



who advances  
drug delivery?

—  
we do.

pharmaceutical product and solution guide



[ashland.com](http://ashland.com) / efficacy usability allure integrity profitability™

# advancing drug delivery

Ashland's pharmaceutical team prides itself on advancing drug delivery with sophisticated science-based solutions. Our global centers of excellence contain the latest equipment and our research scientists and formulators are ready to work with you from concept to commercialization.

We meet formulators' needs by providing an unparalleled range of excipients and technologies, as well as longstanding polymer expertise and technical support for oral solids, liquids, and parenteral dosage forms. Our solutions include:

- o controlled release technologies
- o tablet binders
- o disintegrants
- o solubilizers
- o stabilizers
- o rheology modifiers

Our full line of products combined with our global research and development capabilities can help deliver your drugs when and where they're needed resulting in better outcomes for patients and pharmaceutical companies alike.

# helping to ensure the efficacy, integrity and usability of pharmaceutical formulations

At Ashland, our number one goal is to help you apply pharmaceutical polymers in ways that ensure the **efficacy, integrity** and **usability** of your formulations. Explore how our molecular scientists, chemists, formulation development scientists and process engineers can help advance formulation development, support the commercialization of complex drug molecules, and reduce time to market. Our problem-solving team leverages a diverse polymer portfolio to enable comprehensive solutions, so when you're ready to develop a formulation, we've got you covered.

	application											process			
	tablet binding	modified release	tablet film coating	drug solubilization	disintegration	lyophilization stabilizer	liquid rheology modification	suspending agent	stabilizer	crystallization inhibitor	parenteral/injectable controlled release	hot-melt extrusion	wet granulation	direct-compression tableting	continuous manufacturing
<b>cellulosics – pages 6 - 11</b>															
klucel™ hydroxypropylcellulose	✓	✓	✓				✓					✓	✓	✓	✓
benecel™ methylcellulose and hypromellose	✓	✓		✓			✓			✓			✓	✓	✓
natrosol™ 250 hydroxyethylcellulose		✓					✓						✓		✓
aqualon™ ethylcellulose Ashland® EC pharm ultra	✓	✓	✓									✓	✓	✓	✓
aqualon and blanosel™ sodium carboxymethylcellulose	✓	✓	✓			✓	✓	✓		✓	✓		✓		✓
<b>vinyl pyrrolidones – pages 12 - 13</b>															
plasdone™ S-630 copovidone	✓		✓	✓						✓		✓	✓	✓	✓
plasdone™ povidone c grades				✓		✓	✓	✓		✓	✓				✓
plasdone™ povidone k grades	✓			✓			✓			✓			✓		✓
polyplasdone™ crospovidone				✓	✓									✓	✓
pharmasolve™ N-methyl-2-pyrrolidone				✓							✓				
<b>bioresorbable polymers – pages 14 - 15</b>															
viatel™ bioresorbable polymers											✓	✓			✓
<b>cyclodextrins – pages 16 - 17</b>															
CAVAMAX®, cavitron™ and CAVASOL® cyclodextrins				✓		✓			✓						
<b>film coating systems – pages 18 - 21</b>															
aquarius™ film coating systems		✓	✓												✓

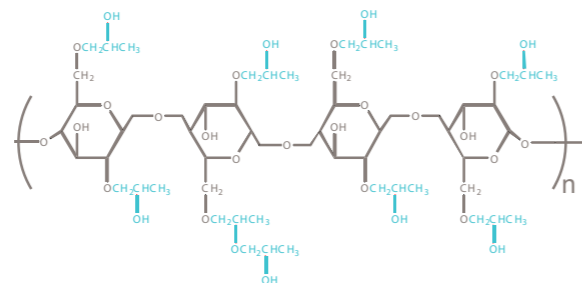
## Klucel™ hydroxypropylcellulose

Klucel™ hydroxypropylcellulose (HPC) provides a remarkable set of physical properties for tablet binding, modified release, film coating, and hot melt extrusion. The versatility of Klucel™ HPC is apparent in a variety of pharmaceutical applications. Low molecular weight grades provide not only unmatched, efficient tablet binding but also adhesive and elastic tablet coating. They can also be used in melt-extrusion applications. High molecular weight grades are typically used for modified release, especially in matrix tablets.

### features and benefits

- unsurpassed tablet hardness and friability
- excellent thermoplastic and mechanical properties for tablet binding
- produce smaller tablets and improve consumer usability
- soluble in aqueous and organic solvents
- excellent formulation performance in wet granulation, dry granulation, and hot melt extrusion
- fine particle size grades available for enhanced performance when dry processing
- save costs through improving yields and reducing the amount of other additives
- flexible films without plasticizers and non-tacky at high humidity

grade (X = Fine)	weight average molecular weight	typical brookfield viscosity (mPa*s)	solution concentration (%)
HF Pharm, HXF Pharm	1,150,000	1,500–3,000	1
MF Pharm, MXF Pharm	850,000	4,000–6,500	2
GF Pharm, GXF Pharm	370,000	150–400	2
JF Pharm, JXF Pharm	140,000	150–400	5
LF Pharm, LXF Pharm	95,000	75–150	5
EF Pharm, EXF Pharm, EXF Ultra Pharm	80,000	300–600	10
ELF Pharm	40,000	150–300	10



## Klucel™ EXF ultra hydroxypropylcellulose

Klucel™ EXF Ultra HPC takes tablet binding effectiveness to the next level. Need premium performance that assures formulation predictability, reliability and robustness? Klucel™ EXF Ultra HPC is your solution.

### features and benefits

- exceptional plasticity
- outstanding compressibility
- enhanced tablet strength
- enables smaller tablets
- low friability even at low usage levels
- low impact on disintegration time

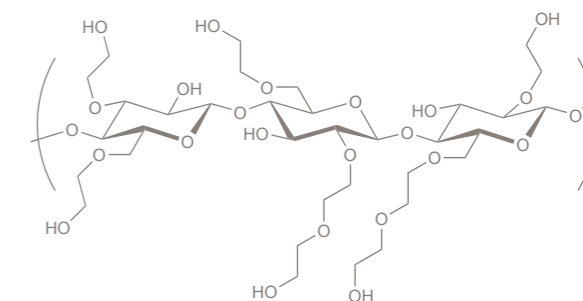
## Natrosol™ 250 hydroxyethylcellulose

Natrosol™ 250 hydroxyethylcellulose (HEC) is a nonionic water-soluble cellulose ether. Natrosol™ 250 HEC is easily dispersed in cold or hot water to give solutions of varying viscosities and desired properties, though it is insoluble in organic solvents. It is used in solutions and gels to control rheology, in emulsions for high-salt tolerance and surfactant compatibility and in modified-release matrix tablets, where high-viscosity grades provide effective diffusion-limiting release of active pharmaceutical ingredients (API) with low water solubility.

### features and benefits

- any desired thickening efficiency can be achieved with the wide variety of grades available
- compatible in solutions with many inorganic salts, as well as with a broad range of other materials such as surfactants, solubilizers, and preservatives
- stable over a broad pH range, with the viscosity of the solutions being largely unaffected
- suitable to match typical viscosity profiles of pharmaceutical syrups
- gels in solution to control rheology
- easily dispersed in cold or hot water

grade (X = Fine, W = Superfine)	weight average molecular weight	typical brookfield viscosity (mPa*s)	solution concentration
HHX Pharm, HHW Pharm	1,300,000	3,500–5,500	1%
HX Pharm, H Pharm	1,000,000	1,500–2,500	1%
M Pharm	720,000	4,500–6,500	2%
G Pharm	300,000	250–400	2%
L Pharm	90,000	75–150	5%



## benecel™ hydroxypropyl methylcellulose (HPMC) or hypromellose

Benecel™ HPMC is the most widely used polymer in hydrophilic matrix systems with widespread use in controlled-release dosage forms. The Benecel™ family of pharmaceutical products provides a full portfolio to support the controlled release of a broad range of APIs and manufacturing processes.

### benecel™ XR and XRF HPMC

grades: K4M, K15M, K100M, K200M

Benecel™ XR and XRF are high-viscosity grades of HPMC with optimized polymer structure and particle morphology for use in matrix controlled-release systems.

#### features and benefits

- enhanced compactibility at high tableting speeds vs standard grades
- optimized polymer structure and particle morphology
- consistent particle size distribution and bulk density
- fine particle size grades available (XRF)

substitution type	grade	weight average molecular weight	solution concentration	nominal viscosity (mPa·s) <sup>a</sup>
hypromellose 2910 "E" types	E4M Pharm, E4M Pharm CR	400,000	2%	2,700–5,040
	E10M Pharm, E10M Pharm CR	746,000	2%	7,500–14,000
hypromellose 2208 "K" types	K4M Pharm XR, K4M Pharm XRF	400,000	2%	2,700–5,040
	K15M Pharm XR, K15M Pharm XRF	575,000	2%	13,500–25,200
	K35M Pharm	675,000	2%	26,250–49,000
	K100M Pharm XR, K100M Pharm XRF	1,000,000	2%	75,000–140,000
	K200M Pharm XR	1,200,000	2%	150,000–280,000

<sup>a</sup>NF/EP/JP viscosity method

### directly compressible benecel™ PH DC HPMC

grades: K4M, K15M, K100M

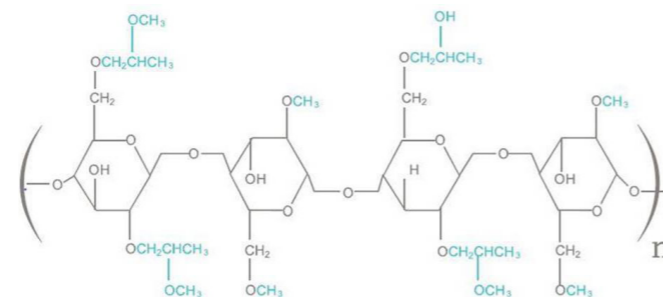
Benecel™ DC HPMC grades offer good powder flow, content uniformity, and compressibility, making them well suited for direct compression.

#### features and benefits

- improves product flow characteristics
- improves content uniformity
- identical, stable dissolution profiles compared with "XR" grades
- reduces processing times
- reduces production costs
- retains tensile strength after double compaction (roller compaction) process

substitution type	grade	weight average molecular weight	solution concentration	nominal viscosity (mPa·s) <sup>a</sup>
hypromellose 2208 "K" types	K4M PH DC <sup>1</sup>	400,000	2%	2,700–5,040
	K15M PH DC <sup>1</sup>	575,000	2%	13,500–25,200
	K100M PH DC <sup>1</sup>	1,000,000	2%	75,000–140,000

<sup>a</sup>NF/EP/JP viscosity method  
<sup>1</sup>these grades are co-processed with silica at <1 %



### custom grades benecel™ PH PRM

grades: K100LV, K250, K750, K1500

For certain drugs, achieving a desired drug release profile has traditionally involved blends of different molecular weights of polymers. Blending, however, can increase release profile variability. Custom grades of Benecel™ HPMC were developed to obviate the need for blending and offer a potential solution to the problem of dissolution variability.

#### features and benefits

- increases predictability and reproducibility of drug release profiles
- decreases research and development time needed to optimize blend ratio
- decreases manufacturing time- no need to blend and manage multiple raw materials

substitution type	grade	weight average molecular weight	solution concentration	nominal viscosity (mPa·s) <sup>a</sup>
hypromellose 2208 "K" types	K100 LV PH PRM	164,000	2%	80–120
	K250 PH PRM	200,000	2%	200–300
	K750 PH PRM	250,000	2%	562–1050
	K1500 PH PRM	300,000	2%	1,125–2,100

<sup>a</sup> NF/EP/JP viscosity method

### benecel™ methylcellulose (MC)

Benecel™ methylcellulose (MC) is a versatile excipient with a variety of applications.

#### features and benefits

- suspending/thickening agent for suspensions
- viscosity modifier
- acceptable binder for tablets

substitution type	grade	nominal viscosity (mPa·s) <sup>a</sup>
methylcellulose	A15 LV PH PRM	12–18
	A4C Pharm	300–560
	A15C Pharm	1,312–2,450
	A4M Pharm	2,700–5,040

<sup>a</sup> NF/EP/JP viscosity method

## aqualon™ ethylcellulose and Ashland® EC pharm ultra

Aqualon™ ethylcellulose (EC) and Ashland® EC pharm ultra are non-ionic ethyl ethers of cellulose, soluble in a wide range of organic solvents. Aqualon™ EC is produced using an aqueous slurry based process while Ashland® EC is produced using an organic solvent based process. Typically, ethylcellulose is used as a non-swellable, insoluble component in matrix or coating systems. When water-soluble binders cannot be used in dosage processing because of water sensitivity of the active ingredient, ethylcellulose is often chosen.

### aqualon™ ethylcellulose (EC)

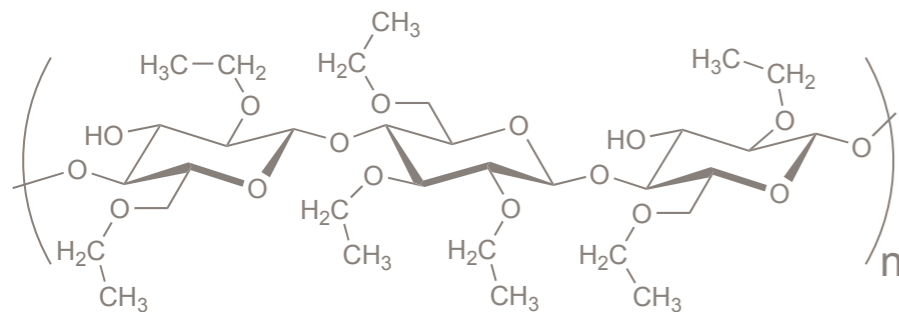
grade	ethoxyl substitution (%)	weight average molecular weight	typical Brookfield viscosity (mPa·s) <sup>1</sup>	solution concentration (%)
T10 Pharm	49.6–51.0	75,000	8–11	5
N7 Pharm	48.0–49.5	65,000	6–8	5
N10 Pharm	48.0–49.5	75,000	8–11	5
N14 Pharm	48.0–49.5	120,000	12–16	5
N22 Pharm	48.0–49.5	140,000	18–24	5
N50 Pharm	48.0–49.5	160,000	40–52	5
N100 Pharm	48.0–49.5	215,000	80–105	5

<sup>1</sup>Viscosity measured in 80:20 mixture of toluene/ethanol

### Ashland® EC pharm ultra

grade	typical Brookfield viscosity (mPa·s) <sup>2</sup>
N4	3.0 – 5.5
N7	6.0 – 8.0
N10	9.0 – 11.0
N14	12.5 – 15.5
N20	18.0 – 22.0
N45	41.0 – 49.0
N50	45.0 – 55.0
N100	90.0 – 110.0

<sup>2</sup> 5% solution of 80/20 mixture of toluene/ethanol



### features and benefits

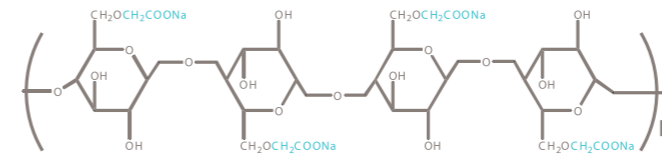
- rough, yet ductile thermoplastic polymer for compression molding or extrusion
- suitable for coating one or more active ingredients of a tablet to prevent APIs from reacting with other materials or one another
- yields flexible films over a wide range of temperatures
- non-ionic, pH insensitive
- prevents discoloration of easily oxidizable substances
- optimized compactability and good powder flow (Aqualon EC T10)

## aqualon™ and blanosé™ sodium carboxymethylcellulose

Aqualon™ and Blanosé™ CMC are anionic, water-soluble cellulose ethers, produced by reacting alkali cellulose with monochloroacetic acid under controlled conditions. A variety of grades with different degrees of substitution, viscosities and particle sizes to meet specific formulation requirements are available. Ashland provides CMC under the tradenames Aqualon™ CMC and Blanosé™ CMC depending on site of manufacture.

### features and benefits

- bioburden and endotoxin tested (BET) grades available for parenteral applications
- suspending agent for two-component, injectable controlled-release systems
- stabilizer, thickener, and film-former for ointments, creams, and lotions
- thickener, gelling agent, protective colloid, and film-former for jellies and salves
- thickener and suspending aid for syrups and suspensions
- physiologically inert water binding agent for bulk laxatives
- absorbency and sustained-release properties for mucoadhesives
- enhanced organoleptic properties for orally disintegrating tablets (ODTs)



### aqualon™ sodium carboxymethylcellulose (CMC)

viscosity (mPa·s)	solution concentration	degree of substitution		
		0.7	0.9	1.2
1500 - 2800	1%	7HF PH		
1500 - 2800	1%	7H3F PH		
1500 - 2800	1%	7HOF PH		
1840 - 2760	2%		9M31F PH	
1340 - 2000	2%			12M31P
470 - 700	2%	7MF PH		
470 - 700	2%	7MF PH BET		
400 - 720	2%	7M8SF PH		
400 - 720	2%		9M8F PH	
30 - 45	2%	7LF PH		
30 - 45	2%	7LF PH BET		
133 - 199	4%	7L2P		
133 - 199	4%	7L2P BET		

### blanosé™ sodium carboxymethylcellulose (CMC)

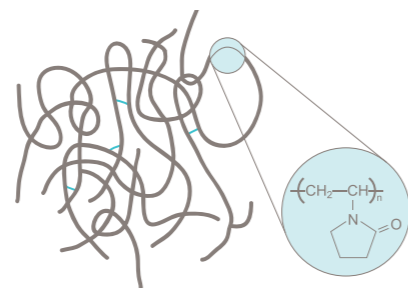
viscosity (mPa·s)	solution concentration	degree of substitution		
		0.7	0.9	1.2
2500 - 4500 6750 - 12600	NF: 1% EP: 2%	7H4XF PH		
2500 - 4500 6750 - 12600	NF: 1% EP: 2%		9H4XF PH	
1500 - 2800 6750 - 12600	NF: 1% EP: 2%	7H3SF PH		
1500 - 2800 6750 - 12600	NF: 1% EP: 2%	7H3SXF PH		
1500 - 2800 6750 - 12600	NF: 1% EP: 2%	7HOF PH		
1500 - 2500 6750 - 12600	NF: 1% EP: 2%	7HF PH		
1500 - 2500 6750 - 12600	NF: 1% EP: 2%	7HXF PH		
1500 - 2500 3750 - 12600	NF: 1% EP: 2%	7HCF PH		
N/A 1500 - 3100	NF: N/A EP: 2%	7M31F PH		
2075 - 3100 N/A	NF: 2% EP: N/A			12M31P
2075 - 3100 N/A	NF: 2% EP: N/A			12M31XP
1500 - 3100 1425 - 2660	NF: 2% EP: 2%		9M31F PH	
1500 - 3100 1425 - 2660	NF: 2% EP: 2%		9M31XF PH	
530 - 790 N/A	NF: 1% EP: N/A			12M8P
400 - 600 415 - 770	NF: 2% EP: 2%		7MF PH	
400 - 600 415 - 770	NF: 2% EP: 2%		7MXF PH	
400 - 600 415 - 770	NF: 2% EP: 2%		7MCF PH	
320 - 480 375 - 700	NF: 2% EP: 2%		7M8SF PH	
320 - 480 375 - 700	NF: 2% EP: 2%		7M8SXF PH	
27 - 50 34 - 63	NF: 2% EP: 2%		7LP EP	

## polyplasdone™ crosppovidone

Polyplasdone™ crosppovidone superdisintegrants are synthetic, insoluble, but rapidly swellable, crosslinked homopolymers of N-vinyl-2-pyrrolidone. Polyplasdone™ crosppovidone particles are granular and porous compared with other superdisintegrants. The high surface area combined with unique chemistry results in high interfacial activity that enhances the dissolution of poorly water-soluble active pharmaceutical ingredients (APIs) in a way that is not possible with other disintegrant technologies.

### features and benefits

- provides rapid disintegration in wet and dry granulation and direct compression tablet processes
- combines multiple mechanisms to achieve disintegration at low use levels (2-5 wt%)
- swells without forming gels that can slow tablet disintegration or dissolution
- increases tablet breaking force and reduces friability
- enhances the dissolution of poorly soluble drugs
- available in Type A and Type B crosppovidone grades
- polyplasdone™ ultra** and **ultra-10** grades provide the same great performance with very low peroxide levels



grade	typical average particle size (microns)	peroxide specification (ppm)
Ultra <sup>1</sup>	110–140	30 max
XL <sup>1</sup>	110–140	400 max
Ultra-10 <sup>2</sup>	25–40	50 max
XL-10 <sup>2</sup>	25–40	400 max
INF-10 <sup>2</sup>	10–15	400 max

<sup>1</sup> Crosppovidone monograph type A

<sup>2</sup> Crosppovidone monograph type B

## plasdone™ s-630 copovidone

Plasdone™ S630 copovidone is a 60:40 random, linear copolymer produced by the free radical polymerization of N-vinyl-2-pyrrolidone and vinyl acetate. It is commonly used to enhance the solubility of APIs and increase bioavailability of poorly water-soluble APIs through the formation of melt-extruded or spray-dried solid dispersions. It can also be used as a binder in direct compression, dry granulation, or wet granulation, resulting in hard, non-friable tablets.

### features and benefits

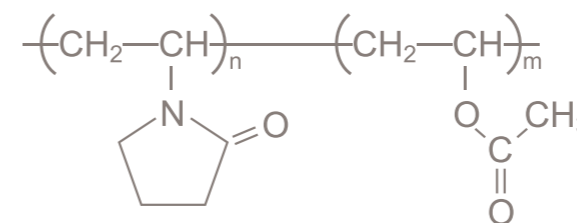
- excellent thermoplastic properties for HME
- amorphous solid dispersion stabilizer
- compatible with most plasticizers

## plasdone™ s-630 ultra copovidone

Plasdone™ S630 Ultra copovidone is a new and improved version of copovidone. It was designed to provide improved stability in tablet formulations, and processability in hot melt extrusion, and continuous processing.

### features and benefits

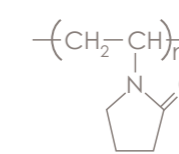
- provides greater long-term stability for oxidative sensitive APIs
- efficient, high throughput, energy saving binder/solubilizer/carrier for hot melt extrusion and continuous processes



grade	weight average molecular weight <sup>a</sup>	K-value viscosity
S-630	43,000	25.0–31.0
S-630 ultra	34,000	23.4–28.6

<sup>a</sup> Absolute molecular weight (SEC/MALLS)

## plasdone™ povidone



Plasdone™ povidones are a family of water-soluble polymers based on N-vinylpyrrolidone that combine a unique set of properties for application in a wide variety of dosage forms.

Plasdone™ povidones are commonly used as binders for the development of tablet formulations, whether manufactured by wet granulation, dry granulation, or direct compression. Plasdone™ K polymers are used in solid dispersion formulations to enhance the solubility of active pharmaceutical ingredients and increase bioavailability. Plasdone™ K grades are also used to inhibit recrystallization in liquid soft gels. Plasdone™ C grades can inhibit crystallization in injectable dosage forms.

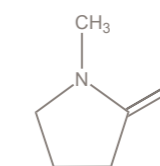
### features and benefits

- amorphous solid dispersion stabilizer
- monomer is hydrogen bond acceptor
- compatible with most plasticizers
- low pyrogen grades for injectables (Plasdone C grades)

grade <sup>a</sup>	weight average molecular weight <sup>b</sup>	K-value viscosity
K-12	4,000	10.2–13.8
K-17	10,000	16.0–17.5
K-25	34,000	24–26
K-29/32	58,000	29–32
K-90	1,300,000	85–95
C-12	4,000	10.2–13.8
C-15	9,400	15.5–17.5
C-17	10,000	16.0–17.5
C-30	58,000	29.0–32.0

<sup>a</sup> C grades have low pyrogen levels <sup>b</sup> Absolute molecular weight (SEC/MALLS)

## pharmasolve™ N-methyl-2-pyrrolidone



Pharmasolve™ N-methyl-2-pyrrolidone (NMP) is a water-miscible polar aprotic solvent with high interfacial activity. It is used as a solubilizer and penetration enhancer in human parenteral and topical-dosage forms, as well as parenteral and topical veterinary products.

### features and benefits

- dissolves a variety of poorly soluble APIs



## CAVAMAX\*, CAVASOL\* and cavitron™ cyclodextrins

The molecular structure of cyclodextrins creates a bucket-like cavity that can complex with molecules or functional groups on molecules to improve solubility of poorly soluble compounds. The same mechanism makes these excipients capable of masking unpleasant taste/odor and stabilizing APIs that are prone to degradation.

### CAVAMAX\* native cyclodextrins

The number of glucose units in the ring determines the internal diameter of the cavity and its volume, as the height of the cyclodextrin cavity is the same for all the native cyclodextrin grades. CAVAMAX cyclodextrins are compatible with a wide range of ingredients commonly used in pharmaceutical applications.

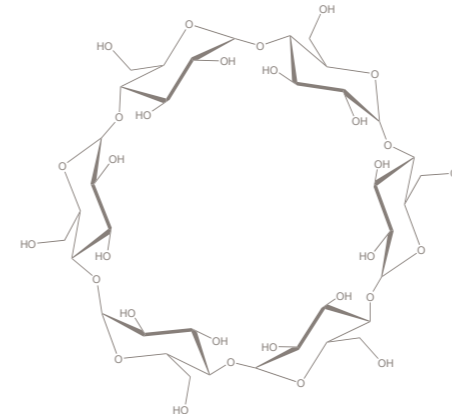
### CAVASOL\* and cavitron™ hydroxypropyl-β- or hydroxypropyl-γ-cyclodextrins (HPBCD or HBGCD)

The substitution of hydroxyl groups on native cyclodextrins to make hydroxypropyl-β- or hydroxypropyl-γ-cyclodextrins (HPBCD or HBGCD) significantly enhances their solubility. Both CAVASOL HPBCD and HPGCD are primarily used to increase solubility of poorly soluble compounds in oral drug-delivery systems. Cavitron cyclodextrins are manufactured and tested to meet low bioburden and endotoxin specifications.

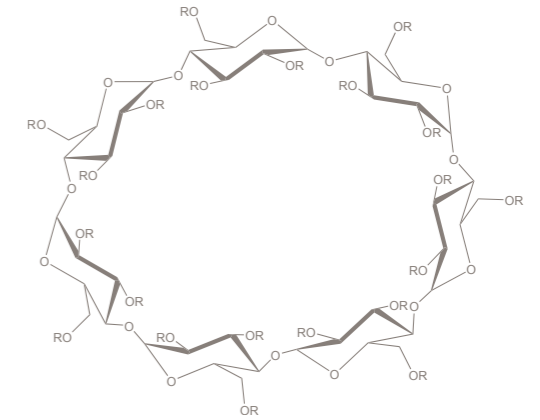
#### features and benefits

- starch derived, ring shaped molecule
- water soluble
- hydrophilic exterior and hydrophobic interior for improved solubility

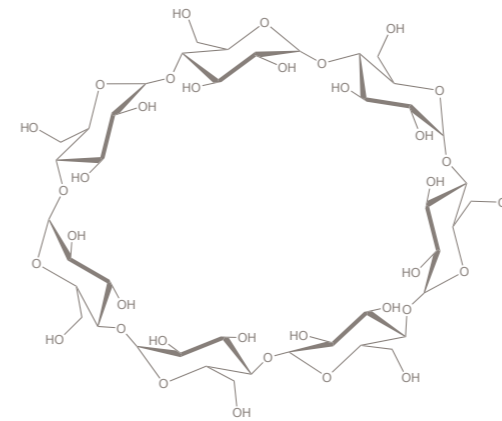
CAVAMAX\* w6 (α-cyclodextrin)



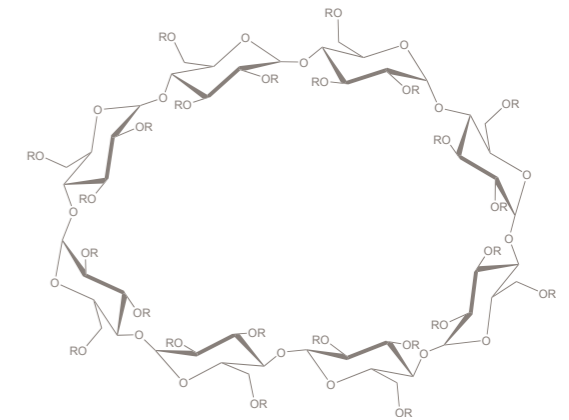
CAVASOL\* and cavitron™ w7(HPBCD)



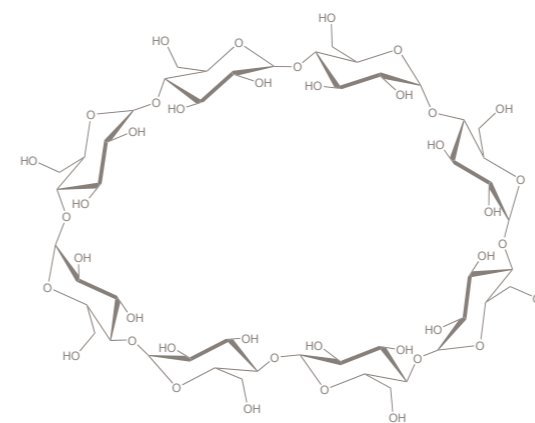
CAVAMAX\* w7 (β-cyclodextrin)



CAVASOL\* and cavitron™ w8(HPBCD)



CAVAMAX\* w8 (γ-cyclodextrin)



#### cyclodextrin derivatives

product and grade	weight average molecular weight	typical degree of substitution
CAVASOL* W7 HP Pharma	1,410	4.1–5.1
cavitron™ W7 HP5 Pharma	1,410	4.1–5.1
Cavitron W7 HP7 Pharma	1,520	6.0–8.0
CAVASOL* W8 HP Pharma	1,574	3.5–4.9

\* Registered trademark owned by Wacker Chemie AG. Ashland acts as a worldwide distributor for Wacker.

#### native cyclodextrins

product and grade	weight average molecular weight	cyclodextrin type
CAVAMAX* W6 Pharma	973	α-cyclodextrin
CAVAMAX* W7 Pharma	1,135	β-cyclodextrin
CAVAMAX* W8 Pharma	1,297	γ-cyclodextrin

\* Registered trademark owned by Wacker Chemie AG. Ashland acts as a worldwide distributor for Wacker.



## aquarius™ film coating systems for immediate release

grade	descriptor	detail
genesis*	-	ultra high-solids based on copovidone and cellulosic polymers that provides a strong film with high adhesion and smooth appearance
preferred*	HSC	high-solids coatings based on cellulosic polymers
preferred*	HSP	high-solids coatings based on copovidone with cellulosic polymers for significant improvements in adhesion and sprayable solids
prime*	-	coatings based on traditional cellulosic polymers
prime	LS	coatings based on lactose and cellulosic polymers with significant improvements in film adhesion
protect	-	label-friendly moisture, odor and taste guard
protect	MB	high-solids moisture barrier coatings based on polyvinyl alcohol (PVA) without the use of polyethylene glycol (PEG)
pva*	-	versatile coating systems with improved performance characteristics

\* titanium dioxide free options available

### aquarius™ genesis film coating systems

Aquarius™ Genesis film coating systems are designed for application at up to 35% solids, which can significantly increase productivity of continuous or traditional batch-based coating equipment. They have been formulated to provide a strong film with high adhesion and smooth appearance.

#### features and benefits

- faster coatings and processing with ultra-high solids (35%)
- lower processing temperatures- suitable for temperature sensitive APIs
- minimizes moisture ingress to tablets
- supports energy and costs savings
- wide processing window helps overcome equipment limitations
- disperses easily in water

### aquarius™ preferred HSC film coating systems

Aquarius™ Preferred HSC film coating systems are ready-to-use, immediate-release coatings based on cellulosics. These products can be applied at up to 20% solids. They are available as clear, white, or pigmented formulations.

#### features and benefits

- reduces processing times
- reduces manufacturing costs
- high-solids coatings
- disperses easily in water
- can be tailored to meet exacting requirements
- applicable to both pharmaceutical and nutraceutical solid dosage forms

### aquarius™ preferred HSP film coating systems

Aquarius™ Preferred HSP film coating systems are ready-to-use, immediate-release coatings based on cellulosic and copovidone polymers. These products can be applied at up to 25% solids, allowing for shorter processing times. They are available as white, clear, or pigmented formulations.

#### features and benefits

- excellent adhesion
- minimizes moisture ingress to tablets
- high tablet gloss and smooth finish
- high-solids coatings enabling cost and energy savings
- disperses easily in water
- applicable to both pharmaceutical and nutraceutical solid dosage forms

### aquarius™ prime film coating systems

Aquarius™ Prime film coating systems are immediate-release tablet coatings consisting of a polymer, a plasticizer, and an optional pigment/ opacifier. These film coating systems are available off the shelf in clear and white formulations.

#### features and benefits

- meets general purpose film coating requirements
- good film strength and adequate film adhesion characteristics
- disperses easily in water
- capability to address common film coating problems
- immediate release

### aquarius™ prime LS film coating systems

Aquarius™ Prime LS film coating systems are made from hypromellose (HPMC) and lactose and are intended to be qualitatively, quantitatively, and functionally equivalent to competitive lactose-based film coating systems.

#### features and benefits

- significant improvement in film adhesion capabilities compared with standard HPMC-based film coating systems
- sprayable at up to 20% w/w solids but, more realistically, at 17–18% w/w solids

## aquarius™ protect film coating systems

Aquarius™ Protect is the premium multi-functional barrier coating system that effectively reduces moisture uptake and masks against offensive taste and odor. These coating systems, composed of cellulose derivatives and a natural wax blend, provide superior barrier properties and efficient processing and flexibility without compromising drug release.

### features and benefits

- provides protection from moisture and objectionable odors and tastes
- remains non-tacky at low processing temperatures allowing for energy savings
- very effective under environmental conditions defined as zones 4 & 5 by stability guidelines
- available as clear, white, and pigmented formulations

## aquarius™ protect MB film coating systems

Aquarius™ Protect MB film coating systems are fully formulated, ready to mix, high solids moisture barrier coatings based on polyvinyl alcohol (PVA) without the use of polyethylene glycol (PEG). These coating systems have easy and efficient application using standard spray equipment and process conditions.

### features and benefits

- moisture and oxygen barrier functionalities
- PEG free, reduces risk of impurity formation
- effective under environmental conditions defined as zones 4 & 5 by stability guidelines
- available as clear, white, and pigmented formulations

## aquarius™ PVA film coating systems

Aquarius™ PVA film coating systems are versatile coating systems with improved performance characteristics that maximize product quality and enhance processing efficiency. They have been formulated for a wide variety of pharmaceutical and nutritional applications. Aquarius™ PVA film coating systems are intended for use with immediate-release dosage forms.

### features and benefits

- high film adhesion
- attractive appearance and finish
- enhanced processing efficiencies
- clean, crisp logos
- clear and pigmented options that can be color matched

## aquarius™ TF film coating systems

Aquarius™ TF film coating systems are formulated without the use of titanium dioxide as the opacifier filler for application to immediate-release dosage forms.

### features and benefits

- white coatings comparable to TiO<sub>2</sub>-based coatings
- attractive appearance and finish
- clean, crisp logo definition
- aqueous systems available in clear, white, or pigmented (synthetic or naturally derived color) versions
- available in a wide range of solids applications (15% to 30%) and polymer-based options
- application at high solids overcomes manufacturing inefficiencies associated with the required higher tablet weight gain related to TF coatings

## aquarius™ film coating systems for enteric release

grade	descriptor	detail
control	ENA	delayed-release (enteric) coatings based on methacrylic acid-ethyl acrylate copolymer

## aquarius™ control ENA film coating systems

Aquarius™ Control ENA film coating systems are fully formulated delayed release (enteric) coatings based on methacrylic acid copolymer. They are designed to protect APIs that degrade in gastric fluid or prevent the release of APIs that may irritate the gastric mucosa.

### features and benefits

- fully formulated, one step coating
- produces stable release profiles
- delivers stable dissolution profiles over a wide pH range
- prevents release of APIs that may irritate the gastric mucosa
- protects active pharmaceutical ingredients (APIs) that degrade in gastric fluid

## aquarius™ film coating systems for controlled release

grade	descriptor	detail
control	ECD	aqueous dispersion for controlled release based on ethylcellulose
control	SRX	controlled release coatings based on ethylcellulose

## aquarius™ control SRX film coating systems

Aquarius™ Control SRX film coating systems are controlled release coatings for APIs that are most effective when released over time. These film coating systems produce predictable and controllable release profiles, are custom formulated based on solubility and desired release profile, and do not require a curing step.

### features and benefits

- modified with hydroxypropyl cellulose or hydroxypropyl methyl cellulose as a pore former
- variable porosities can be matched to active pharmaceutical ingredient solubility and/or desired release profile
- suitable for moisture and heat sensitive actives
- do not require curing after application

## aquarius™ control ECD film coating systems

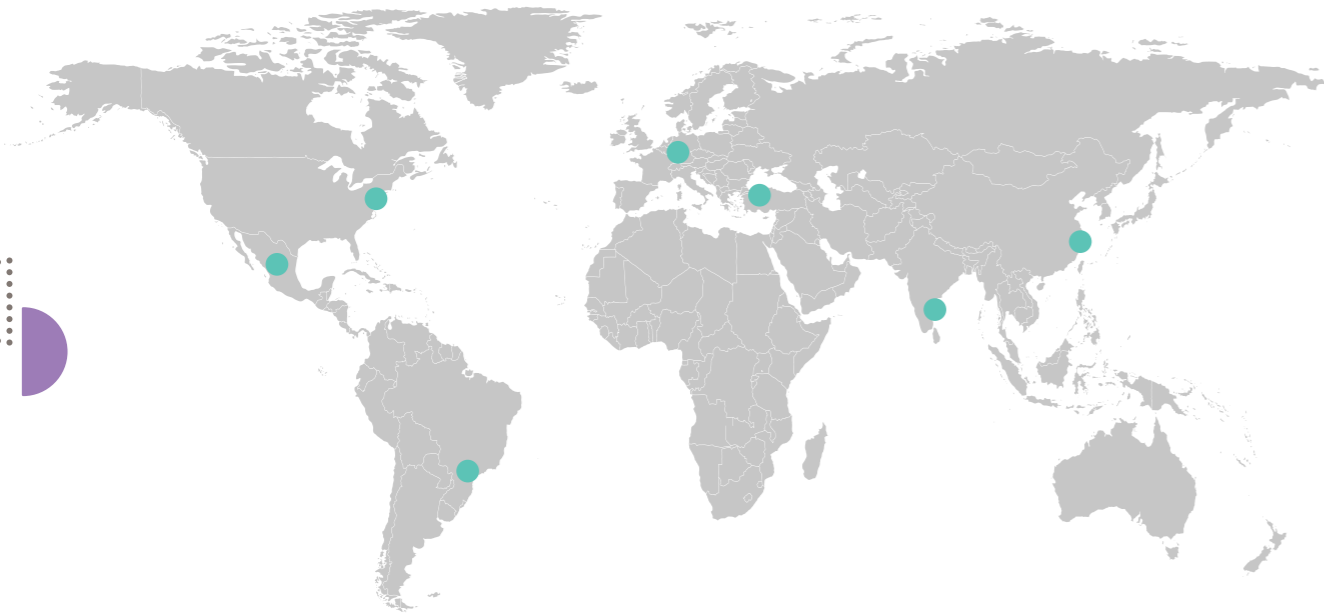
Aquarius™ Control ECD is an aqueous dispersion of ethyl cellulose polymer for achieving controlled release, taste-masking, and moisture protection by forming a water insoluble film.

### features and benefits

- multifunctional coatings for controlled release, taste masking, and moisture protection
- reproducible drug results
- reduces environmental impact and improves product safety by eliminating use of hazardous solvents in film coating process
- compatible with a broad range of plasticizers
- supports a solvent and ammonia free coating process
- easy to clean after coating

# technical capabilities

We offer a range of technical capabilities to meet the needs of the pharmaceutical and nutraceutical industries. Through a global network of technical service laboratories we provide assistance with formulation development, problem-solving and analytical support.



## global technical centers

<b>North America</b> Wilmington, Delaware*	<b>Latin America</b> Mexico City, Mexico Sao Paulo, Brazil	<b>EMEA</b> Düsseldorf, Germany Istanbul, Turkey	<b>Asia Pacific</b> Hyderabad, India* Shanghai, China
---	--	--	---

\*center of excellence

Our scientists support the pharmaceutical industry with formulation and process development in various application areas:

- standard granulation: fluid bed, high shear, and hot-melt extrusion
- tableting: direct compression, bi-layer, multi-layer, tablet in tablet, compaction simulation, 3D printing
- solid dispersion: hot-melt extrusion and spray drying
- controlled-release: release-profile prediction and simulation, melt extrusion, particle and pellet coating, drug layering, and matrix tablets
- film coating: fluid bed coating, pan coating, color matching

Ashland also has considerable expertise in characterization of powder properties including: flow, particle size, surface area, morphology, and more.

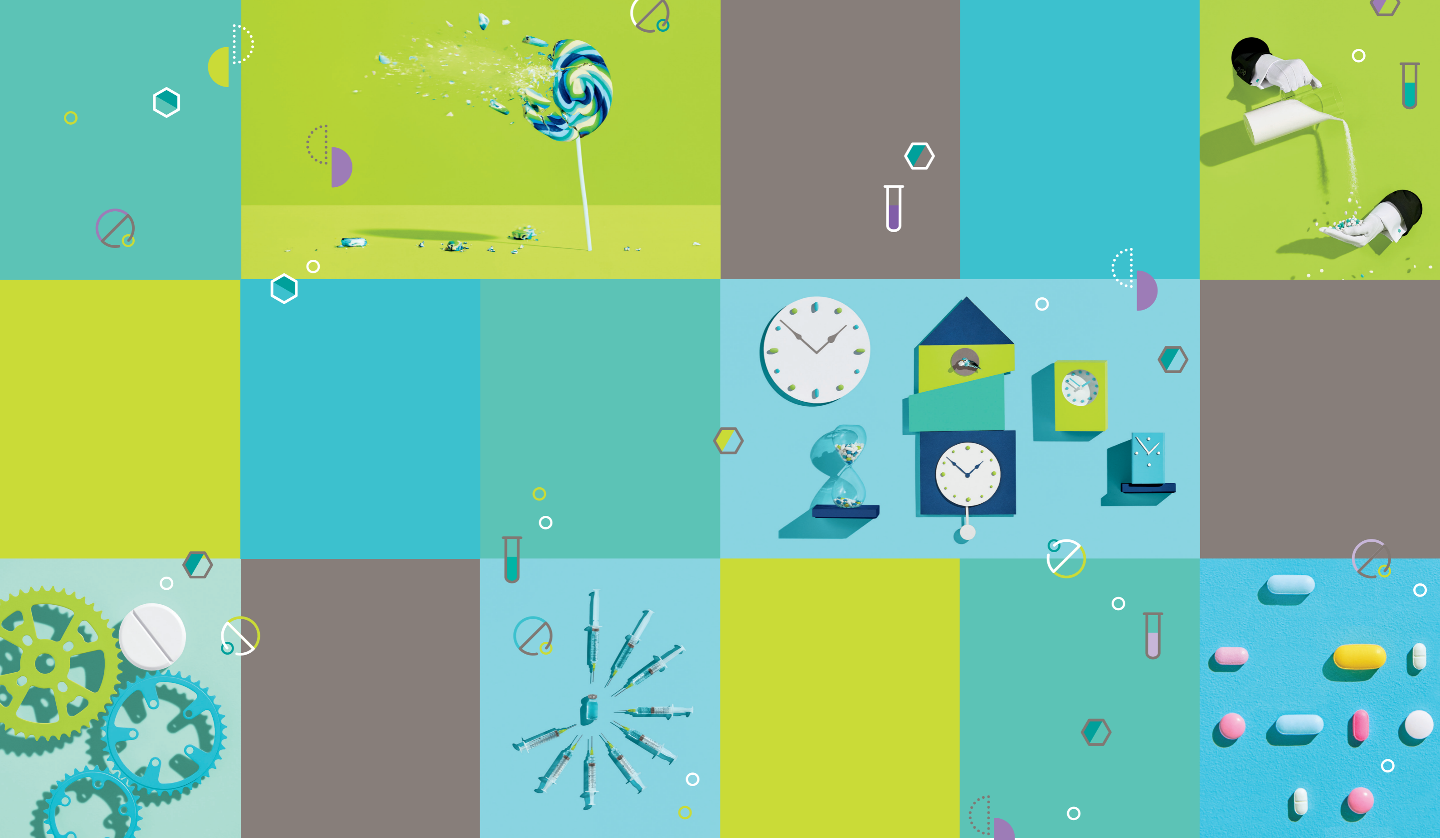
## analytical and testing capabilities include:

- advanced powder flow and segregation testing
- dissolution USP I, II and III
- differential scanning calorimetry and thermogravimetric analysis
- melt rheology
- microscopy—scanning electron, polarized light, and high resolution digital
- kinetic dissolution
- advanced mechanical testing
- size exclusion chromatography
- Karl Fischer titration
- coulometry
- nuclear magnetic resonance
- high-performance liquid chromatography and gas chromatography
- infrared and ultraviolet spectroscopy
- x-ray powder diffraction
- laser diffraction
- ASTREE electronic tongue taste masking analyzer

## pilot manufacturing capabilities include:

- fluid beds with capacity up to 5 kg
- several sizes of tablet coaters
- numerous rotary tablet presses
- MEDELPHARM StyOne Evolution and Stylcam compaction simulators
- extrusion/spheronization
- hot-melt extruders
- spray dryers
- formulation design
- oral solid dosage forms





### global headquarters

**Ashland LLC.**  
Wilmington, DE USA  
Tel: +1 877 546 2782

### regional centers

**North America**  
Wilmington, DE USA  
Tel: +1 877 546 2782

**Europe**  
Switzerland  
Tel: +41 52 560 55 00

**India**  
Maharashtra  
Tel: +91 22 62828700

**Asia Pacific**  
Singapore  
Tel: +65 6775 5366

**Middle East, Africa**  
Istanbul, Turkey  
Tel: +00 90 216 538 08 00

**Latin America**  
Mexico  
Tel: +52 55 52 76 6169  
Brazil  
Tel: +55 11 36 49 0435

### [ashland.com/contact](http://ashland.com/contact)

- ® Registered trademark, Ashland or its subsidiaries, registered in various countries
- ™ Trademark, Ashland or its subsidiaries, registered in various countries
- © 2020, Ashland / PHA17-1001.2

[ashland.com](http://ashland.com) / efficacy usability allure integrity profitability™

The information contained in this brochure and the various products described are intended for use only by persons having technical skill and at their own discretion and risk after they have performed necessary technical investigations, tests and evaluations of the products and their uses. Certain end uses of these products may be regulated pursuant to rules or regulations governing medical devices, drug uses, or pesticidal or antimicrobial uses. It is the end user's responsibility to determine the applicability of such regulations to its products. All statements, information, and data presented herein are believed to be accurate and reliable, but are not to be taken as a guarantee of fitness for a particular purpose, or representation, express or implied, for which seller assumes legal responsibility. No freedom to use any patent owned by Ashland, its subsidiaries, or its suppliers is to be inferred.

