

MECELLOSE®

Total Solution Provider

www.lotte-cellulose.com



LOTTE FINE CHEMICAL

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Our
Cellulosic
products are a core
business unit that hold the
key to the future of LOTTE Fine

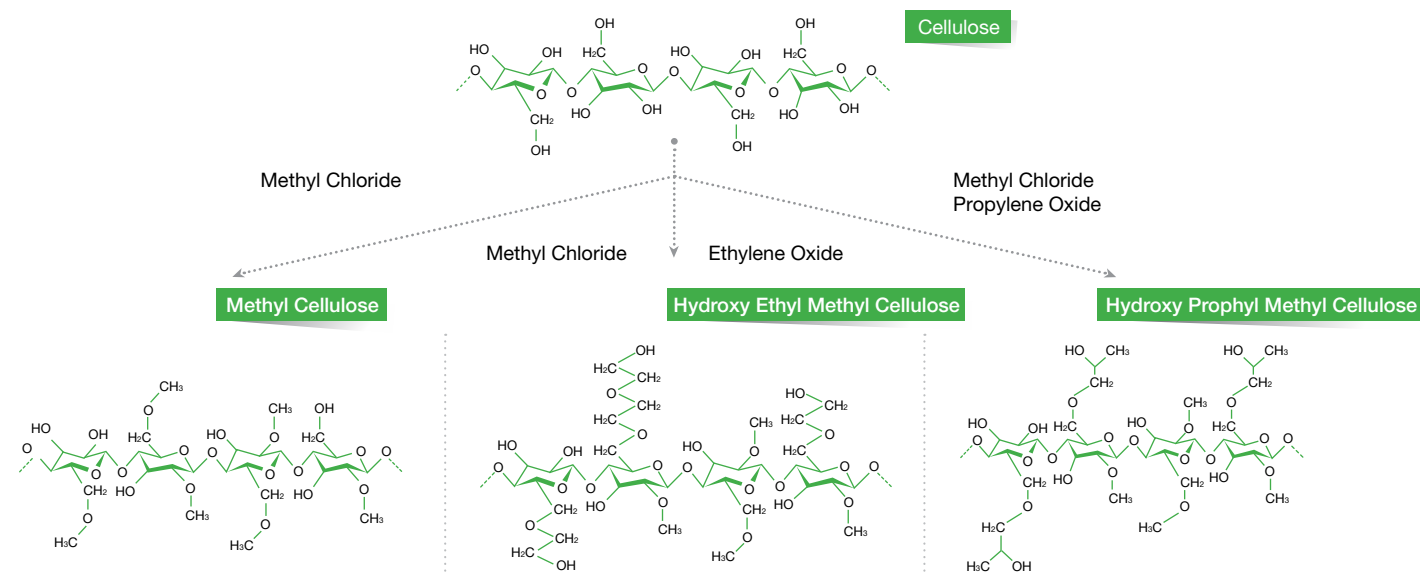
Chemical. With an extremely unique technology base, over 20 years of development, manufacturing and sales of our products, we believe that we can offer fine tuned, efficient products that can suit your needs. At LOTTE, we know that better value chains and high performance products with superior quality bring about an overall better industry; from us, to you, to your customers. MECELLOSE® by LOTTE Fine Chemical is a non-ionic cellulose ether and has been specifically modified to be applied in a wide range of applications from building and construction, waterborne architectural coatings, personal care products, oil technologies through to emulsion protective colloids for polymerization. With a strong and experienced team supporting, our continuous research and development, as well as specifically tailored services that we provide to meet our customer's needs, we are glad to say that we are able to guarantee that our extensive range of products will always be able to optimize and make your business as efficient as possible.



General Properties

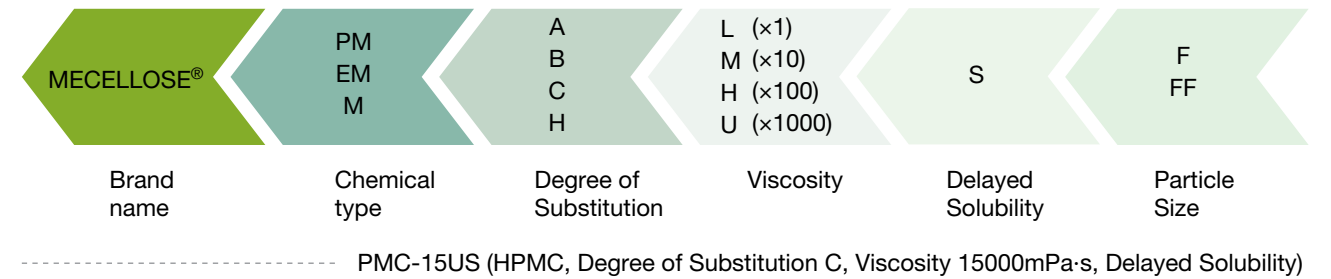
<p>Thickening effects</p> <p>Increases viscosity of liquids and enhances the stability of suspension and emulsion systems.</p>	<p>Partial organic solubility</p> <p>Soluble in some organic solvents and solvent-water systems due to the special hydrophobic groups in its molecules.</p>	<p>Water retention</p> <p>MECELLOSE® reduces water loss of its formulations when applied to water absorbing surfaces such as a wallboard, etc.</p>	<p>Water solubility</p> <p>Easily dissolves in cold water.</p>
<p>Enzyme resistance</p> <p>Provides excellent viscosity stability during long-term storage due to its resistance against fungi and bacterial attacks.</p>	<p>Film formation</p> <p>Forms clear, tough and flexible film, which provides excellent barrier properties against oils and greases.</p>	<p>Non-ionic charges</p> <p>Compatible with other ionic and non-ionic additives in aqueous solutions while providing a stable combination when dissolved in water.</p>	
<p>pH stability</p> <p>Remains stable in the range of pH 3.0~11.0. However, the solubility of MECELLOSE® can be affected by the presence of acid or alkali.</p>	<p>Lubrication</p> <p>MECELLOSE® improves workability and processing of cement bases and ceramic base extrusions through its lubrication.</p>	<p>Surface activities</p> <p>MECELLOSE® has a surfactant property in solutions and can act as a protective colloid and emulsifier.</p>	<p>Thermal gelation</p> <p>MECELLOSE® transforms into a gel form when the temperature of its solution rises up to a specific level. The gel returns to its original solution state upon cooling.</p>

Chemical Structure of MECELLOSE®



Nomenclature & Classification

MECELLOSE® is classified into pure and modified grades. Pure grades are also divided into MC (Methyl Cellulose), HPMC (Hydroxypropyl Methyl Cellulose) and HEMC (Hydroxyethyl Methyl Cellulose).



Modified MECELLOSE® (FMC grade)

MECELLOSE® FMC grades are finely modified to improve the rheological properties of cellulose ethers in accordance with various application requirements such as additional thickening, better workability, less stickiness, longer open time, etc.

Modified MECELLOSE® grades are especially produced through chemical reactions or physical blending of organic or inorganic additives. The viscosity range varies from under 50mPa·s to over 80,000mPa·s.

Classification

Chemical Type	M	Methylcellulose
	EM	Hydroxyethyl methylcellulose
	PM	Hydroxypropyl methylcellulose
	FM	Modified cellulose derivatives
Degree of Substitution	A	High degree of substitution
	B	Medium degree of substitution
	C	Low degree of substitution
	H	Ultra high degree of substitution
Viscosity	50L	50 × 1 mPa·s
	10M	10 × 10 mPa·s
	40H	40 × 100 mPa·s
	15U	15 × 1,000 mPa·s
Viscosity range : 50 ~ 80,000 mPa·s 2% wet solution, 20°C , pH7, and 20rpm at Brookfield viscometer HA type		
Solubility	-	No-delayed solubility (Non-surface treated)
	S	Delayed solubility (Surface treated)
Particle Size	-	90% through 250 μm (ASTM Mesh No.60)
	F	80% through 125 μm (ASTM Mesh No.120)
	FF	90% through 106 μm (ASTM Mesh No.140)

How to Prepare MECELLOSE® Solutions

Usually, non treated MECELLOSE® can only be dispersed in hot water to prevent lumping, but surface treated MECELLOSE® can be dispersed in cold water.

In the mean time, have a look at the brief illustrations below to see the key differences.

Surface treated MECELLOSE® (Delayed solubility grade)

Surface treated powder is specially developed to prevent lumping in wet blending applications such as paints and emulsion based applications. To make the solution with surface treated powder, powder is directly placed into cold water. With time, a fully developed-solution with the right viscosity is prepared through continuous stirring of the solution.



Dispersion
in cold water

Stirring 1~2hr
at room temp.

Adjust
water temp. (20°C)

Solution

Non-surface treated MECELLOSE® (Non-delayed solubility grade)

If non-surface treated powder is put into cold water directly, it easily forms lumps due to its too quick solubility with cold water. To prevent lumping, put the powder into hot water (over 90°C) first, then stir in order to disperse the powder, and then cool down the solution while stirring continuously.



Hot water
(over 90°C)

Dispersion
in Hot water

Stirring 1~2hr
cool to room temp.

Adjust water
temp. (20°C)

Solution

When non-surface treated powder is used in a dry-mixing application, lumping is not a concern since each particle of MECELLOSE® is distributed throughout the final product evenly.

Modified MECELLOSE®

Each modified MECELLOSE® shows different solubility properties.

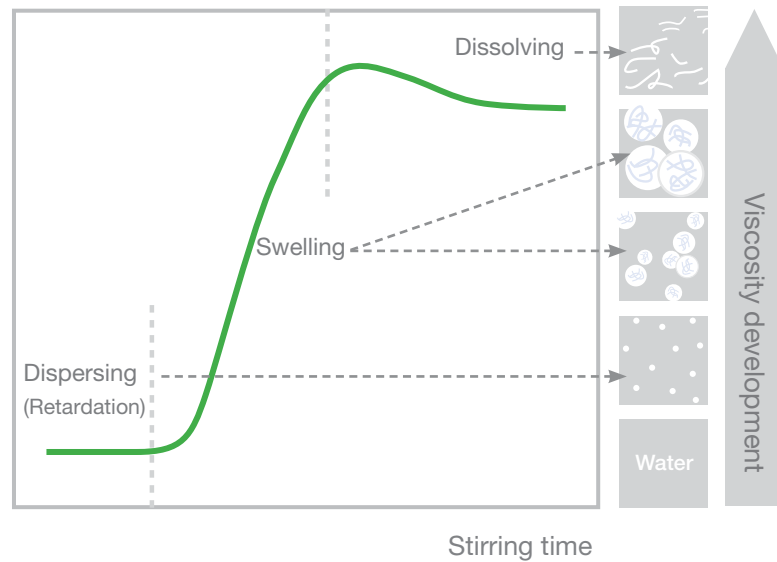
The solubility of modified MECELLOSE® depends on the original property of the basic MECELLOSE® and its degree of modification.



Solubility

Dissolution of MECELLOSE®

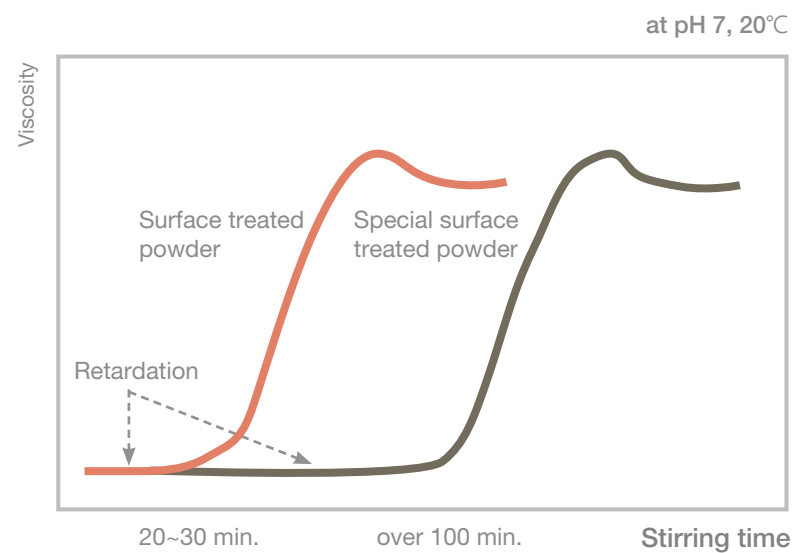
When it comes to water solubility levels and speed, the general dissolution mechanisms of MECELLOSE® is shown in the right side graph.



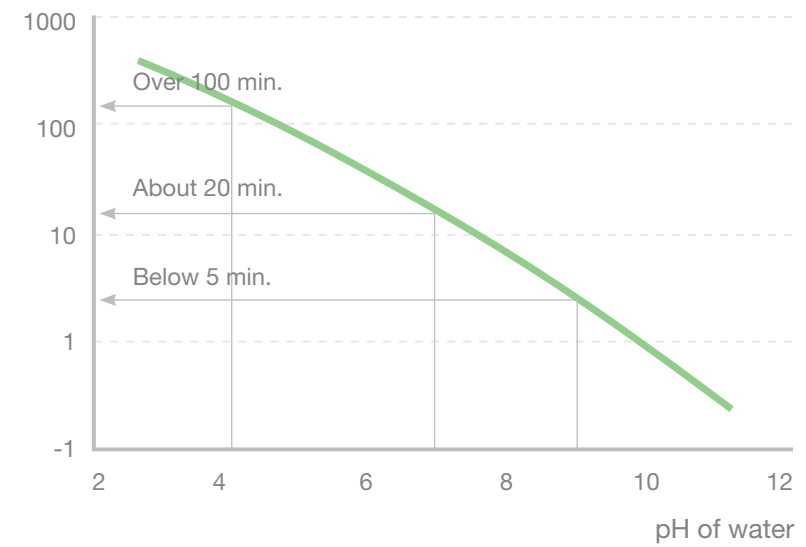
Non-surface treated MECELLOSE®

The viscosity measuring of non-surface treated MECELLOSE® is impossible in cold water due to lump formations.

The retardation time of surface treated MECELLOSE® approximates to about 20 minutes at pH7. However, the higher the pH of the solution is, the shorter the retardation time will be.



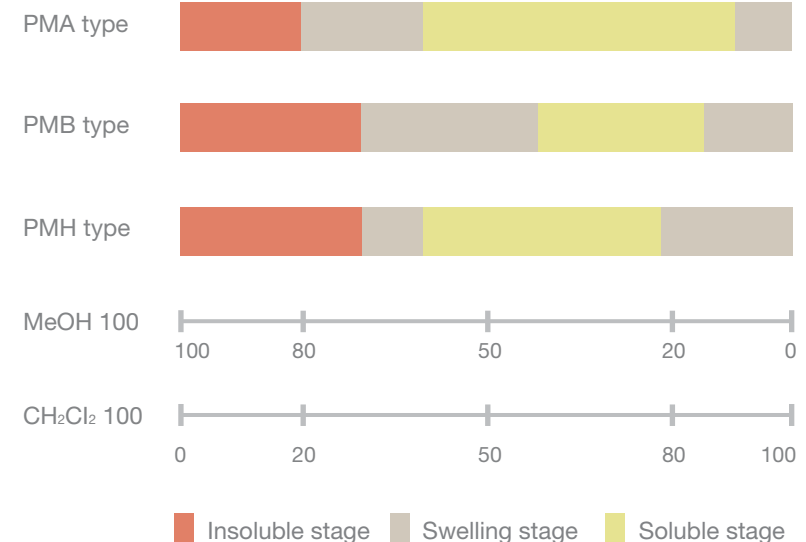
Stirring time (min.)



The effect of pH on MECELLOSE® dissolving times

The viscosity development time is dependent upon the pH of the solution for surface treated grades. The higher the pH of the solutions is, the shorter retardation time will be.

For paint applications, long-retarded grades are more suitable because of the high pH conditions (CaCO₃, ammonia, etc.) of the applications.



Solubility in organic solvents

MECELLOSE® is both soluble in water and in some organic solvents as well as other water-organic co-solvents. The PMA type is the most soluble MECELLOSE® which works in various organic solvents.

The PMB and PMH types are normally used in paint remover applications.

PMA, PMB and PMH are soluble in Methanol/(some organic solvents, IPA, Methylene chloride, etc.) water.

According to the figure left, if there is a co-solvent of MeOH and CH₂Cl₂ (50:50), PMA and PMH types will be solved. However PMB products will be in the swelling stage.

Aqueous Solution Viscosity

Viscosity comparison through various measurements

- Viscosity is a resistance force (based on the flow rate, gravity force, rotation resistance of the product, etc.)
- In general, Höppler(= Falling B) and Ubelode all types measure Newtonian solutions.

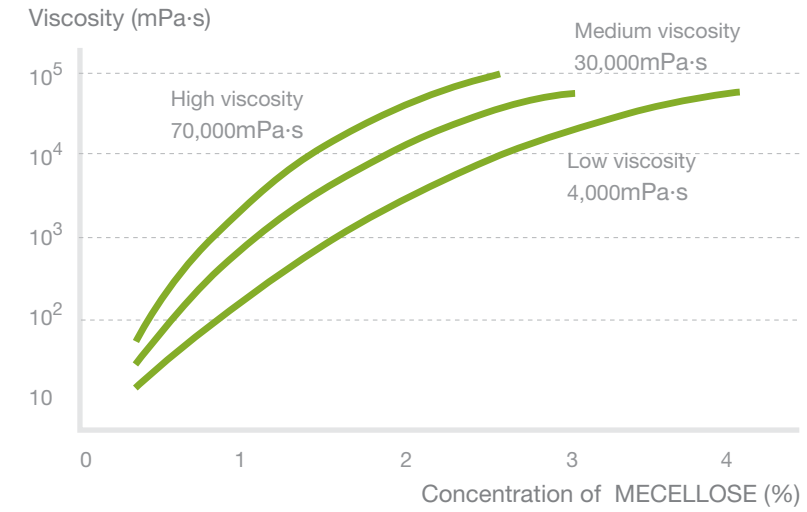
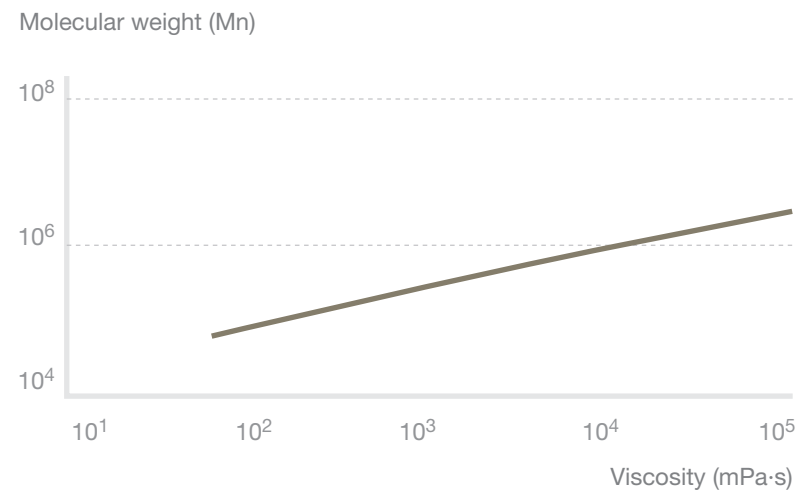
2% Viscosity of MECELLOSE®	Viscosity (mPa·s)			
	Brookfield	Roto	Höppler	Ubelode
4,000	4,000	6,000 ~ 6,500	6,000 ~ 6,500	4,500 ~ 5,500
8,000	8,000	10,000 ~	6,000 ~ 6,500	8,000 ~ 12,000
15,000	15,000	18,000 ~	15,000 ~	18,000 ~
30,000	30,000	33,000 ~	50,000 ~	70,000 ~
40,000	40,000	44,000 ~	80,000 ~	80,000 ~
50,000	50,000	60,000 ~	over 120,000	-
70,000	70,000	-	-	-

Note. measured values could vary with the types of Brookfield viscometer.

Relationship between viscosity and molecular weight

The viscosity of a solution is proportional to the MECELLOSE® molecular weight or chain length.

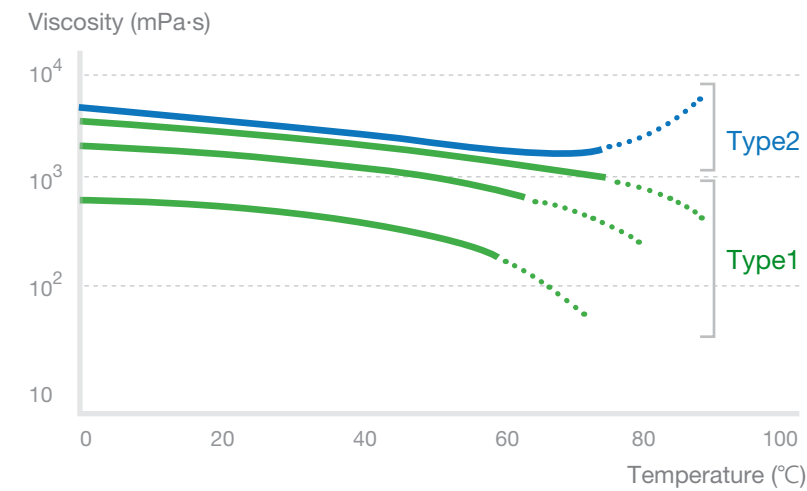
Average molecular weight of MECELLOSE® varies from 20,000 to 200,000.



Relationship between viscosity and concentration

In general, viscosity is proportional to the concentration of solution.

Limited to about 2.5% for high viscosity grade. (over 15,000 mPa·s, 2% solution)

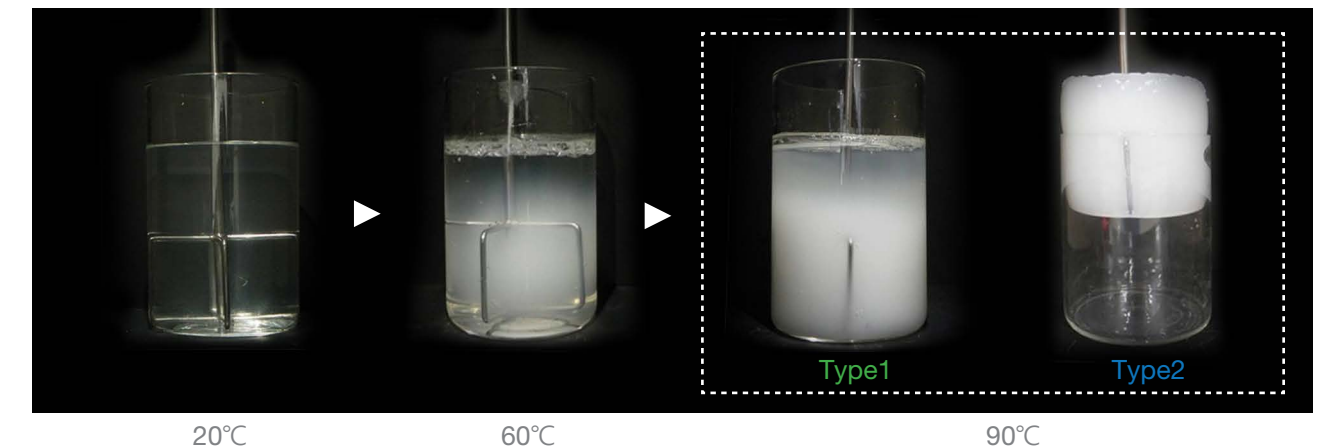


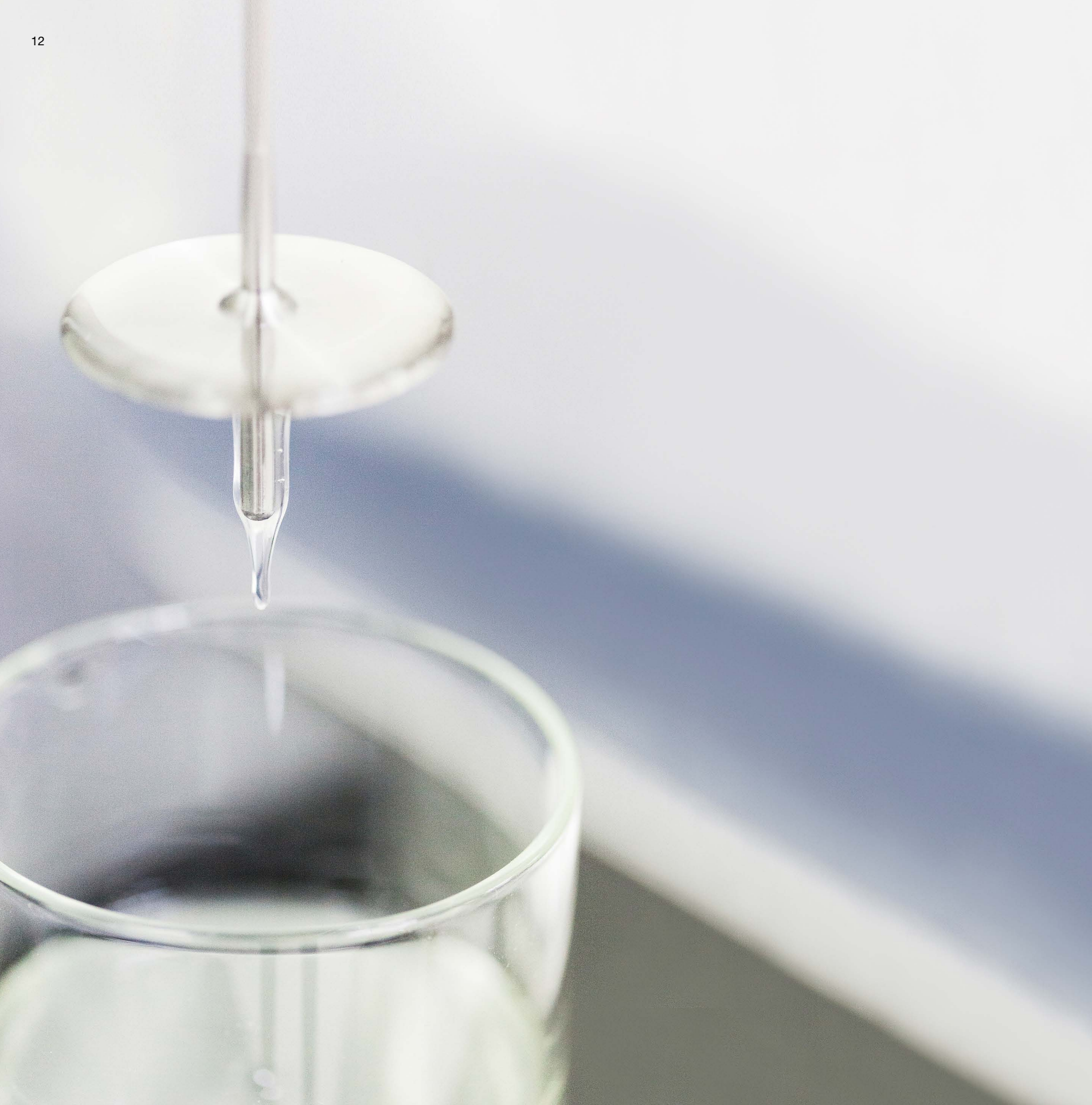
Relationship between viscosity and temperature

The viscosity of MECELLOSE® solution depends on its temperature. As the temperature increases, viscosity gradually decreases. When it reaches a certain temperature, viscosity decreases sharply producing the trend shown in dotted line; this temperature is called Gel-point.

- Type 1 : Hydroxyethyl methyl cellulose
- Type 2 : Methyl cellulose
- Hydroxypropyl methyl cellulose

Thermal gelation of MECELLOSE® solution





Main Benefits of MECELLOSE®

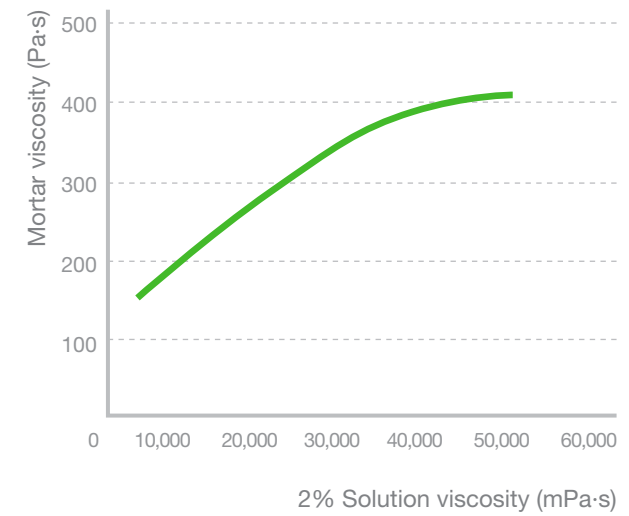


Thickening effect

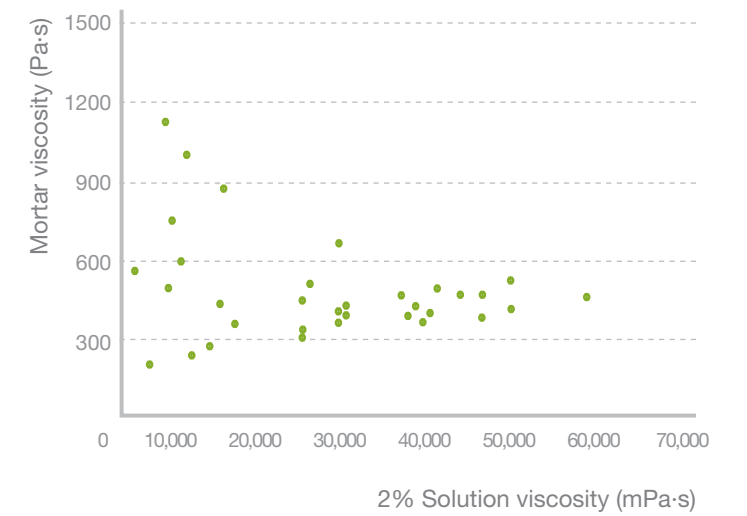
MECELLOSE® is used very often as a thickener in building applications as it prevents segregation and improves the cohesion of the formulation components. The viscosity of MECELLOSE® depends on the degree of polymerization, concentration, temperature, shear rate, concentration of dissolved salts and modification.

In dry mix mortar, thickening power of pure grades is related to their solution viscosity. On the other hand, mortar viscosity of modified grades is not necessarily proportional to the solution viscosity.

Pure grades



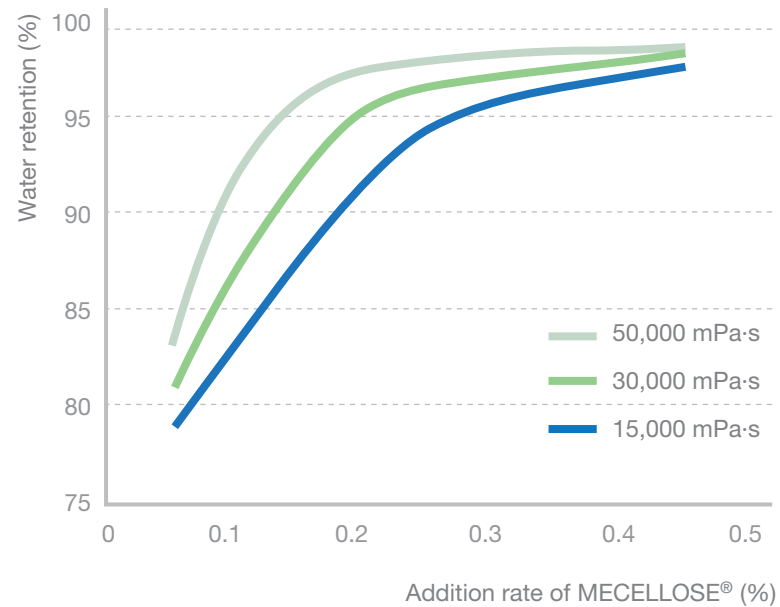
Modified grades



Water retention

MECELLOSE® substantially reduces the loss of water into absorbing substrates in formulations like cement renders, tile cements, gypsum plasters, etc.

The water retention ability of MECELLOSE® also strongly enhances the adhesion strength of thin-bed mortars. This is because the binders in the mortar such as the cement and gypsum have enough time for hydration and at the same time do not lose water.

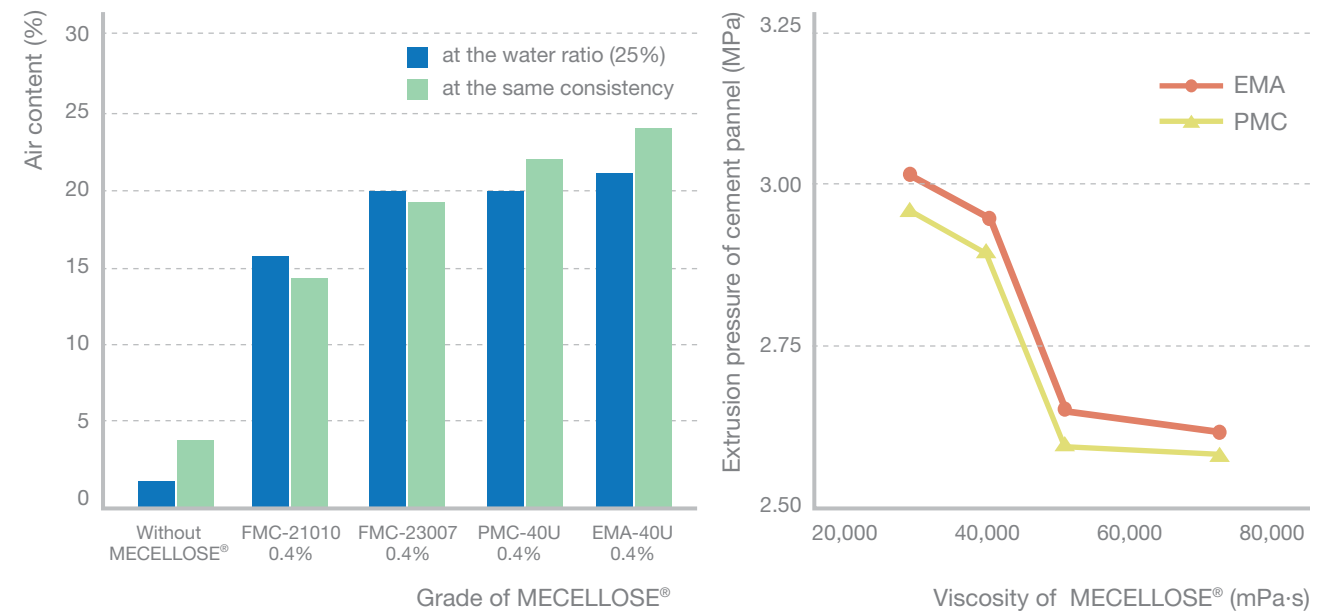


From the graph on the above, we can see that the water retention is strongly correlated to the viscosity levels. When the addition rate of MECELLOSE® reaches a high dosage, the difference in water retention among the different viscosity grades decreases.

Air entraining & Lubrication effects

MECELLOSE® shows surface activity as it is a polymer surfactant that has hydrophilic and hydrophobic groups in its molecules. When the mortars with MECELLOSE® are mixed with water, air voids are entrained into the matrix which provide positive effects such as easy handling (light weight), improved workability and cost saving (high mortar yield).

In addition, MECELLOSE® enhances the extrudability in cement and ceramic extrusion process due to its lubrication effects which reduce the extrusion pressure.



These results are measured in special condition; therefore, the results could be changed by various conditions.

Applications

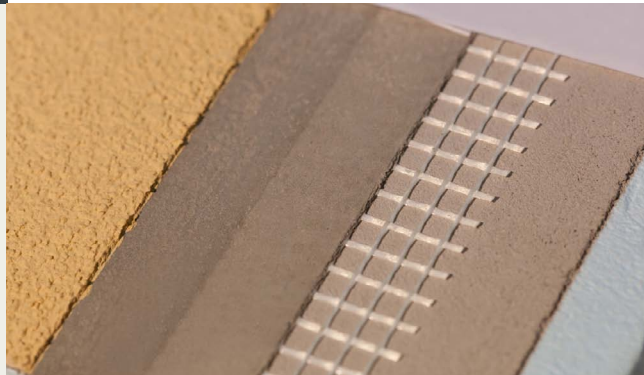


Tile Adhesives

To provide excellent thickening efficiency, long open time and adhesion power.

EIFS / ETICS

To provide excellent workability and long working time.



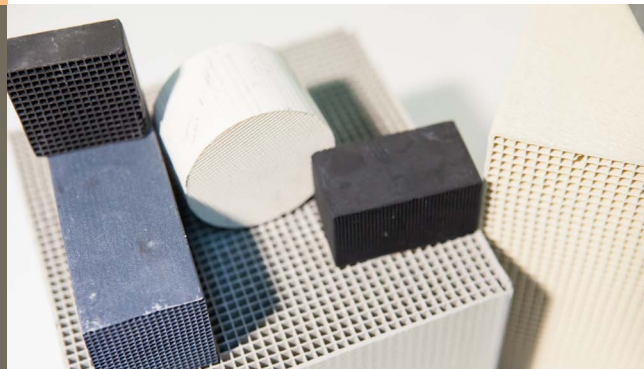
Plasters & Renders

To provide excellent workability and water retention.



Ceramic & Cement extrusion

To provide water retention and lubricity during processing.



Paints & Coatings

To be used as thickeners and pigment suspension aids. To improve the viscosity stability and dissolution of water based emulsion paints.



Personal care & Detergents

To be used as thickening, dispersing and emulsifying agents for the manufacturing of lotions, shampoos, toothpastes, etc.

Polymerization

To be used as thickening and suspending agents, protective colloids, and emulsion stabilizers for the manufacturing of PVC and PVAc.



Joint compound

To provide workability and tape adhesion, crack resistance.

Pharmaceuticals (AnyCoat®)

To be used as emulsifying and dispersing agents for ointments and creams, as binders for plaster bondage and as a compression aid and coating agent for a tablet.

MECELLOSE® in Tile Adhesives

MECELLOSE® promises the high performance and excellent working efficiencies for attachment of tiles to various substrates.

Being slip resistance and having better open time is the key to better adhesive requirements.

These improvements can only be gained through MECELLOSE®.

Effects of raw materials

Raw material	Cement CEM I 42.5R	Quartz sand	Hydrated lime	Redispersible powder	MECELLOSE®
Content (wt%)	30~50	40~70	0~5	0~5	0.20~0.60
Adhesion strength	●		●	●	○
Viscosity	●		●		○
Flexibility				●	
Workability		●	●	●	○
Slip resistance					○
Water retention					○
Setting time	●			●	○
Open time					○
Correction time					○

Grade	Viscosity (mPa·s, 2% solution)	Tile Cement Class	Properties
HIEND-2001	7,000~13,000	Premium class	Superior overall performance & Perfect slip resistance
FMC-21010	12,000~18,000	High performance & Standard	Excellent slip resistance & Excellent open time
FMC-22501	18,000~26,000	Standard & Normal	Good slip resistance & Good open time & Heat resistance
FMC-23007	27,000~35,000	Standard & Normal	Good slip resistance & Suitable open time
FMC-23021	26,000~36,000	Standard & Normal	Excellent slip resistance & Good open time
FMC-23502	32,000~40,000	Standard & Normal	Excellent open time & Heat resistance
FMC-23701	33,000~43,000	Standard & Normal	Good slip resistance & Long open time
ETC-4001	35,000~45,000	Normal & Economical	Good open time & Excellent Heat resistance
FMC-24502	40,000~50,000	High performance & Standard	Excellent slip resistance & Excellent open time
FMC-26002	53,000~63,000	Normal	Good slip resistance & Excellent open time

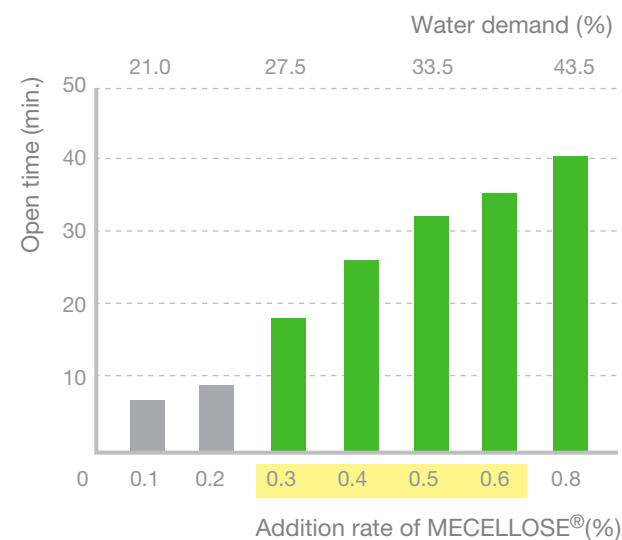
Slip resistance

Slip resistance is crucial in order to improve working efficiency in applied tile cement mortars on walls. MECELLOSE® provides adhesives with better slip property so that tiles can be applied in a better way. With suitable MECELLOSE® grades and concentration levels, heavy tiles over 50 kg can be applied to walls without slipping.

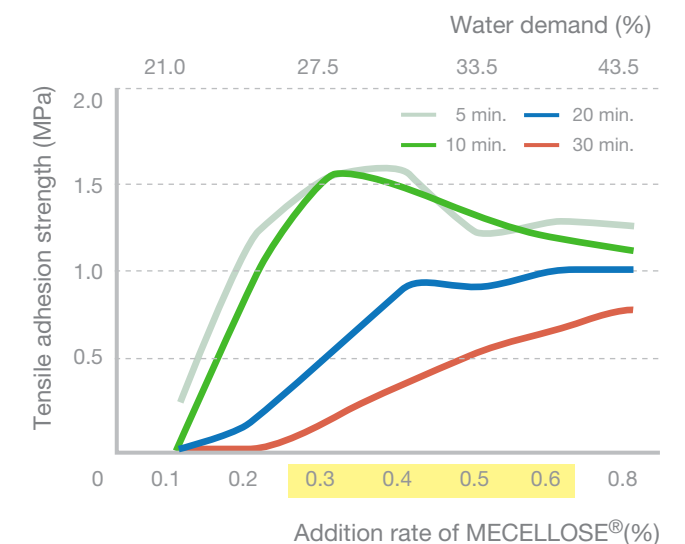
Open time & Tensile adhesion strength

Less skin formation and high water retention through MECELLOSE® ensure better quality during longer working time on the field. Suitable addition rate of MECELLOSE® ensure longer open time, higher tensile adhesion strength and better workability.

Open time vs. MECELLOSE® addition rate

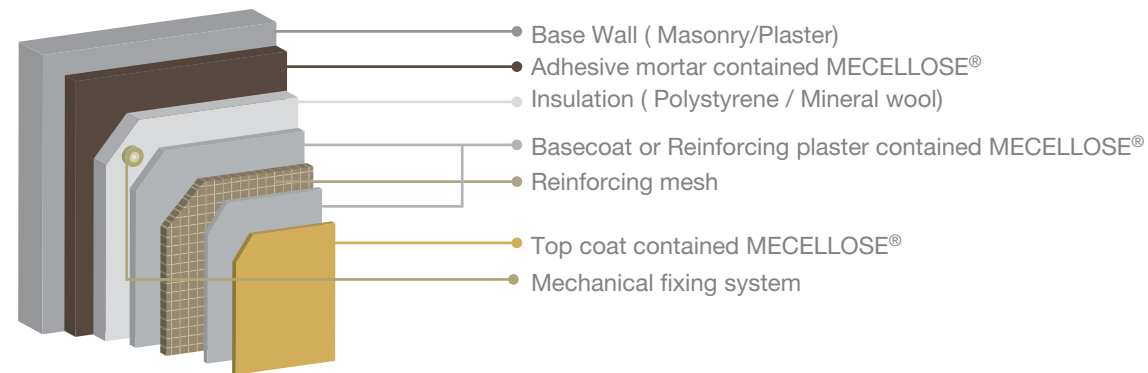


Strength vs. MECELLOSE® addition rate



MECELLOSE® in EIFS¹⁾ / ETICS²⁾

EIFS with MECELLOSE® promises even higher performances and excellent working efficiencies on job sites. MECELLOSE® leads to high sag resistance and long embedding time, which are the required key properties of EIFS.



1) EIFS (Exterior Insulation and Finishing System)
 2) ETICS (External Thermal Insulation Composite Systems)

Effects of raw materials

Raw material	Cement CEM I 42.5R	Quartz sand	Hydrated lime	Redispersible powder	Hydrophobic agent	Starch ether	MECELLOSE®
Content (wt%)	20~30	60~70	0~5	1.5~4	0.1~0.3	0.01~0.02	0.15~0.4
Adhesion strength	●		●	●			○
Open time						●	○
Water retention							○
Consistency	●		●			●	○
Crack	●		●				○
Easy trowelling		●	●	●		●	○
Sag resistance						●	○
Stickiness						●	○
Setting time	●			●			○
Waterproof					●		○

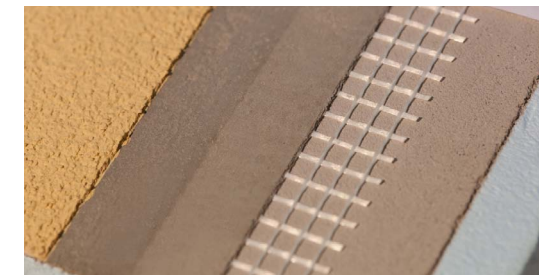
Better sag resistance

It is well known that mortar sag is a common problem on the field. Better sag resistance means that mortar can be applied more efficiently to walls without sag.

Longer open time and embedding time

Open time and embedding time refers to the possible working minutes to bond insulation board or mesh on to fresh mortar after the mortar is applied on the substrate. This relates to the skin formation and water evaporation of EIFS mortar.

Samsung's MECELLOSE® extends the open time and embedding time of mortars with its high water retention power and controlled skin formation properties of mortar surfaces.



Easier workability

Better leveling and reduced stickiness of MECELLOSE® can be applied easily to thick layers of EIFS.

Grade	Viscosity (mPa-s, 2% solution)	Properties
FMC-2070	14,000 ~ 22,000	Excellent workability & Good sag resistance
FMC-23007	27,000 ~ 35,000	High water retention & Good workability
FMC-23008	26,000 ~ 36,000	Less retardation time & Strong thickening power
FMC-23504	27,000 ~ 39,000	Very long open time & Excellent sag resistance
FMC-24006	34,000 ~ 44,000	Excellent water retention & Good workability
FMC-24503	42,000 ~ 52,000	Excellent open time & Less stickiness & Good workability

MECELLOSE® in Cement based Render

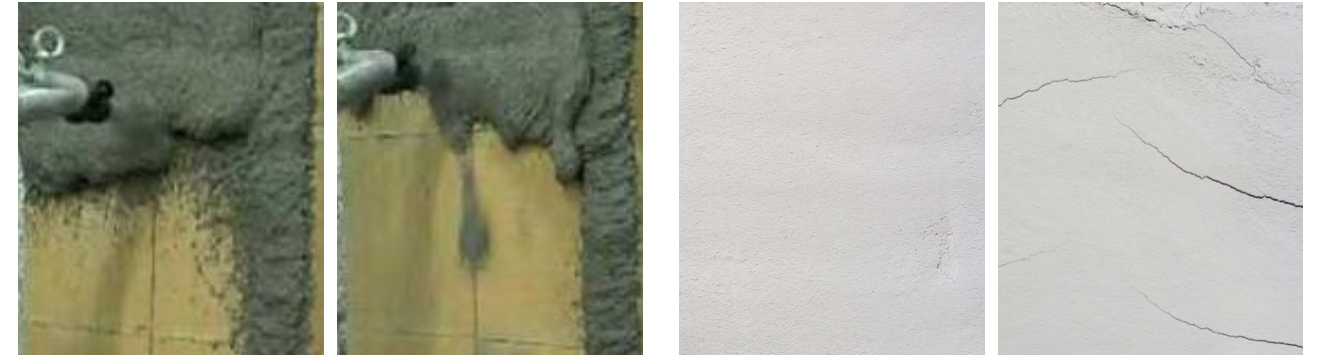
Cement based render with MECELLOSE® ensures superior quality and high efficiencies when applied to job sites. Have a look at the information on the below to see how you can customize your products to gain a competitive advantage.

Effects of raw materials

Raw material	Cement CEM I 42.5R	Limestone sand	Hydrated lime	Air entraining agent	Hydrophobic agent	MECELLOSE®
Content (wt%)	20~30	60~70	2~5	0.015~0.03	0.1~0.2	0.08~0.15
Tensile strength	●		●			●
Crack resistance	●	●	●			●
Workability		●	●	●		●
Sag resistance			●			●
Water retention						●
Setting time	●			●		●
Working life						●
Waterproof					●	●

Fast solubility

The amount of cellulose ether is usually used about 0.1% in cement based render. However, it is a key ingredient to secure sagging and cracking resistance. Fast solubility of cellulose ether offers the better sag resistance and workability for thicker layers. In addition, higher water retention power reduces crack formations because it prevents water loss into substrates or air. Again, this means that your finishing works will gain a better workability.



Sag resistance

Crack resistance

Grade	Viscosity (mPa-s, 2% solution)	Properties
FMC-21027	7,000 ~ 13,000	Excellent crack resistance & Fast solubility
FMC-21510	11,000 ~ 17,000	Fast thickening effect & Easy workability
FMC-22013	15,000 ~ 23,000	Excellent crack resistance, Less retardation of cement hydration & Fast solubility
FMC-22511	20,000 ~ 30,000	Excellent sagging resistance & water retention
FMC-22512	20,000 ~ 30,000	Excellent sagging resistance & Easy workability

MECELLOSE® in Gypsum based Plasters

Gypsum based plaster displays different properties based on the type of formulations and resource origins.

That's why special grades of MECELLOSE® have been developed to meet the specific requirements of our customers. With our well-equipped, specialized gypsum application laboratories, our broad product offerings, and our experienced team of application experts, we can always assist you in finding the right solutions in order to meet your requirements.

Effects of raw materials

Raw material	Gypsum (Hemi hydrate)	Hydrated lime	Limestone flour	Limestone sand or Silica sand	Perlite	Retarder	Air entrainment agent	Starch ether	MECELLOSE®
Content (wt%)									
GMP-1	40~60	1~5	5~30	30~50	0~3	0.02~0.2	0.01~0.03	0.01~0.1	0.15~0.3
GMP-2	74~98	1.5~5	0~5	5~10	0.3~3	0.02~0.2	0.01~0.03	0.01~0.1	0.15~0.3
GHP	74~95	0.5~5	-	5~25	0~3	0.02~0.2	0.01~0.03	0.01~0.05	0.1~0.2
GFP	70~100	0~2	0~30	-	-	0.02~0.2	0.01~0.02	0.~0.1	0.3~0.7
Strength	●	●							●
Workability		●			●		●	●	●
Sag resistance								●	●
Water retention	●								●
Consistency	●	●	●	●				●	●
Easy trowelling		●					●	●	●
Stickiness								●	●
Setting time	●					●			●
Working life						●			●

Water retention

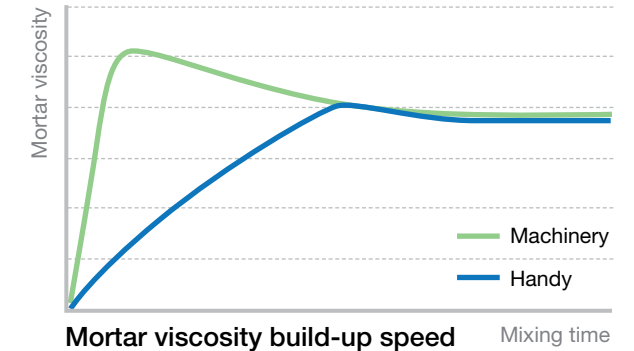
Water retention is the most significant property of MECELLOSE®, which controls the workable time. Generally, water retention depends on the viscosity, fineness, and dosage of MECELLOSE®.

Controlling thickening speed

Special types of MECELLOSE® control the mortar viscosity build-up. In general, fast thickening effects of MECELLOSE® are necessary to obtain better sag resistance and proper rheological functions in machine plasters. On the other hand, slow thickening enables easy mixing and stable mortar viscosity as well as less lump formation in manual & finishing plasters.

Workability & Sag resistance

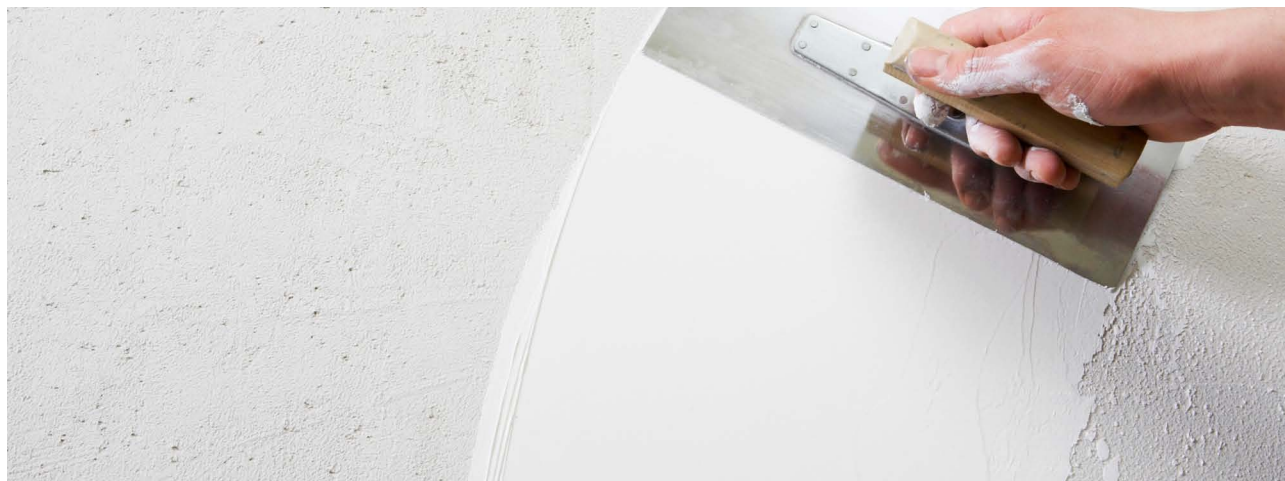
MECELLOSE® is a vital key to adjust suitable consistency in fresh mortars. Suitable consistency enables fresh plaster to attach well on walls as well as to make surfaces smooth and be applied easily without the feeling of stickiness. This translates to better workability and a better finished product for your customers.



Grade	Viscosity (mPa·s, 2% solution)	Class	Properties
FMC-7150	30,000 ~ 40,000	Gypsum Hand Plaster	High water demand & Good sag resistance
FMC-74013	33,000 ~ 43,000	Gypsum Hand Plaster	Easy mixing, High water demand & High water retention
FMC-72507	25,000 ~ 35,000	Gypsum Finishing Plaster/ Joint Filler	Excellent workability & Less lumping
FMC-7115	27,000 ~ 37,000	Gypsum Finishing Plaster/ Joint Filler	High water demand, High water retention & Good workability
FMC-73516	28,000 ~ 38,000	Gypsum Machine Plaster	Fast thickening effect, Excellent sag resistance & Good workability
FMC-75502	48,000 ~ 62,000	Gypsum Machine Plaster	High water retention & Good sag resistance

MECELLOSE® in Skimcoat

Skimcoat with MECELLOSE® offer smooth wall surface. It ensures easy workability, long pot life, excellent water retention and more.



Effects of raw materials

Raw material	White Cement	Limestone sand	Hydrated lime	Redispersible powder	Hydrophobic agent	MECELLOSE®
Strength	●		●	●		●
Workability		●	●			●
Water retention						●
Pot life						●
Stickiness						●
Waterproof					●	●

Grade	Viscosity (mPa·s, 2% solution)	Properties
FMC-25002	45,000 ~ 55,000	Excellent workability & pot life
FMC-25004	46,000 ~ 56,000	Excellent workability & pot life

MECELLOSE® in Extrusion

We are glad to say that our MECELLOSE® enables differentiated & optimized products for cement extrusion and ceramic extrusion. We have set ourselves apart from our competitors and we can guarantee that you will be satisfied with every aspect of our service to delivery.

Lubrication

MECELLOSE® improves workability and extrudability of cement extrusion based products and ceramic extrusion through its lubricant properties.

Water retention

MECELLOSE® extends pot-life of extrusion composites because it prevents the dry out and the leakage of water from the composites and extrusion die.

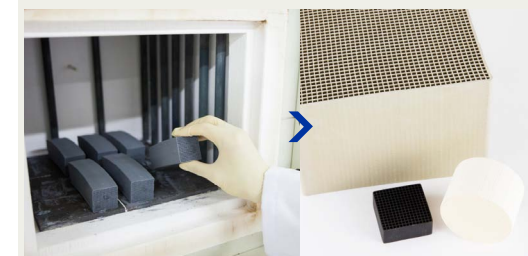
Shape stability

MECELLOSE® leads to excellent crack resistance and shape stability during extrusion process through its binding power.

Cement extrusion



Ceramic extrusion



Grade	Viscosity (mPa·s, 2% solution)	Properties
EMA-70U	50,000 ~ 70,000	Excellent extrusion speed, Very good green-body hardness & Good surface state
FMC-96001	55,000 ~ 65,000	Excellent surface state, Excellent green-body hardness & Excellent high temperature stability
MC-40H	3,500 ~ 6,000	Excellent extrusion pressure, Excellent green-body hardness & Excellent lubricous property
PMB-40H	3,500 ~ 5,600	Excellent pressure, Very good green-body hardness & Good surface state
PMB-15UFF	13,500 ~ 16,500	Excellent surface state, Excellent green-body hardness & Excellent extrusion pressure
PMB-30U	25,000 ~ 35,000	Excellent pressure, Very good green-body hardness & Good surface state
FMC-91002	7,000 ~ 11,000	Excellent surface state, Excellent green-body hardness & Excellent lubricous property

Packaging

Packaging

MECELLOSE® is packed in the following two types of packages.

A. 20 Kg : Net multi-layer paper bag with polyethylene inner liner

- 600 Kg is placed on one pallet, and 9.6 MT is loaded in one container of 20 ft.

B. 350 Kg : Net jumbo bag with polyethylene inner liner

- 1,050 Kg is placed on one pallet, and 10.5 MT is loaded in one container of 20 ft.



Storage & Safety Information

Storage

MECELLOSE® should be stored under dry and clean conditions in its original packaging due to its hygroscopic properties.

Relative humidity	Water absorption
50 %	6 - 8 %
60 %	9 - 10 %
70 %	12 -14 %
80 %	16 - 18 %

Safety information

While MECCELLOSE® is classified as a non-hazardous material, the following should be taken notice of in order to avoid unexpected accidents when handling:

Storage : Dust of MECCELLOSE® is capable of exploding. To avoid explosion due to dust, store away from heats, sparks and fires, and do not expose it directly to high temperatures.

Handling : Solutions of MECCELLOSE® are very slippery. To avoid any accidents, sweep the spilled powder and keep dry.

Health : Use appropriate procedures to avoid direct contact such as the skin or eyes and prevent any inhalation of the product.

Additional information : For further information on safety, refer to the Material Safety Data Sheet (MSDS) and/or contact LOTTE Fine Chemical directly or our representatives.

LOTTE

FINE CHEMICAL

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