

# VISIONER®

The first choice in methacrylate solutions



## VISIONER®

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The story of methacrylates at Evonik starts with Otto Röhm.



Everything old is new again: Besides traditional uses, methacrylate monomers also provide benefits for a variety of modern applications.

## VISIOMER® – more than 80 years of expertise in methacrylate monomers

In 1901, Dr. Otto Röhm, a pioneer in methacrylate polymer chemistry, paved the way for a longstanding tradition of innovation within Evonik Industries.

With large-scale industrial production of methacrylate monomers and polymers already on the rise in the 1930s, Evonik developed into a preferred partner for methacrylate solutions globally.

Today, the standard portfolio includes more than 40 monomers, offering a versatile toolbox to solve literally any challenge in a broad range of application areas. As a consequence of running at the forefront of innovation, Evonik's methacrylate labs have developed more than 400 different monomers over the past decades. As Evonik continues to embrace the innovative spirit of its founders, a personal invitation goes out to our customers to help add new pages to the book for outstanding cooperation.

VISIOMER®, Evonik's global trademark for methacrylate monomers, stands for high-quality products, global service, and comprehensive expertise.





## VISIONER® – the first choice in methacrylate solutions

Besides one of the broadest product portfolios available, Evonik offers various services and broad expertise in the field of methacrylates:

- Broad product portfolio, including methacrylate monomers based on bio-renewable resources
- Global, state-of-the-art production network, high expertise in technology development & engineering
- Global sales, logistics and technical service network
- Expertise in applications for methacrylates, support for polymerization methods and analysis

- R&D support, customized solutions
- Expertise in HCN production technology

From joint product development and specialized technical support to vendor-managed inventory and warehousing, we develop solutions by means of strategic partnerships. From production to application, we provide know-how for start-to-finish solutions. Through our international network of ISO 9001 certified, strategically located and integrated production facilities, we are able to develop tailored solutions based on the local needs of our customers, while guaranteeing consistently high quality products.





1. PVC Modifier
2. Waste Water Treatment
3. Anaerobic Adhesives
4. Industrial Coatings
5. Cosmetics/Hair Care
6. Contact Lenses
7. Electronic Applications
8. Paper Sizing Agents
9. Packaging Coatings
10. Textile Coatings
11. Concrete Additives
12. Wood Coatings
13. Architectural Coatings
14. Structural Adhesives
15. Rubber Modification
16. PVC Plastics
17. Metal Impregnation
18. Chemical Anchoring
19. Automotive Coatings
20. Plastics

## A broad range of products for a variety of applications

Versatile properties make methacrylate monomers the product of choice for a variety of applications. Hard or soft, hydrophobic or hydrophilic, VISIOMER® methacrylate monomers offer functionality and flexibility to solve specific application and performance challenges.

Methacrylate monomers can be found everywhere, and in places you'd never expect. Discover inspiring examples in paints and coatings, automotive, construction, adhesives, and cosmetic applications, just to name a few.

## VISIONER® Terra – methacrylate monomers based on bio-renewable raw materials

The partially bio-based products in our standard portfolio are grouped under the product family VISIONER® Terra to highlight their origin from bio-renewable raw materials.

Sustainability is one of our guiding principles. Count on us as your partner for sustainable solutions tailored to your specific needs. In addition to analyzing and reducing the carbon footprint throughout the supply chain, we develop processes with the highest possible degree of resource efficiency. Another key aspect of constantly challenging and improving sustainability performance is the use of bio-based raw materials. Our motivation is both to use bio-renewable raw materials and to offer added value in the end applications.

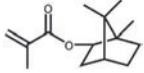
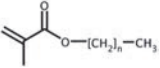
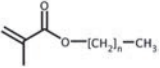
With VISIONER® Terra we provide a range of partially bio-based products that deliver excellent performance in different applications. Furthermore, we dedicate significant resources to developing new bio-based products and

exploring options to produce existing products with a reasonable bio-content in the future.

Our high-solid monomer VISIONER® Terra IBOMA offers a partially bio-based raw material source and brings environmental benefits to the end use applications as well. Its main raw material, camphene, is made from 100% renewable feedstock. Camphene is mainly produced from pine tree resin, which can be harvested without harming the pine trees. VISIONER® Terra IBOMA enables the formulation of environmentally friendly paint resins with a lower volatile organic compound (VOC) content, and reduces resin viscosity.

VISIONER® Terra C13-MA and VISIONER® Terra C17.4-MA improve water repellency and resistance against polar solvents, and are typically used to increase the hydrophobicity of resins. Both products are based on raw materials recovered from natural oils.

### The VISIONER® Terra product family

VISIONER® Terra product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Glass transition temperature Tg °C	Standard stabilization ppm MEHQ*	Bio-content**
IBOMA	Isobornyl methacrylate	 CAS No. 7534-94-3	222.3	258/0.6	150	150±30	71%
C13-MA	Methacrylic ester 13.0	 CAS No. 90551-76-1	268.0	>300/1013	-46	100±25	76%
C17.4-MA	Methacrylic ester 17.4	 CAS No. 90551-84-1	330.0	>250/1013	-22	100±25	81%

\* MEHQ = Hydroquinone monomethyl ether

\*\* Calculated as a ratio of C-number alcohol to C-number methacrylate







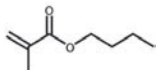
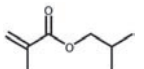


## The VISIOMER® methacrylate monomer portfolio

VISIOMER® offers a unique modular system for tailoring desired product properties in various end use applications. The standard product range covers basic methacrylates, alkyl/aryl methacrylates, hydroxyesters, aminofunctional monomers, methacrylamides, ether methacrylates, crosslinkers, wet adhesion monomers, specialty methacrylates, and specialty cyanohydrins. Should you be looking for further methacrylate derivatives not listed here, please do not hesitate to contact us.

We are your experienced partner for developing customized products based on methacrylate chemistry. For decades, new monomers have been developed resulting in specific property enhancements as well as specialized grades of existing products. These are all tailored to the specific needs of our customers. If you have a question or are about to start a new project, contact us today so we can begin working on the future together!

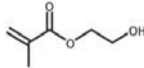
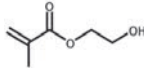
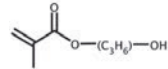
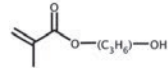
### Basic methacrylates

VISIOMER® product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Glass transition temperature Tg °C	Standard stabilization ppm MEHQ*	Main applications
MMA	Methyl methacrylate	 CAS No. 80-62-6	100.1	100/1013	105	100±10	Coatings, plastics, reactive resins
GMAA	Methacrylic acid	 CAS No. 79-41-4	86.1	161/1013	185	200±20	Coatings, reactive resins, fiber
n-BMA	n-Butyl methacrylate	 CAS No. 97-88-1	142.2	163/1013	20	100±10	Coatings, plastics, reactive resins
i-BMA	i-Butyl methacrylate	 CAS No. 97-86-9	142.2	155/1013	53	100±10	Coatings, reactive resins

Basic methacrylates such as VISIOMER® MMA, n-BMA and i-BMA are used as building blocks in a wide range of applications, such as paints, reactive resins, waterborne coatings, adhesives and many others. These monomers provide very good exterior durability and color stability. VISIOMER® MMA, which has a glass transition temperature of 105 °C, is used wherever hardness and thermo-mechanical stability is needed. VISIOMER® n-BMA and i-BMA, on the other hand, provide flexibility due to softening temperatures of 20 °C and 50 °C. VISIOMER® GMAA is used as building block in applications like paints, dispersions or construction chemicals. It confers specific properties, such as improved freeze-thaw resistance, colloidal stability in emulsion, and enhanced film adhesion.

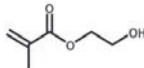


## Hydroxyesters

VISIOMER® product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Glass transition temperature Tg °C	Standard stabilization ppm MEHQ	Main applications
HEMA 97	2-Hydroxyethyl methacrylate	 CAS No. 868-77-9	130.1	213/1013	55	200±20	Coatings, reactive resins, adhesives
HEMA 98	2-Hydroxyethyl methacrylate	 CAS No. 868-77-9	130.1	213/1013	55	200±20	Coatings, reactive resins
HPMA 97	Hydroxypropyl methacrylate	 CAS No. 27813-02-1	144.2	209/1013	73	200±20	Coatings, reactive resins, adhesives
HPMA 98	Hydroxypropyl methacrylate	 CAS No. 27813-02-1	144.2	209/1013	73	200±20	Coatings, reactive resins

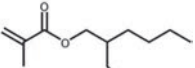
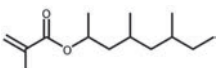
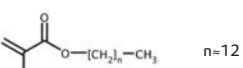
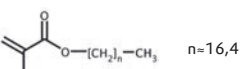
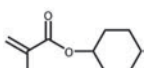
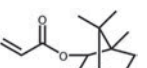
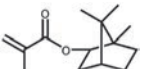
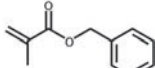
Hydroxyesters are recommended for heat or room temperature cured coatings with permanent marring and solvent resistance, high gloss retention and weatherability. Hydroxyfunctional prepolymers, for example, can be crosslinked via melamine resins, blocked isocyanates (one-component systems), or multifunctional isocyanates (two-component systems). Hydroxyesters also serve as adhesion promoters in reactive resins for bonding to metal surfaces.

## HEMA for contact lenses

VISIOMER® product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Glass transition temperature Tg °C	Standard stabilization ppm MEHQ	Main applications
UHP HEMA	Ultra high purity 2-Hydroxyethyl methacrylate	 CAS No. 868-77-9	130.1	213/1013	55	10±3	Contact lenses

VISIOMER® UHP HEMA enables the production of dimensionally stable soft contact lenses with high oxygen permeability and water uptake to ensure optimum wear comfort.

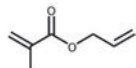
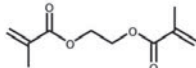
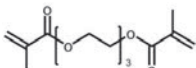
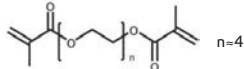
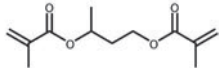
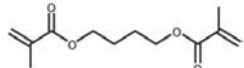
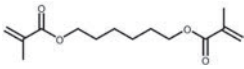
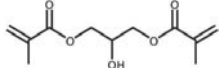
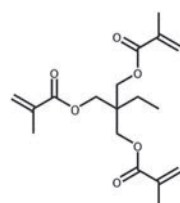
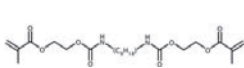
## Alkyl/aryl (meth)acrylates

VISIOMER® product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Glass transition temperature Tg °C	Standard stabilization ppm MEHQ	Main applications
EHMA	2-Ethylhexyl methacrylate	 CAS No. 688-84-6	198.3	218/1013	-10	50±10	Coatings, absorbing materials
IDMA	Isodecyl methacrylate	 CAS No. 29964-84-9	226.0	>250/1013	-30	100±25	Coatings, adhesives
Terra C13-MA	Methacrylic ester 13.0	 CAS No. 90551-76-1	268.0	>300/1013	-46	100±25	Coatings, adhesives
Terra C17.4-MA	Methacrylic ester 17.4	 CAS No. 90551-84-1	330.0	>250/1013	-22	100±25	Coatings, adhesives
c-HMA	Cyclohexyl methacrylate	 CAS No. 101-43-9	168.2	210/1013	110	50±5	Coatings, adhesives
IBOA	Isobornyl acrylate	 CAS No. 5888-33-5	208.3	275/1013	96	250±25	Coatings, radiation curing
Terra IBOMA	Isobornyl methacrylate	 CAS No. 7534-94-3	222.3	258/1013	150	150±30	Coatings, adhesives
BNMA	Benzyl methacrylate	 CAS No. 2495-37-6	176.0	243/1013	54	50±5	Coatings, reactive resins

Alkyl methacrylate monomers are primarily used as building blocks for polymeric binders, generally known as synthetic resins. The excellent weather resistance of methacrylate polymers results from their purely aliphatic structure and effective steric hindrance of the polymer chains. There is hardly any oxidative degradation or ester hydrolysis in methacrylate polymers, as impressively demonstrated by the longevity of acrylic glass products. With our range of monomers, polymer softening temperatures can be adjusted from approx. -70 °C to 150 °C. Polymers of long-chain esters, such as VISIOMER® Terra C17.4-MA, show waxlike polymer properties in their natural state. Esters with bulky side chains provide solution polymers with reduced viscosity, thus allowing a higher solids content.



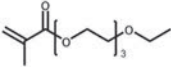
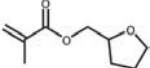
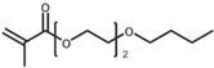
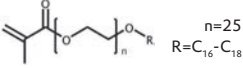
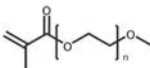
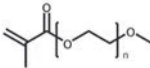
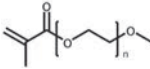
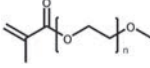
## Crosslinkers

VISIONER® product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Standard stabilization ppm MEHQ	Main applications
AMA	Allyl methacrylate	 CAS No. 96-05-9	126.2	141/1013	100±20	Modifiers & processing aids
EGDMA	Ethylene glycol dimethacrylate	 CAS No. 97-90-5	198.2	240/1013	100±20	Reactive resins, rubber, dental compounds
TRGDMA	Triethylene glycol dimethacrylate	 CAS No. 109-16-0	286.3	>250/1013	150± 30	Reactive resins, dental compounds
PEG200DMA	Polyethylene glycol 200 dimethacrylate	 CAS No. 25852-47-5	336.0	>200/0.13	200±20	Adhesives, contact lenses
1,3-BDDMA	1,3-Butanediol dimethacrylate	 CAS No. 1189-08-8	226.3	>211/1013	200±20	Reactive resins, rubber
1,4-BDDMA	1,4-Butanediol dimethacrylate	 CAS No. 2082-81-7	226.3	> 200/1013	100±10	Reactive resins, plastics
1,6-HDDMA	1,6-Hexanediol dimethacrylate	 CAS No. 6606-59-3	254.0	≈190/1013	200±20	Reactive resins, elastomers
GDMA	Glycerol dimethacrylate	 CAS No. 1830-78-0	228.2	110/1013	200±20	Adhesives
TMPTMA	Trimethylol-propane trimethacrylate	 CAS No. 3290-92-4	338.3	>200 /1013	100±10	Rubber, reactive resins
HEMATMDI	Diurethane dimethacrylate	 CAS No. 72869-86-4	471.0	283/1013	225±25 <sup>1)</sup>	Dental compounds, radiation curing

<sup>1)</sup> BHT: 2,6-Di-tert-butyl-4-methylphenol

These products are characterized by a minimum of two polymerizable groups in one molecule. Polymerization leads to crosslinked and insoluble structures. Allyl methacrylate offers exceptional performance with two double bonds of different reactivity, allowing graft copolymerization in emulsions. Crosslinkers are ideally suited for hot and cold curing reactive adhesives and for peroxide crosslinking of high performance elastomers due to their low volatility and high reactivity.

## Ether methacrylates

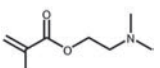
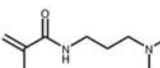
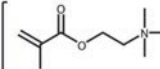
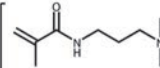
VISIOMER® product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Glass transition temperature Tg °C	Standard stabilization ppm MEHQ	Applications
ETMA	Ethyltriglycol methacrylate	 CAS No. 39670-09-2	246.3	292/1013	-31	100±25	Reactive resins
THFMA	Tetrahydrofurfuryl methacrylate	 CAS No. 2455-24-5	170.2	222/1013	40	100±10 + 150±15 <sup>1)</sup>	Adhesives
BDGMA	Butyl diglycol methacrylate	 CAS No. 7328-22-5	230.3	271/1013	-	100±25	Coatings, reactive resins
C18 PEG 1105 MA W	Methacrylic ester (25 EO) C16-C18 fatty alcohol (in water/GMAA)	 CAS No. 70879-51-5	1432	200/1013	-	200±20 150±20 <sup>2)</sup>	Emulsion polymers, cosmetics
MPEG 750 MA W	Methoxypolyethylene glycol 750 methacrylate (50% in water)	 CAS No. 26915-72-0	818	100/1013	-	200±20	Emulsion polymers, cosmetics
MPEG 1005 MA W	Methoxypolyethylene glycol 1000 methacrylate (50% in water)	 CAS No. 26915-72-0	1000	100/1013	-	200±20	Construction, emulsifiers
MPEG 2005 MA W	Methoxypolyethylene glycol 2000 methacrylate (50% in water)	 CAS No. 26915-72-0	2000	100/1013	-	200±20	Construction, emulsifiers
MPEG 5005 MA W	Methoxypolyethylene glycol 5000 methacrylate (50% in water)	 CAS No. 26915-72-0	5000	100/1013	-	200±20	Construction, emulsifiers

<sup>1)</sup> BHT: 2,6-Di-tert-butyl-4-methylphenol <sup>2)</sup> 2,4-Dimethyl-6-tert-butylphenol

The favorable solution property of the ether functionality is combined with the high monomer reactivity of the methacrylate functionality. Unbranched ether methacrylates behave as internal plasticizers and provide polymers with very low glass transition temperatures. Due to their low volatility, VISIOMER® ETMA, THFMA and BDGMA can be used as reactive diluents for reactive systems. Long polyether side chains make the corresponding polymers water-soluble and capable of ion chelation.

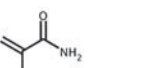
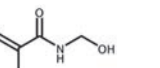


## Aminofunctional monomers

VISIONER® product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Glass transition temperature Tg °C	Standard stabilization ppm MEHQ	Applications
MADAME™	2-Dimethylaminoethyl methacrylate	 CAS No. 2867-47-2	157.2	182/1013	18	800±80	Paper & water, coatings, cosmetics
DMAEMA	3-Dimethylaminoethyl methacrylate	 CAS No. 5205-93-6	170.0	263/1013	96	675±75	Paper & water, oil & gas
TMAEMC	Trimethylammoniumethyl methacrylate chloride (aqueous solution)	 CAS No. 5039-78-1	207.7	100/1013	-	600±60	Paper & water, cosmetics
MAPTAC	3-Trimethylammoniumpropyl methacrylamide chloride (aqueous solution)	 CAS No. 51410-72-1	220.5	100/1013	-	200±20	Paper & water, cosmetics

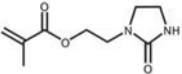
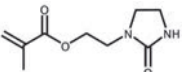
Predominantly used in their quaternized form, these products provide water-soluble cationic polymers. Combining these products with either hydrophilic or hydrophobic co-monomers results in a wide variation of the physical properties of the resulting polymers. Copolymers containing these monomers are excellent flocculation agents and can furthermore be used as cationic thickeners.

## Methacrylamides

VISIONER® product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Glass transition temperature Tg °C	Standard stabilization ppm MEHQ	Applications
MAAamide	Methacrylamide	 CAS No. 79-39-0	85.1	215/1013	250	-	Textile coatings, plastics
N-MMAA	N-Methylol methacrylamide (aqueous solution)	 CAS No. 923-02-4	115.1	100/1013	59	120±20	Textile

Combinations of methacrylamide and acetal-modified methacrylamides are recommended for heat-activated self-crosslinking resins. VISIONER® MAAamide alone can be used as a polar co-monomer with a high Tg for improving solvent resistance and cohesion. For specific applications, methacrylamide can be grafted onto natural fibers (silk weighting).

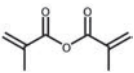
## Wet adhesion monomers

VISIOMER® product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Standard stabilization ppm MEHQ	Applications
MEEU 50 W	N-(2-Methacryloyloxyethyl) ethylene urea (50% in Water)	 CAS No. 86261-90-7	198.2	100/1013	900±100 <sup>1)</sup>	Architectural coatings
MEEU 25 M	N-(2-Methacryloyloxyethyl) ethylene urea (25% in methyl methacrylate)	 CAS No. 86261-90-7	198.2	100/1013	500±100 <sup>1)</sup>	Architectural coatings

<sup>1)</sup> MEHQ mixture

The benefit of our VISIOMER® MEEU ureidofunctional monomer becomes evident in emulsion polymers that are able to provide desired wet adhesion properties. It improves the adhesion properties of the emulsion polymers, especially on wood or aged alkyd paint surfaces, as well as the wet scrub resistance of the final products.

## Specialty methacrylates



VISIOMER® product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Standard stabilization ppm MEHQ	Applications
MAAH	Methacrylic anhydride	 CAS No. 760-93-0	154.2	200/1013	2000±200 <sup>1)</sup>	Synthesis

<sup>1)</sup> 2,4-Dimethyl-6-tert-butylphenol

VISIOMER® MAAH is a highly reactive material suitable for manufacturing specialty monomers.



## Specialty cyanohydrins

VISIOMER® product	Chemical name	Formula	Molecular weight g/mol	Boiling point °C/hPa	Standard stabilization ppm MEHQ	Applications
ECH	Ethylene cyanohydrin	 CAS No. 109-78-4	71	228/1013	-	Synthesis
ACH	Acetone cyanohydrin	 CAS No. 75-86-5	85.1	82/31	1000–3000 <sup>1)</sup>	Synthesis

<sup>1)</sup> sulfuric acid

Based on our highly flexible production processes for this wide variety of monomers, we have developed expertise in a number of key technologies, enabling us to offer several intermediate products suitable for organic synthesis.

## EHSQ information

For all VISIOMER® products, technical data sheets are available that provide information on purity standards and physical product properties as well as TSCA registration and storage conditions. Safety data sheets, according to GHS standards, are also available for all products.

It is our aim to have our products registered and listed within chemical inventories according to the regional legislative rules. One example are the REACH Regulations (REACH = Registration, Evaluation, Authorization and Restriction of Chemicals).

For any questions with regard to safety, handling, or the current status of registration of our monomers, please refer to the safety data sheet or contact our customer service department.

The contact details can be found on the back cover of this brochure.

Above and beyond existing legal requirements, all products and services promoted under the VISIOMER® trademark adhere to the corporate policies, guidelines and initiatives of Evonik Industries AG.

These include, but are not limited to, Responsible Care, Chemicals Management System, REACH and many more.

For additional details, please visit the Evonik Industries official website:

<http://corporate.evonik.com/en/responsibility/pages/default.aspx>

VISIOMER®	Basic methacrylates				Hydroxyesters			Alkyl/aryl(meth)acrylates								Crosslinkers			
	MMA	GMAA	n-BMA	i-BMA	HEMA 97/98	HPMA 97/98	UHP HEMA	EHMA	IDMA	Terra C13-MA	Terra C17.4-MA	c-HMA	IBOA	Terra IBOMA	BNMA	AMA	EGDMA	TRGDMA	PEG200DMA
<b>1. Paints &amp; Coatings</b>																			
1.1 Solvent-borne coatings	•	•	•	•				•	•	•	•	•	•	•	•				
1.2 Reactive coatings (OEM, industrial)	•	•	•	•	•	•		•	•	•	•	•	•	•	•				
1.3 Water borne coatings	•	•	•	•									•						
<b>2. Emulsions</b>																			
2.1 Emulsion polymers	•	•	•	•									•						
<b>3. Performance products</b>																			
3.1 Silk grafting																			
3.2 Textile coating/fiber bonding	•	•			•	•													
3.3 Oil and gas applications	•	•						•	•	•	•								
3.4 Emulsifiers, dispersants & thickeners		•																	
3.5 Floor care products	•	•	•	•	•	•		•	•										
<b>4. Paper and water</b>																			
4.1 Flocculants																			
4.2 Retention and dewatering aids																			
4.3 Sizing additives																			
<b>5. Reactive systems</b>																			
5.1 Reactive adhesives and sealants	•	•	•	•	•	•		•	•	•	•	•	•	•	•		•	•	•
5.2 Photopolymer plates and photoresists	•	•			•	•							•	•				•	•
5.3 Additives for PVC plastisols																	•		
5.4 Radiation curing					•	•							•						
5.5 Chemical Fixing					•	•											•		
<b>6. Health and personal care</b>																			
6.1 Dental compounds	•		•	•													•	•	
6.2 Cosmetics																			
6.3 Contact lenses							•										•	•	•
6.4 Pharmaceutical Applications	•	•																	
6.5 Absorbent materials								•									•	•	•
<b>7. Plastics &amp; Elastomers</b>																			
7.1 Acrylic sheet/molding compounds	•																		
7.2 Modifiers and processing aids	•		•														•		
7.3 Rubber additives		•															•		
<b>8. Composites</b>																			
8.1 Artificial marble/solid surface	•																•		
8.2 UPV/VER	•	•			•	•												•	•
8.3 Fiber bonding		•																	
<b>9. Intermediates for synthesis</b>																			
9.1 Building blocks																•			

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**VISIONER<sup>®</sup>**

The first choice in methacrylate solutions

## NAFTA

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® = registered trademark

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