Surface tension, dynes/cm	Hansen solubility parameters (joules/cm ³) ^{1/2}			Solubility wt% at 25°C	
								delta d	delta p	delta h	In water	Water in
0.62	0.919	7.65	0.916	1.7	8.7	107-98-2	27.7	15.6	7.2	13.6	∞	∞
0.035	0.951	7.91	0.948	3.7	0.28	34590-94-8	28.8	15.5	4.0	10.3	∞	∞
0.0026	0.965	8.03	0.962	5.5	0.01	25498-49-1	30.0	15.1	2.5	8.7	∞	∞
0.33	0.966	8.04	0.963	1.1	2.8	108-65-6	28.9	15.6	5.6	9.8	16.0	3.0
0.015	0.977	8.13	0.974	1.7	0.08	88917-22-0	27.3	16.3	4.9	8.0	16.0	3.5
0.21	0.883	7.34	0.880	2.4	1.53	1569-01-3	25.4	15.3	4.9	11.2	∞	∞
0.014	0.919	7.65	0.916	3.9	0.08	29911-27-1	27.8	15.0	2.9	9.2	19.6	20.3
0.093	0.878	7.30	0.875	2.8	0.85	5131-66-8	27.5	15.2	4.2	10.5	5.5	15.5
0.006	0.91	7.57	0.907	4.9	0.04	29911-28-2	28.4	14.8	2.5	8.7	4.5	12.0
0.0004	0.93	7.73	0.927	7.0	0.002	55934-93-5	29.7	14.8	1.7	7.9	4.5	8.0
0.002	1.062	8.84	1.059	25.2	0.01	770-35-4	38.1	17.4	5.3	11.5	1.0	6.0
0.039	1.056	8.77	1.051	2.6	0.23	623-84-7	32.5	15.8	3.5	8.8	7.4	4.1
0.13	0.902	7.50	0.899	1.0	0.55	111109-77-4	26.3	14.9	2.1	3.8	35.0	4.5
0.019	1.020	8.49	1.017	3.5	0.23	111-77-3	32.5	16.2	7.8	12.6	∞	∞
0.002	1.046	8.70	1.043	6.2	0.008	112-35-6	37.4	16.0	7.0	11.2	∞	∞
0.013	0.989	8.23	0.986	3.6	0.09	111-90-0	31.8	16.1	9.2	12.2	∞	∞
0.002	1.021	8.50	1.018	6.8	0.006	112-50-5	33.7	16.0	6.8	10.6	∞	∞
0.22	0.91	7.57	0.907	2.7	1.77	2807-30-9	26.3	16.1	8.0	13.1	∞	∞
0.079	0.901	7.49	0.898	2.9	0.66	111-76-2	27.4	16.0	7.6	12.3	∞	∞
0.004	0.951	7.91	0.948	4.9	0.028	112-34-5	30.0	16.0	7.0	10.6	∞	∞
0.0004	0.987	8.21	0.984	7.9	0.0015	143-22-6	29.8	16.0	6.4	9.9	∞	∞
0.0082	0.866	7.37	0.883	4.5	0.038	112-25-4	27.7	16.0	6.9	10.9	0.88	17.7
0.0006	0.931	7.74	0.928	6.2	0.001	112-59-4	29.2	16.0	6.0	10.0	2.00	53.40
0.001	1.109	9.23	1.106	21.5	0.004	122-99-6	42.0	17.8	5.7	14.3	2.5	9.0
0.0002	1.112	9.29	1.109	30	<0.002	104-68-7	37.7	16.4	6.7	11.6	4.00	22
<0.0001	1.12	9.06	1.085	89-93	<0.001	9004-78-8	45.2	17.4	6.6	10.6	∞	∞
<0.001	1.111	9.28	1.112	40	<0.004	122-99-6 / 104-68-7	42	17.3	6.1	13.3	3.00	12.0

Regulatory information on Dow glycol ethers

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) spill requirements
 Superfund Amendment and Reauthorization Act (SARA) Title III Release reporting required
 Volatile Organic Compound (VOC), per Federal Register, Vol. 57, No. 22, 1/3/92, per Title I, Clean Air Act Amendments of 1990
 Hazardous Air Pollutant (HAP) compound per Title III, Clean Air Act Amendments of 1990

P-Series

No
 No
 Yes
 No

E-Series

Yes – No reportable quantity
 Yes
 Yes
 Yes (except Butyl CELLOSOLVE™)

Dow oxygenated solvents

Your single source – today and tomorrow

Product stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products - from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

Customer notice

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.

Want to learn more?

Call us to discuss how Dow can help you with your next application.

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