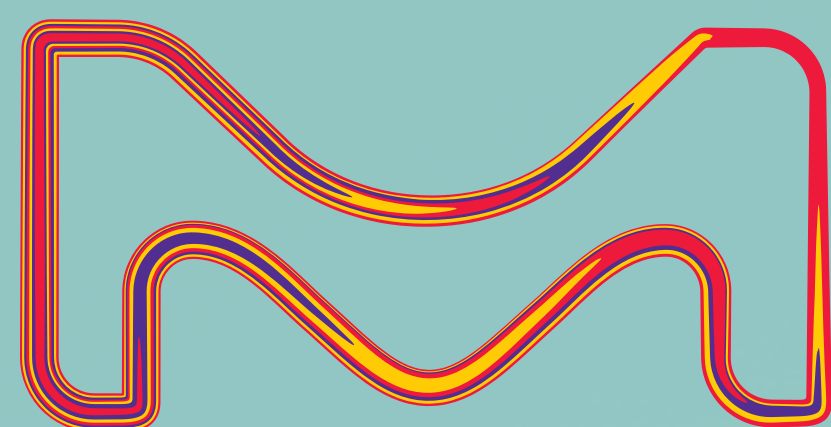


Cover your
raw material needs

Bench to Batch

**Polyethylene Glycol (PEG)
and Polyethylene Oxide (PEO)
for Medical Devices**



Polyethylene Glycol (PEG) and Polyethylene Oxide (PEO) for Medical Devices

Due to their solubility, biocompatibility, non-toxicity, and low immunogenicity, PEG and PEO materials are used in a wide variety of medical devices and medical device applications.

Let us support you with:

- Comprehensive portfolio of more than 450 well-defined PEGs available in quantities that support a seamless scale-up from R&D to production
- Wide range of molecular weights, end functionalities, reactivities, and polymer architecture for medical device development and production
- Consistent and reliable supply chain for risk mitigation, including dual-source and inventory management
- Custom packaging, additional QC testing and potential customization of PEG chemistry



M-Clarity is a program designed to help customers navigate our diverse MilliporeSigma product catalog, guiding them in selecting the appropriate quality for medical device R&D through manufacturing.



M-Clarity™ Program

select

the right product to meet your needs

The M-Clarity™ Program includes the majority of our Life Science products, classified into 6 MQ levels, MQ100 to MQ600:

- Each level provides specific documentation and services
- The levels have increasing attributes to meet your application and regulatory requirements
- Transparency allows you to select the right product for your needs

1

MOVE

smoothly through product development phases

Developing and manufacturing products is a complex process involving multiple suppliers and raw materials. Minimizing disruptions when moving from development to manufacturing requires a clear risk assessment.

The M-Clarity™ Program provides the perfect tool to guide the process of choosing components and raw materials, allowing for comparison of quality support and documentation, and ultimately minimizing costs and delays.

2

ENSURE

compliance by informed product selection

MQ levels provide transparency in the attributes of materials to support your regulatory requirements. The decision regarding the most relevant quality profile is driven by your specific needs for controlled and verified or validated processes as appropriate.

Leverage the M-Clarity™ Program to choose the appropriate products to develop your own risk assessment.

3



Learn more at
 SigmaAldrich.com/M-Clarity



Available Product Types



ICON KEY

 *Links to Sigma-Aldrich.com
summary page*

 *Links to summary page
within this document*



General Characterization and Usage

Functionality

- **Monofunctional:**
PEGylation, surface conjugation and nanoparticle coating
- **Homo/heterofunctional:**
Conjugation & crosslinking for hydrogels

Reactivity

- **Reactive end groups, such as an N-hydroxysuccinimide ester, thiol, or carboxyl groups:** Covalent conjugation
- **Azide or alkyne reactive groups:** Click chemistry for conjugation or hydrogen formation
- **Acrylate-terminate:** Polymerization and photopolymerization under mild reactive conditions

Polymer Architecture

- **Linear:**
PEGylation, bioconjugation and crosslinking
- **Multiarm (4-, 6-, 8-arm):**
Crosslinked into hydrogels and scaffolds for tissue engineering
- **Y-shaped:** PEGylation, as the branched structure may improve stability *in vivo*

Molecular Weight

- $M_w \leq \text{kDa}$: PEGylation of proteins
- $M_w \geq \text{kDa}$: Hydrogel formation of typical mesh size and mechanical properties, conjugation to small molecules, siRNA, and peptides
- $M_w < \text{kDa}$: Surface conjugation and crosslinking



Key Applications for PEGs in Medical Device Development

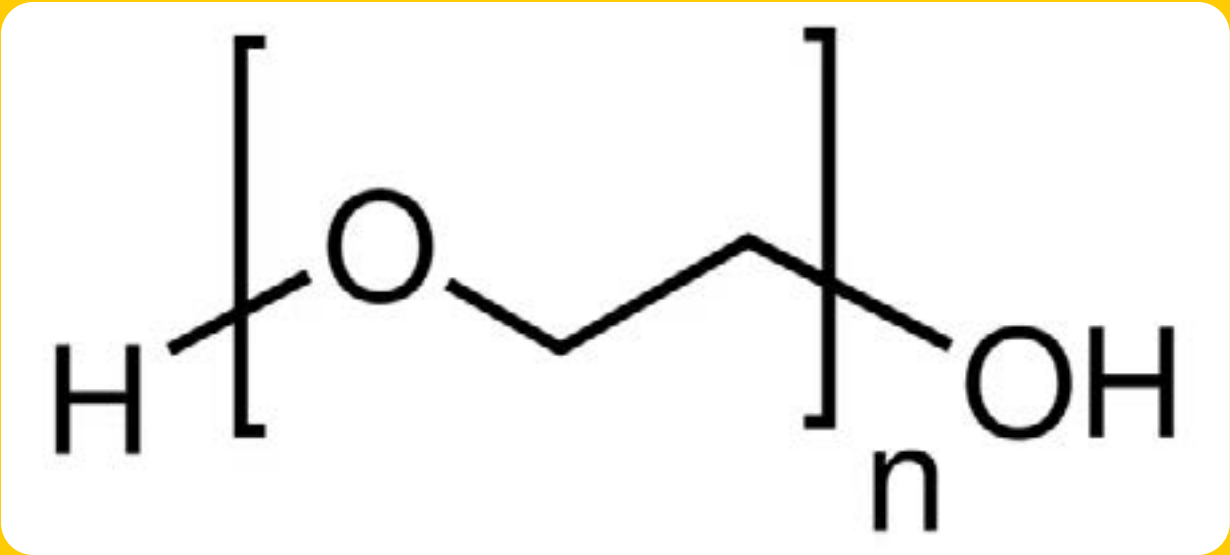
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summary page*

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within this document*



PEGs and PEOs



What’s the difference?

Poly(ethylene glycol) (PEG)

Molecular weight:
typically <~20,000 g/mol

Applications:
PEGylation, crosslinking, surface modification, drug delivery, hydrogels

Poly(ethylene oxide) (PEO)

Molecular weight:
typically >~20,000 g/mol

Applications:
Adhesives, coatings, thickeners, lubrication aids, water treatment, inks, electronics, agrochemicals

Product Highlights

Cat. No.	Description	Average M _n
202371	Poly(ethylene glycol)	300
202398		400
295906		2,050
202444		3,350
81260		6,000
P2139		8,000
81280		10,000
81300	Poly(ethylene oxide)	20,000
181986		100,000
181994		200,000
372773		400,000
372781		1,000,000
372803		2,000,000
189472		5,000,000
372838		8,000,000

For a full product list on our website, [click here >](#)



HETEROBIFUNCTIONAL PEGS

X-PEG-Y

Where X and Y are two different functional groups

Applications:
Crosslinkers or spacers between two different chemical entities conjugation linkers, such as conjugation links.

Product Categories

Reactivity	Functional Group
Amine reactive	Carboxylic acid
	Acetic acid
	NHS ester
	Biotin
Thiol reactive	Thiol
	Maleimide
	Mercaptoethyl ether
Carboxyl reactive	Amine
Acrylate reactive	Acrylate
	Methacrylate

Product Highlights

Cat. No.	Description	Average M _n
409537	Poly(ethylene glycol) methacrylate	360
409529		500
407348	Poly(ethylene glycol) phenyl ether acrylate	324
757810	Poly(ethylene glycol) 2-mercaptoethyl ether acetic acid	1,000
757829		2,000
757837		3,400
757845		5,000
757861	Poly(ethylene glycol) 2-aminoethyl ether acetic acid	1,100
757896		3,500
757705		10,100

For a full product list on our website, [click here >](#)



HOMOBIFUNCTIONAL PEGS

X-PEG-X

Contains two of the same functional group X

Applications:

- Hydrogels
- Crosslinking
- Coatings

Product Categories

Reactivity	Functional Group
Amine reactive	Diglycidyl ether
	Carboxymethyl ether
	Propionic acid
	NHS ester
	Carboxylic acid
Thiol reactive	Bis(cholorformate)
	Thiol
	Vinylsulfone
Carboxyl reactive	Acrylamide
	Amine
Acrylate reactive	Methacrylate
	Acrylate

Product Highlights

Cat. No.	Description	Average M _n
734616	Hexa(ethylene glycol) dithiol	314
335681	Ethylene glycol dimethacrylate	198
475629	Poly(ethylene glycol) diacrylate	250
437441		575
406996	Poly(ethylene glycol) bis (carboxymethyl) ether	250
407038		600
475696	Poly(ethylene glycol) diglycidyl ether	500
261548	Triethylene glycol dimethacrylate	286
172405	Tetraethylene glycol dimethyl ether	220
398802	Tetra(ethylene glycol) diacrylate	302
437468	Poly(ethylene glycol) dimethacrylate	750
445886		500
445894	Poly(ethylene glycol) dimethyl ether	1000
445908		2000
301477	Tri(ethylene glycol) bis(chloroformate)	275

For a full product list on our website, [click here >](#)



MONOFUNCTIONAL PEGS

PEG-X

Contains one functional group X

Applications:

- PEGylation of proteins, peptides, lipids
- Surface modification
- Nanoparticle coatings

Product Categories

Reactivity	Functional Group
Amine reactive	Succinimidyl
	Carboxymethyl Ester
	NHS
	Acetaldehyde T-butyl ester
Thiol reactive	Thiol
	Maleimide
	Mercaptopropionyl amine
Carboxyl reactive	Amine
	Hydrazide
Acrylate reactive	Methacrylate
	Acrylate

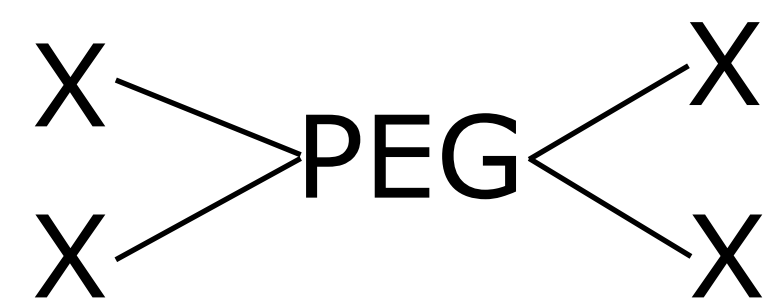
Product Highlights

Cat. No.	Description	Average M _n
457876	Poly(ethylene glycol) methyl ether methacrylate solution	2,000
447943	Poly(ethylene glycol) methyl ether methacrylate	500
202509		2,000
202487	Poly(ethylene glycol) methyl ether	550
81323		5,000
732613		20,000
90450		164
729108		800
729140	Poly(ethylene glycol) methyl ether thiol	2,000
729159		6,000

For a full product list on our website, [click here >](#)



MULTI-ARM PEGS



Contains multiple functional groups

Applications:

- Hydrogels
- Controlled release
- 3D cell culture scaffolds
- Wound healing
- Bioconjugation

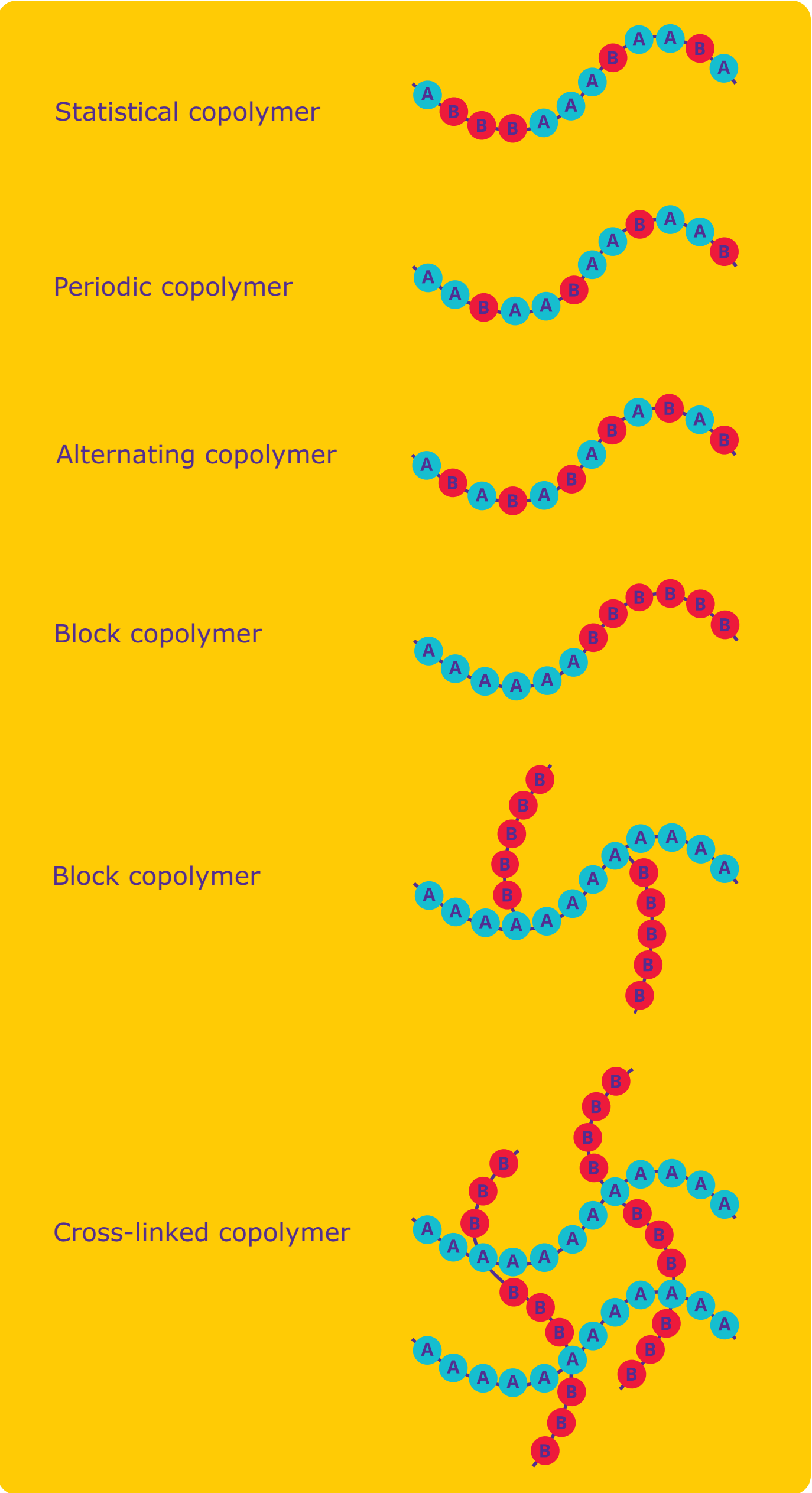
Product Categories

Shape	Description	Functional Group Options	Average M _n
Y-shaped	Amine Reactive Thiol Reactive	• NHS • Maleimide • Acetaldehyde	40,000
		• Amine • Thiol • Maleimide • Acrylate • Vinylsulfone • COOH • Succinimidyl Glutarate • Isocyanate • Succinimidyl Carboxymethyl Ester • Norbornene	2,000 5,000 10,000 20,000 40,000
8-arm	Amine Reactive Thiol Reactive Acrylate Reactive Carboxyl Reactive	• Norbornene • Vinylsulfone • Thiol • Maleimide • Amine • Acrylate	10,000 15,000 20,000 40,000

For a full product list on our website, [click here >](#)



PEG COPOLYMERS



Product Categories

Shape

Description

Poly(ethylene glycol) methyl ether-block-poly(lactide-co-glycolide)
(PEG-PLGA)

Amphiphilic biodegradable block copolymer used in drug delivery, PEGylation, controlled release applications.

Poly(ethylene glycol)-block-poly(propylene glycol)-block-poly(ethylene glycol)
(PEG-PPG-PEG)

Triblock copolymer consisting of hydrophilic PEG and hydrophobic PPG allowing the polymer to interact with both water and oil phases. Can be used as a surfactant, lubricant, defoamer, drug delivery system.

Polyethylenimine-block-poly(ethylene glycol)
(PEG-PEI)

Cationic copolymer used in nucleic acid and oligonucleotide delivery and improves transfection efficiency.

Poly(ethylene glycol)-block-poly(ε-caprolactone)
(PEG-PCL)

Biodegradable, biocompatible copolymer used in hydrophobic drug delivery, controlled release, surface coatings, and hydrogels.

Poly(ethylene glycol)-block-poly(lactide)
(PEG-PLA)

Biodegradable, biocompatible copolymer used in drug delivery of vaccines, small molecules, and proteins. Can be used as device coating for controlled release.

For a full product list on our website, [click here >](#)





Key Applications for PEGs

Key PEGs for Dental Development



Cat. No.	Name	Average Mol. Wt./Purity
<u>729094</u>	Poly(ethylene glycol) diacrylate	Average M_n 10,000, acrylate, MEHQ as inhibitor
<u>806757</u>	Poly(ethylene glycol) diacrylate	mol wt 3350, 0.2 μ m filtered
<u>409510</u>	Poly(ethylene glycol) dimethacrylate	average M_n 550, 80-120 ppm MEHQ as inhibitor, 270-330 ppm BHT as inhibitor
<u>437468</u>	Poly(ethylene glycol) dimethacrylate	average M_n 750, contains 900-1100 ppm MEHQ as inhibitor

For more information [click here >](#)



Key PEGs for Ophthalmic Contact Lens Applications



Cat. No.	Name	Average Mol. Wt./Purity
<u>407348</u>	Poly(ethylene glycol) phenyl ether acrylate	average M_n 324, contains 150-350 ppm MEHQ as inhibitor
<u>335681</u>	Ethylene glycol dimethacrylate	98%, contains 90-110 ppm monomethyl ether hydroquinone as inhibitor
<u>398802</u>	Tetra(ethylene glycol) diacrylate	contains 150-200 ppm MEHQ as inhibitor, 100-150 ppm HQ as inhibitor
<u>437433</u>	Di(ethylene glycol) diacrylate	75%

For more information [click here >](#)



Key PEGs for Optical Coating Applications

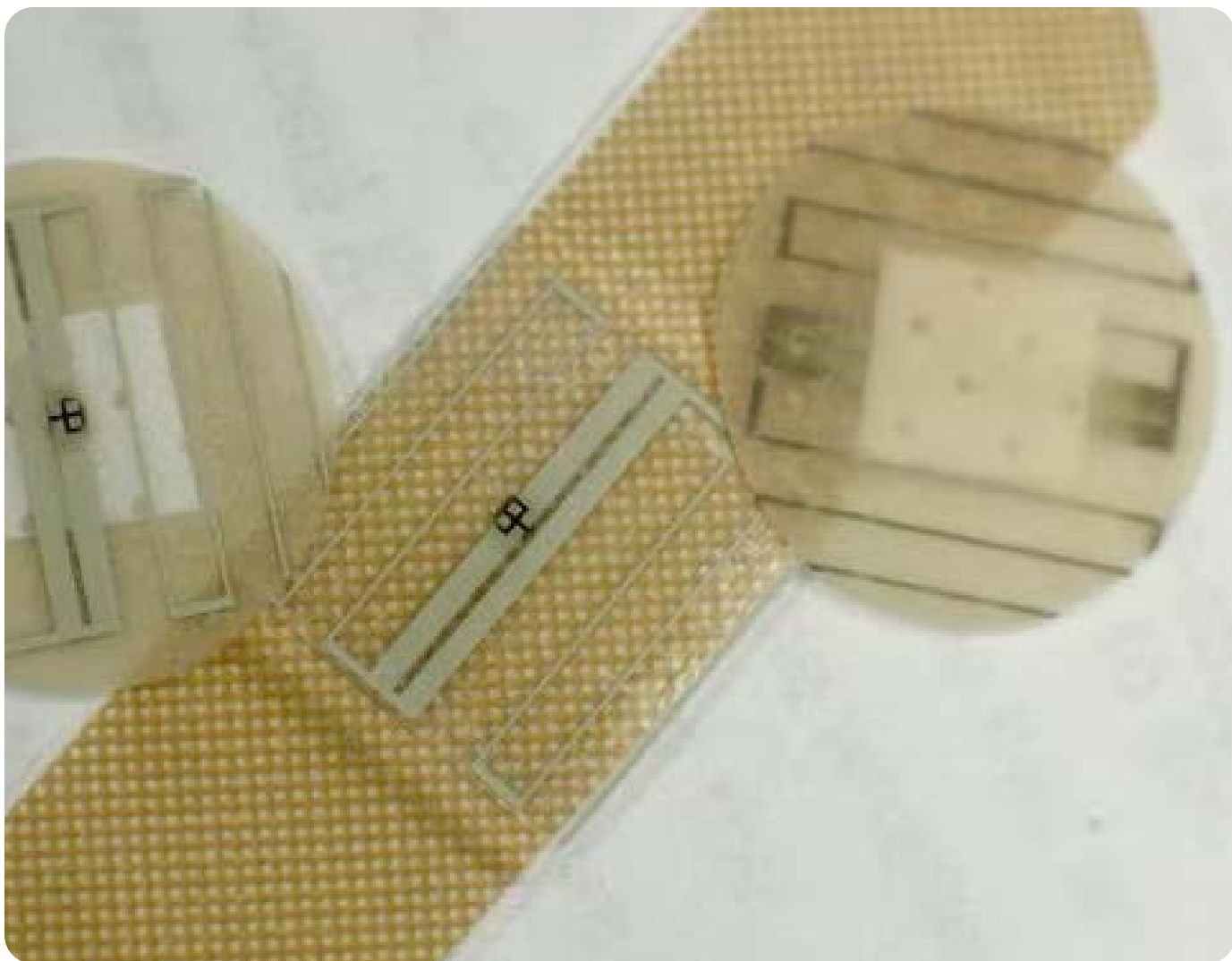


Cat. No.	Name	
202371	Poly(ethylene glycol)	average M_n 300, hydroxyl
90450	Triethylene glycol monomethyl ether	purum, $\geq 97.0\%$ (GC)
202398	Poly(ethylene glycol)	average M_n 400, hydroxyl

For a more information [click here >](#)



Key PEGs for Diagnostic Development Applications



Cat. No.	Name	Average Mol. Wt./Purity
<u>189456</u>	Poly(ethylene oxide)	average M_v ~900,000, powder, hydroxyl, BHT as inhibitor
<u>81310</u>	Poly(ethylene glycol)	average M_n 35,000, hydroxyl
<u>181986</u>	Poly(ethylene oxide)	average M_v 100,000, powder, hydroxyl, BHT as inhibitor
<u>81210</u>	Poly(ethylene glycol)	average MW 1,500
<u>P2139</u>	Poly(ethylene glycol)	average M_n 8,000, hydroxyl
<u>261548</u>	Triethylene glycol dimethacrylate	contains 80-120 ppm MEHQ as inhibitor, 95%
<u>202401</u>	Poly(ethylene glycol)	average M_n 600, waxy solid (moist)
<u>372781</u>	Poly(ethylene oxide)	average M_v ~1,000,000, powder, hydroxyl, BHT as inhibitor
<u>445886</u>	Poly(ethylene glycol) dimethyl ether	average M_n ~500, contains 100 ppm BHT as stabilizer
<u>202371</u>	Poly(ethylene glycol)	average M_n 300, hydroxyl
<u>P4338</u>	Poly(ethylene glycol)	average M_n 3,350, hydroxyl, BioXtra

For more information [click here >](#)



Key PEGs for Hydrogel Applications



Cat. No.	Name	Average Mol. Wt./Purity
729086	Poly(ethylene glycol) diacrylate	average M_n 1,000, contains MEHQ as inhibitor
701963	Poly(ethylene glycol) diacrylate	average M_n 6,000, contains ≤ 1500 ppm MEHQ as inhibitor
729094	Poly(ethylene glycol) diacrylate	average M_n 10,000, contains MEHQ as inhibitor
767549	Poly(ethylene glycol) diacrylate	average M_n 20,000, contains ≤ 1000 ppm MEHQ as inhibitor
409510	Poly(ethylene glycol) dimethacrylate	average M_n 550, contains 80-120 ppm MEHQ as inhibitor, 270-330 ppm BHT as inhibitor
202495	Poly(ethylene glycol) methyl ether	average M_n 750

For more information [click here >](#)



Optimizing Product Scale-Up

Your Partner for Manufacturing Success

Scaling up a product from bench to manufacturing is never an easy process.

Considerations about supply chain, batch consistency, production standardizations, and packaging are just a few of the critical aspects of moving a product to manufacturing.

Choosing a manufacturing partner with long-standing expertise and global materials sourcing and production can greatly improve the scale-up of your new product.

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For more information, visit
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