DOW INDUSTRIAL SOLUTIONS

CARBOWAX™ PEG formulation guide for agriculture, household products, and more

Table of contents

CARBOWAX™ PEGs in adhesives

- Polyethylene glycols (PEGs) are often used as plasticizers and to increase lubricity. They tend to stabilize the adhesives by providing the humectancy necessary to maintain wet-tack strength.
- PEG 300, 400, and 600 may be used in aqueous emulsions of polyvinyl acetate to produce water resistant adhesives.
- Pressure-sensitive adhesive tape has been made using PEGs with amines, maleic anhydride, sebacic acid, and heat-reactive melamine-formaldehyde resin.
- PEGs have been used to make resinous binders useful in casting and adhesive compounds.
- A thermoplastic adhesive for bottle labels can be produced by modifying coumarone-indene resins or polyvinyl acetate with a polyethylene glycol maleate.

Adhesives formulation guide

Product / Process	Function of PEG	Suggested CARBOWAX™ PEGs	Formulation guideline
Band-Aid type (Medical adhesives)	Humectant	600, 600E	10-25%
Denture adhesives	Hydrophilic vehicle	400, 400E, 600, 600E, 8000	50%
Dyes & pigments for adhesives	Carrier/Dispersant	200-600 200E-600E	5-20%
Epoxy adhesives	Carrier	1000, 3350	5-20%
Heat-sealable adhesives	Antiblocking agent	600, 600E, 3350	15%
Hot-melt adhesives	Plasticizer	1450	1-10%
Label adhesives	Humectant	1450	5-15%
Plywood adhesives	Viscosity control	400, 400E, 3350	1-10%
Pressure-sensitive adhesives	Humectant	200-400 200E-400E	5-10%
Stamp paper adhesive	Humectant/anti-curl agent	200-400 200E-400E	1-10%
Urethane adhesives	Reactant with isocyanate	1000	Stoichiometric ratio
Wallpaper adhesive (Starch paste)	Plasticizer/Lubricant	200, 200E, 300, 300E, 3350	1-10%

Find local contact information at **dow.com/contactus.**

CARBOWAX™ PEGs in agriculture

- Polyethylene glycols (PEGs) may be used as plant and flower preservatives, carriers for plant hormones, and solubilizers for agriculture chemicals, such as benzene-derived insecticides.
- The water solubility and high melting points of PEG 3350 and PEG 8000 make them useful cake vehicles for plant hormones and herbicides.
- PEGs and their esters make excellent emulsifiers; PEG 400, 600, and 1000 can be used unreacted or as the fatty acid mono- and di-esters.
- PEGs have EPA approval for use as inert ingredients in pesticide formulations.
- Seeds treated with osmotic solutions containing PEG show increased rates of germination with higher efficiency.
- Due to excellent humectant properties, PEGs are used as anti-dusting agents in many agricultural compositions.

Agriculture formulation guide

Product / Process	Function of PEG	Suggested CARBOWAX™ PEGs	Formulation guideline
Seed treatment	(a) Carrier for fungicides & insecticides/Anti-dusting agent (b) Osmotic agent	200, 200E, 8000 3350, 8000	1-5% 10-30% in water
Pesticides	Solvent/Spreading agent	3350	5-20%
Herbicides	Cake vehicle/Granular coating	3350, 8000	2-5%
Fertilizer spikes	Binder	8000	5-35%
Plant hormones	Cake vehicle	3350, 8000	2-5%

Find local contact information at **dow.com/contactus.**

CARBOWAX™ PEGs in ceramics

Polyethylene glycols (PEGs) have the following advantages as plasticizers, binders, and carriers:

- Easy and smooth distribution throughout the ceramic mass.
- Good plasticizing properties for higher green density.
- Good lubricant for mold and die release.
- Improved green-strength.
- Burn-off smoothly without residue.
- Colors supplied with help of PEGs are easily etchable and suitable for scraping technique.
- Low slurry viscosity and higher solids loading.
- Compatible with several aqueous- and non-aqueous-based additives.

Ceramic formulation guide

Product / Process	Function of PEG	Suggested CARBOWAX™ PEGs	Formulation guideline
Green-body formation	Binder Plasticizer	3350, 8000 1450, 3350, 8000	5-40% 1-5%
Dry pressing	Internal lubricant	3350 and lower	1-2%
Tape casting	Mold lubricant	200-600 200E-600E	Directly on the mold
Powder processing	Grinding aid/Lubricant	1450, 3350	1-5%

Find local contact information at **dow.com/contactus.**

CARBOWAX™ PEGs in electroplating / electropolishing

Polyethylene glycols (PEGs) are insensitive to electrolytes, so they are widely used in electroplating baths:

- Small additions of PEG in tin and copper plating baths give bright, fine-grained, compact deposits with excellent adhesion.
- In electropolishing of aluminum and stainless steel, the addition of PEG results in a fine and glossy surface.
- PEGs have been found to be useful brightening agents for sulfate and chloride nickel-plating baths.

Electroplating and electropolishing formulation guide

Product / Process	Function of PEG	Suggested CARBOWAX™ PEGs	Formulation guideline
Electroplating of:			
Tin	Solvent for other chemicals / Adherence improver	540 Blend, 3350, 8000	1-25%
Copper	Brightening agent	1450, 8000	1-25%
Zinc	Wetting agent	3350	1%
Electropolishing of:			
Aluminum/Stainless steel	Brightening agent / Adhesion improver	3350	1-25%

CARBOWAX™ PEGs in household products

- CARBOWAX™ PEG liquids and solids find a wide range of uses in all types of household products because of their combination of desirable properties - water solubility, nonvolatility, inertness, and lubricity.
- Their texture, viscosity, and degree of hygroscopicity can be varied according to the molecular weight used.
- PEGs show good solvent action and good compatibility with the ingredients normally used in such products. Hence, they go into cleaners and polishes, detergents, toilet bowl cleaners, automotive formulations, and many other household products.

Household product formulation guide

Product / Process	Function of PEG	Suggested CARBOWAX™ PEGs	Formulation guideline
Cleaners & polishes			
Abrasive cpd	Lubrication/Consistency	1000, 3350	5-50%
Copper/Brass cleaner	Base/Carrier	540 Blend	25-35%
Silver polish	Base/Carrier	400, 400E	3-5%
Tarnish remover	Base/Carrier	1000	10-50%
Laundry aids			
Powdered detergents	Anti-caking agent	3350, 8000	1-3%
	Dust suppressant	400, 400E, 600, 600E	1-5%
	Anti-redeposition agent	3350	1-10%
	Carrier for starch	8000	1-3%
Liquid detergents	Solubilizing agent	200, 200E, 300, 300E, 400, 400E	5-15%
Detergent cakes	Binder	8000	1-10%
Automotive			
Tire sidewall cleaner	Base	540 Blend	5-15%
After wash spray	Wetting	8000	2-5%
Hand cleaner	Coupling agent/Base	300, 300E	5-10%
Stick stain remover	Base/Consistency	3350	50-75%
Leather/Vinyl care	Antistat/Conditioner	400, 400E, 3350	3-5%
Toilet bowl cleaner	Binder/Dissolution control	8000	25-50%
Shoe polish	Spreading agent/Binder	1450, 3350	1-5%
Glass cleaner/Antifog	Lubricant/Coating	400, 400E	5%

Find local contact information at **dow.com/contactus.**

CARBOWAX™ PEGs in paints and coatings

- As intermediates for preparing coatings resins, CARBOWAX™ Polyethylene Glycols (PEGs) provide a convenient method for modifying alkyd and polyester resins during synthesis to obtain water dispersibility. Usually about 10-30% PEG is required for this purpose.
- PEGs can also be used as flexibilizing components in synthesizing other types of coatings resins.
- PEGs are also used as modifiers in latex paints, in shellacs, and as binders in artists' water colors. Very thin films of PEGs applied to glass greatly improve the scratch resistance.
- Some non-flammable, water-removable paint removers are formulated with PEGs.

Paints and coatings formulation guide

Product / Process	Function of PEG	Suggested CARBOWAX™ PEGs	Formulation guideline
Water-based paints	Pigment dispersant/Grinding aid/Solvent/Plasticizer	200, 200E, 400, 400E, 3350	1-2%
Water-dispersible alkyd resins	Modifier	1000, 1450	5-25%
Wood stains	Penetrant/Protectant	300, 300E, 1000	5-10%
Aqueous dispersion thermoset coatings	Solvent/Flow control	300, 300E, 1000, 3350	1-5%
Strippable coatings	Plasticizer/Release agent	540 Blend	1-10%
Watercolor paints	Binder	4600	5-10%

CARBOWAX™ PEGs in paper

Polyethylene glycols (PEGs) are also used as plasticizers, antisticking agents, dimensional stabilizers, and as color stabilizers in various paper coating formulations.

- Solid polyethylene glycols are effective lubricants in paper coating compositions, promoting good flow out with better gloss and smoothness in calendering operations.
- PEGs 200, 300, and 400 are used to soften, add flexibility and desirable slip characteristics and prevent swelling and curling of paper caused by changes in humidity.

Paper formulation guide

Product / Process	Function of PEG	Suggested CARBOWAX™ PEGs	Formulation guideline
Paper coatings	Lubricant Plasticizer/Humectant/ Pigment dispersant	3350 200-600	1-10% 1-3%
Calendering operation	Sizing/Lubricant	540 Blend, 3350	5%
High-slip paper	Aid for wetting with adhesives	3350, 8000	1-5%
Cardboard	Non-scruff coating/lubricant	3350	5-10%
Paper for stamps, photographs, etc.	Humectant (Anti-curl agent)	200, 200E, 300, 300E, 400, 400E	5%

Find local contact information at **dow.com/contactus.**

CARBOWAX™ PEGs in printing

The humectancy, solvent power, and lubricating properties of the polyethylene glycols (PEGs) make them excellent ingredients in many types of ink formulations. Some examples include:

- Excellent carriers for various classes of dyes.
- Controlling hygroscopicity and setting of inks.
- Used as the polyol portion of UV-cured printing inks.
- Providing lubrication for printing equipment when used as a component of inks.

Printing formulation guide

Product / Process	Function of PEG	Suggested CARBOWAX™ PEGs	Formulation guideline
Jet printing inks	Humectant/Viscosity/ Wetting agent	200, 200E, 300, 300E, 400, 400E, 600, 600E	5-20%
Grocery marking ink	Base	3350	5-20%
High-speed press	Lubricant	540 Blend	Pure PEG or with 1-10% water
Stamp pad ink	Carrier/Humectant	200, 200E, 300, 300E, 540 Blend	5-20%
Stencil ink	Carrier/Humectant	8000	10-50%
Ink stain remover (solid stick)	Consistency control	1450, 3350	50-75%
Ball point pen ink	Humectant/Carrier	5200, 200E, 300, 300E, 400, 400 E	2-15%

Find local contact information at **dow.com/contactus.**

CARBOWAX™ PEGs in rubber and elastomers

CARBOWAX™ PEGs are widely used as mold release agents and lubricants for fabricating natural rubber and all kinds of synthetic rubber. PEGs have properties which make them particularly useful to the rubber industry:

- Water-soluble, hence easy to apply and remove.
- Non-volatile, thus suffering minimum losses in use.
- Very low ash content, so there is no residue to buildup in molds.
- Chemically inactive, producing no adverse effect on rubber.

Rubber and elastomers product formulation guide

Product / Process	Function of PEG	Suggested CARBOWAX™ PEGs	Formulation guideline
Compounding	Dispersant	8000	5-10%
Processing (molding, extrusion, machining)	Lubricant/Mold release/Antistat	All	100% (applied from 1-5% aqueous solutions)
Latex	Processing aid/Coagulant	300, 300E, 400, 400E, 1450	2-5%
Ethylene copolymers	Plasticizer/Antistat	8000	1%
Tires (Air-bag, mounting, retreading)	Lubricant	300, 300E, 540 Blend	Pure PEG or with 1-10% water
Polystyrene molding	Mold release	1450	1%
Vulcanization	Heat transfer agent	300, 300E, 400, 400E	Pure PEG
Calendar sheeting operation	Release agent	300, 300E, 3350	2-5%

Find local contact information at **dow.com/contactus.**

CARBOWAX™ PEGs in wood treating

- Polyethylene glycol (PEGs) are valuable for the dimensional stabilization of wood and wood products, preventing shrinkage, cracking, and drying out.
- In green woods, especially those of highest quality, preliminary soaking in PEG solution can permit kiln drying at higher temperatures without warping or cracking dangers. This also facilitates subsequent cutting and woodworking operations and provides permanent dimensional stabilization.

Wood treating formulation guide

Product / Process	Function of PEG	Suggested CARBOWAX™ PEGs	Formulation guideline
Dimensional stabilization of:			
Green woods	Bulking agent	1000	10-50% in water
Veneer	Dye carrier/Reactive site	3350	10-50% in water
Plywood	Bulking agent	200, 200E, 3350	10-50% in water
Preservation of waterlogged woods	Bulking agent	3350	10-50% in water
Preservative compositions	Thickening agent	3350	10-50% in water
Photooxidation preventors	Penetrant/Carrier for UV absorbers	400, 400E, 3350	10-50% in water

Dow Industrial Solutions

US

Toll Free 800 441 4DOW
989 832 1542

International

Europe / Middle East + 800 36 94 63 67
Italy + 800 783 825
Asia / Pacific + 800 77 76 77 76
+ 60 37 958 3392
South Africa + 800 99 5078

dow.com

Image: dow_58906540946

2000024765-6403

Form No. 118-01882-01-0923 S2D