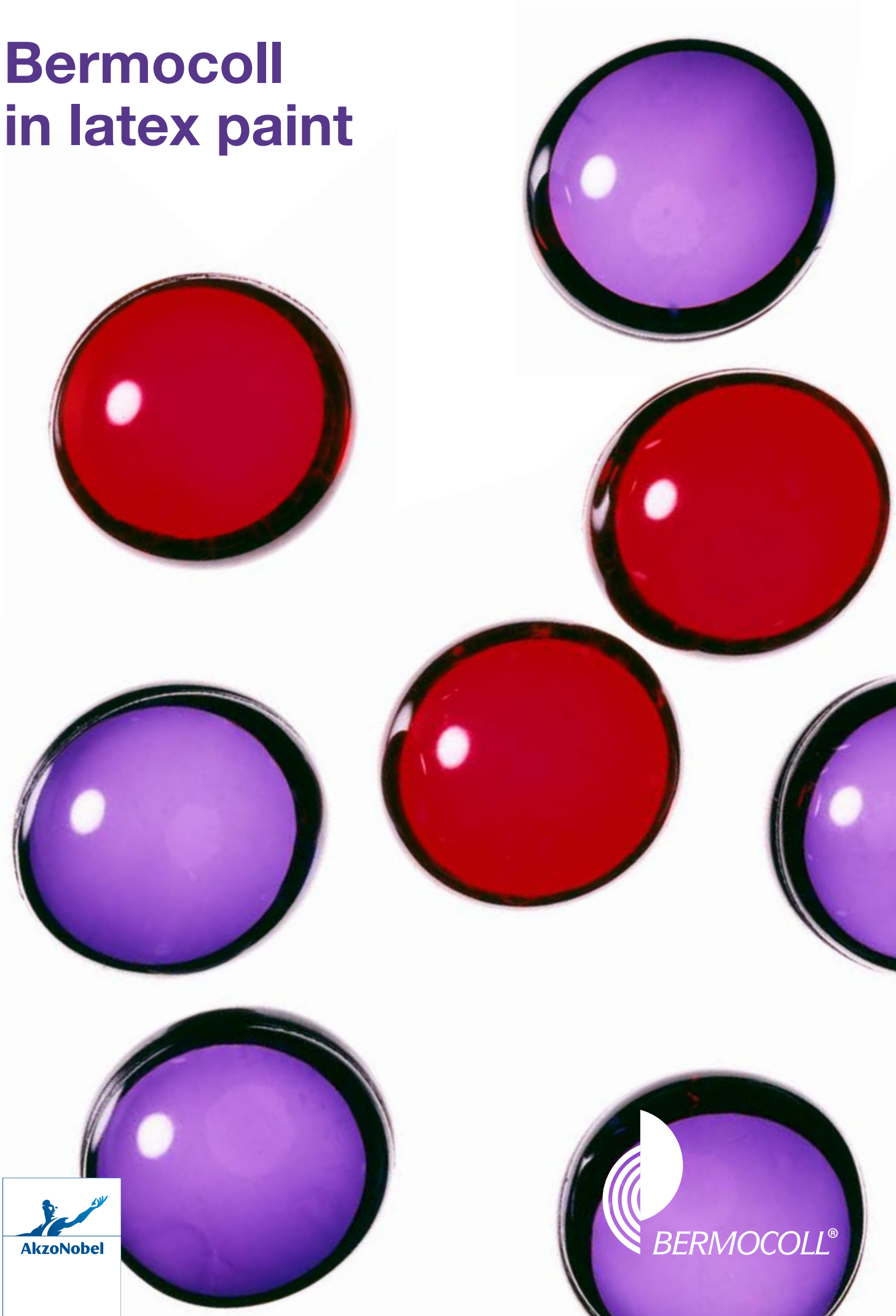
Bermocoll in latex paint



AkzoNobel

BERMOCOLL®

Contents

Bermocoll makes a difference

We at AkzoNobel have been serving the paint industry for more than 50 years with Bermocoll, a range of non-ionic cellulose ethers. Bermocoll is used as a thickener, stabilizer and water-retaining agent for water-based decorative paints.

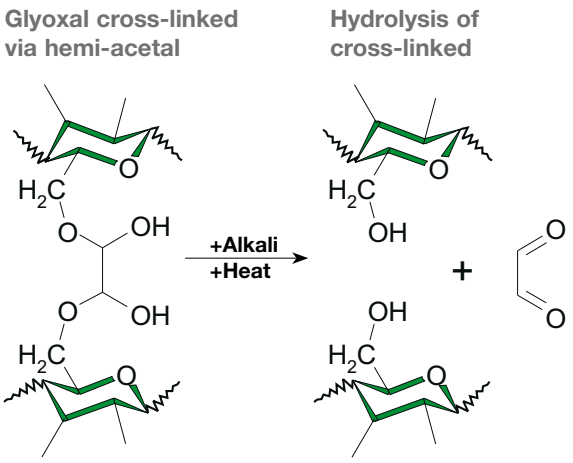
Bermocoll is a non-ionic cellulose ether and is available in a wide range of viscosities, and a variety of modified grades.
Cellulose is a natural polymer and the chief component is wood pulp or cotton linters. When we manufacture Bermocoll, the cellulose reacts with different substituents such as methyl, ethyl, hydroxyethyl, or hydrophobic groups. This process, called etherification, makes Bermocoll water soluble.

Bermocoll for Latex paint:

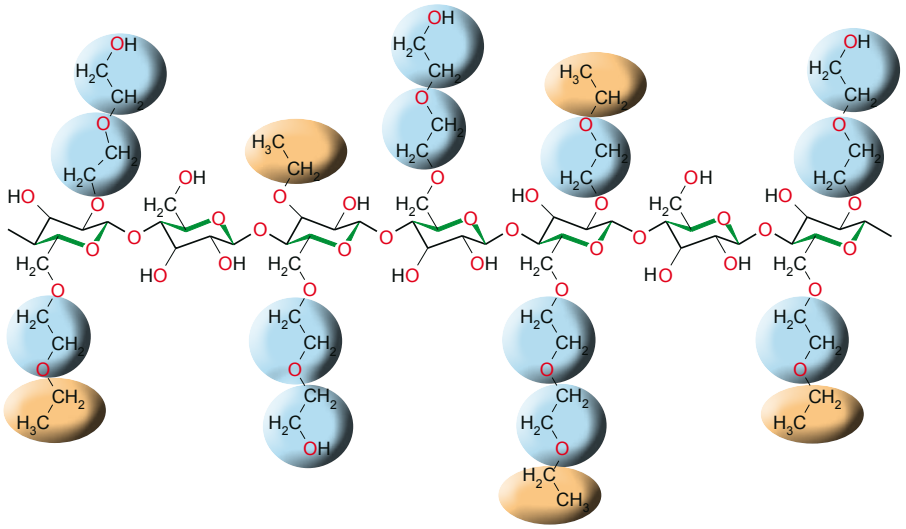
- **Bermocoll E** grades are ethyl hydroxyethyl celluloses
- **Bermocoll EM** grade is ethyl methyl hydroxyethyl cellulose ether, and is a high efficiency thickener
- **Bermocoll EBS and EBM** grades are resistant against enzymatic attack
- **Bermocoll EHM** grades are hydrophobically modified EHEC and are restistant against enzymatic attack

Dissolving of FQ grades

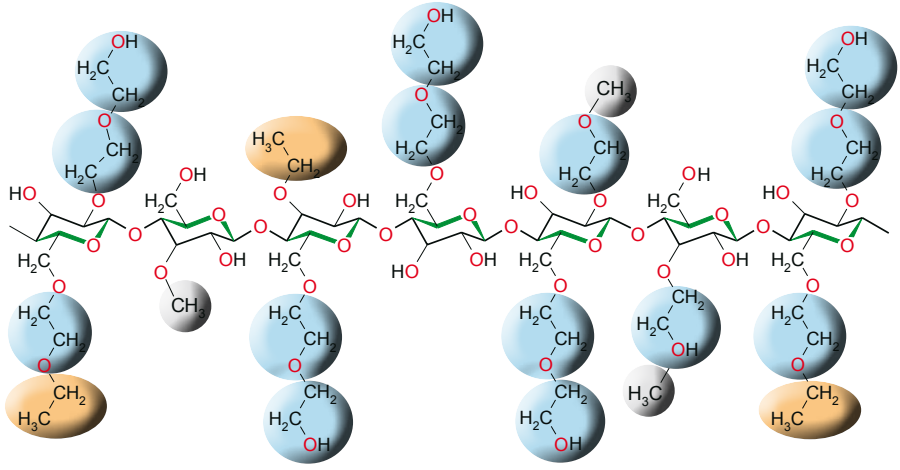
We want to avoid the lump formation that can occur when Bermocoll is added to water. That's why we treat all paint grades of Bermocoll that we describe in this brochure with controlled amounts of glyoxal.



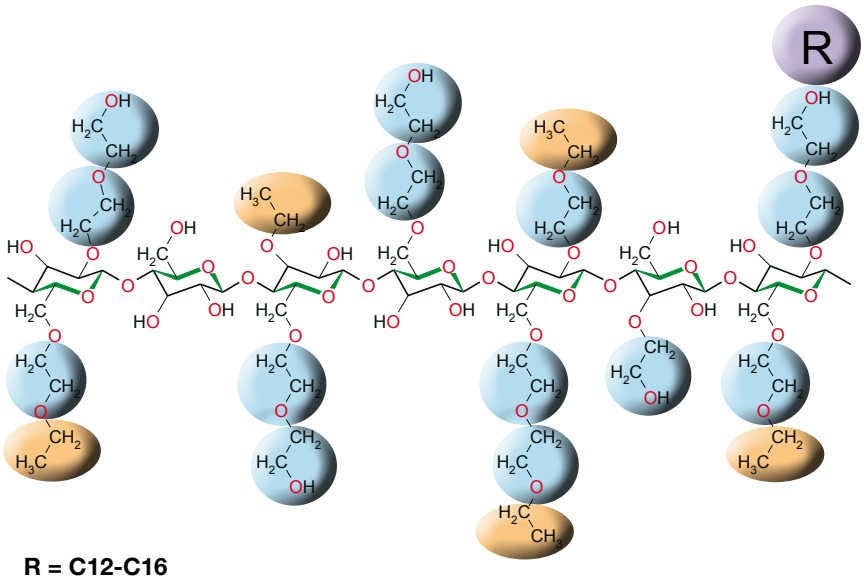
Bermocoll EHEC – Ethyl Hydroxyethyl Cellulose ether



Bermocoll EM/EBM – Ethyl Methyl Hydroxyethyl Cellulose ether



Bermocoll EHM – Hydrophobically modified EHEC



R = C12-C16

Bermocoll in latex paint

Bermocoll cellulose ethers can be regarded as polymeric surface active agents. They can contribute to the dispersion of pigments by improving the flow during grinding.

Bermocoll also helps us to stabilize the pigments from flocculation.
The thickening efficiency, i.e. the ability to build up viscosity, is dependent on the degree of polymerization of Bermocoll and thus the high viscosity grades have the highest thickening efficiency. The medium viscosity grades give a balanced low and high shear viscosity. The low viscosity grades of Bermocoll are the most efficient for improving the high shear viscosity.

Bermocoll, like all other cellulose ethers, has good water retention properties. We know how important it is to have long open times when working with paint.
Bermocoll helps to retain the water within the paint film and also to delay it from penetrating into the substrate or evaporating. This gives an increased open time.

Bermocoll is used in textured paint, chemical plaster, flat paint, satin paint, and semi-gloss paint.

Example of Latex paint formulation:

A. Pigment grind

- Water
- Foam suppressor
- Cellulose ether
- pH-buffer
- Propylene glycol
- Pigment dispersant
- Preservative
- Pigment (titanium dioxide)
- Fillers

B. Let down

- Surfactant
- Coalescing agent
- Latex
- Defoamer
- Fungicides
- Rheology modifier
- Colorant

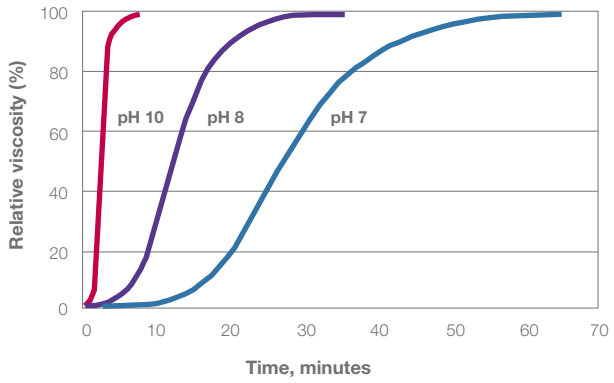


Fig. 1
Bermocoll FQ grade, influence of pH at 20°C.

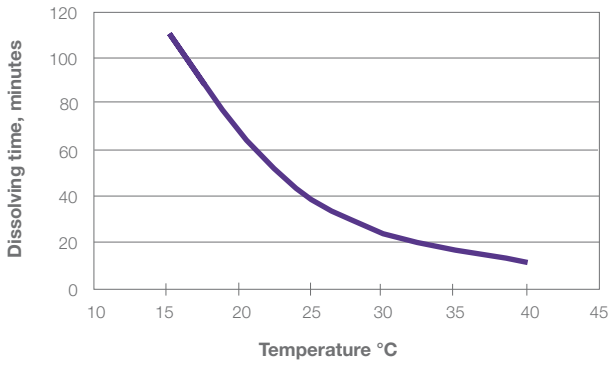


Fig. 2
Bermocoll FQ grade, influence of temperature at pH 7.

Incorporating Bermocoll ...

... as a dry powder

Bermocoll FQ grades can be added as a dry powder directly to the batch of water in the pigment grind. When added, the water should be neutral or slightly acid. Alkaline ingredients are added after thorough dispersion of the cellulose ether. We have seen that with this method, the dispersion power of Bermocoll is utilized during the subsequent grinding.

... as a slurry

Slurries containing up to 15–20% Bermocoll are readily made by dispersing a Bermocoll FQ grade either in water or in a suitable organic solvent. Such slurries are generally usable within half an hour after preparation. When working with aqueous slurries of Bermocoll FQ grades, the pH must be 7 or less.

... as a stock solution

Stock solutions are made by adding Bermocoll powder to water and stirring until the thickener is dissolved. We recommend a concentration of 2–5% depending on the Bermocoll type.
When using a Bermocoll FQ grade, the water should be neutral or slightly acid. If it is alkaline when adding Bermocoll FQ, the thickener will dissolve too quickly, forming an insoluble gel instead of a solution.
If you're planning to store stock solutions for a prolonged length of time, we recommend that stock solutions should be protected from micro organisms by using a suitable preservative.

Bermocoll cellulose ethers can be incorporated into the paint in different ways and at several stages during the manufacturing process. We recommend the following three main addition methods to be considered: as a dry powder (”batch in one”), as a slurry, and as a stock solution. All three methods have their pros and cons. Your choice of method will mainly be dependent upon the type of equipment and process you use.

Bermocoll E

is an ethyl hydroxyethyl cellulose

When choosing the viscosity type of Bermocoll you should consider its influences on a number of properties in the paint.
Leveling, hiding power and spatter will be better when using medium and low viscosity grades due to their more Newtonian character. We know that the higher viscosity grades offer improved cost efficiency and water resistance because of lower addition levels.

Typical properties of Bermocoll E

Physical data

Appearance	Whitish powder
Particle size according to Malvern	98%<425 µm
(Bermocoll E 230 and E 320	98%<500 µm)
Water content	Max 4%
(Bermocoll E 230 and E 320	Max 5%)
Salt content (as NaCl)	Max 5%
pH (1% solution)	Neutral

Viscosity at 20°C
(Brookfield LV) 1% or 2% solution

Bermocoll E 230 FQ 260 – 360 mPa·s (2%)
Bermocoll E 320 FQ 1850 – 2650 mPa·s (2%)
Bermocoll E 351 FQ 4250 – 6000 mPa·s (2%)
Bermocoll E 411 FQ 850 – 1200 mPa·s (1%)
Bermocoll E 431 FQ 1700 – 2400 mPa·s (1%)
Bermocoll E 451 FQ 2550 – 3600 mPa·s (1%)
Bermocoll E 481 FQ 4250 – 6000 mPa·s (1%)

Choosing the right Bermocoll

Paint characteristics	Influenced by	Bermocoll grade Low	Medium	High
Structure, body	Thickening viscosity	-	+	++
Hiding power	Application viscosity	++	+	-
Leveling	Paint viscosity at low shear rate	+	+	-
Spatter resistance	Thickener viscosity	++	+	-
Open time	Thickener concentration	++	+	+
Water resistance	Thickener concentration	-	+	++
Cost	Thickener concentration	-	+	++

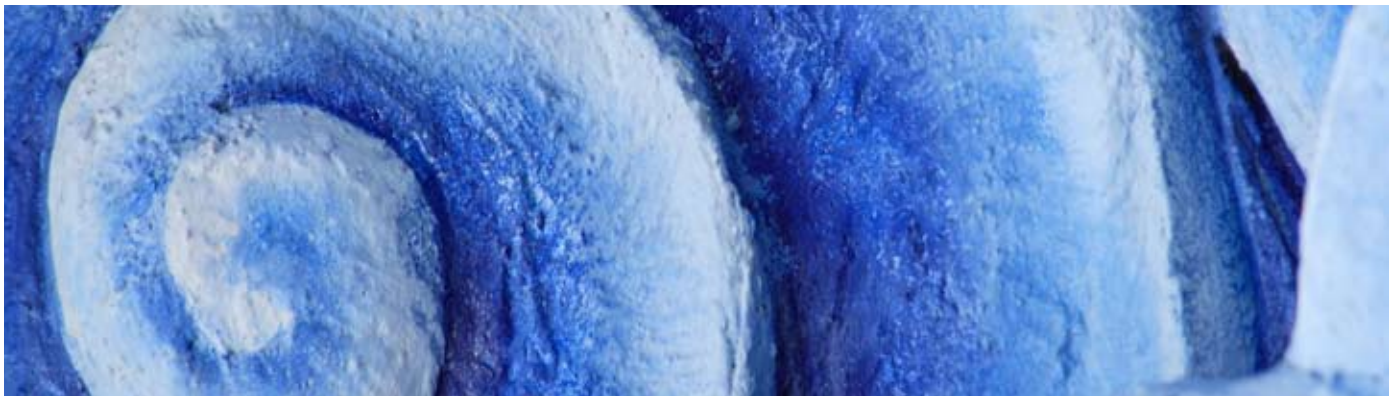
Bermocoll EBS

is an ethyl hydroxyethyl cellulose, resistant against enzymatic attack

Cellulose ethers are attacked with varying intensity by micro-organisms or enzymes. We see that this results in a decrease in viscosity due to reduction in the degree of polymerization.

The degree to which cellulose derivate will resist enzyme degradation depends primarily on the nature of the substituent groups and the pattern of substitution along the cellulosic backbone. We use a specific production technology that makes it possible to produce Bermocoll EBS, which is significantly more resistant to enzymatic attack than most other water soluble gums and polymeric materials. This increased resistance is an important factor when used in Latex paints.

Bacterial growth can be a problem during storage. But we find that it can easily be prevented by adding a sufficient amount of a suitable preservative. Preservatives are only effective against bacteria and not against enzymes. We offer Bermocoll EBS in grades of viscosity ranging from medium to high.



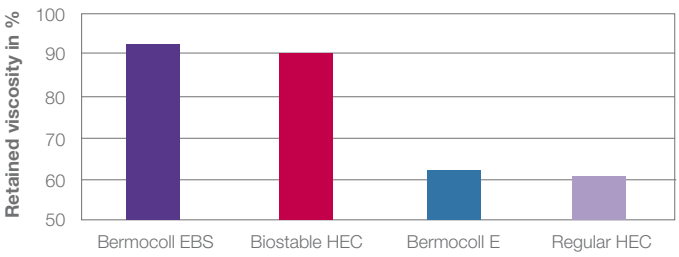


Fig. 3
Enzyme resistance at 20°C.
Viscosimetric determination of the resistance to enzymatic degradation of cellulose derivatives, at 20°C. Bermocoll EBS has excellent enzymatic resistance.

Typical properties of Bermocoll EBS

Physical data

Appearance	Whitish powder
Particle size	98%<425 µm
Water content	Max 4%
Salt content	Max 5%
pH (1% solution)	Neutral

Viscosity at 20°C
(Brookfield LV) 1% or 2% solution

Bermocoll EBS 351 FQ 5000 – 6000 mPa·s (2%)
Bermocoll EBS 411 FQ 850 – 1200 mPa·s (1%)
Bermocoll EBS 431 FQ 1700 – 2400 mPa·s (1%)
Bermocoll EBS 451 FQ 3000 – 4000 mPa·s (1%)
Bermocoll EBS 481 FQ 4000 – 6000 mPa·s (1%)

Bermocoll EM 7000 FQ

is an ethyl methyl hydroxyethyl cellulose

Bermocoll EM 7000 FQ can be used in all types of Latex paints ranging from low to high PVC. Its performance advantages are most apparent in flat interior as well as exterior paints. Bermocoll EM 7000 FQ combines color acceptance and improved wet scrub resistance with high thickening efficiency.

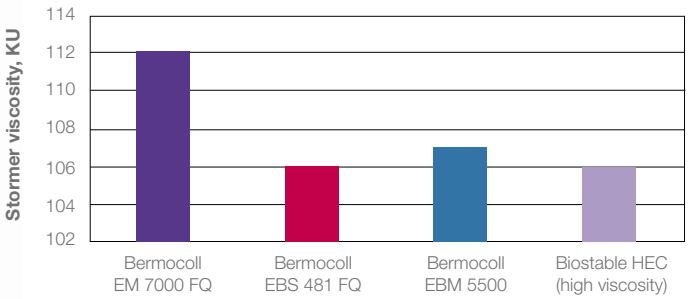


Fig. 4
Thickening efficiency.
Efficiency of different cellulose thickener in a flat PVC 58% paint. 0.4% thickener is added. The efficiency of Bermocoll EM 7000 FQ is normally considerably higher than other high molecular weight cellulose ethers.

Typical properties of Bermocoll EM

Physical data

Appearance	Whitish powder
Particle size	98%<425 µm
Water content	Max 4%
Salt content	Max 6%
pH (1% solution)	Neutral

Viscosity at 20°C (Brookfield LV) 1% solution

Bermocoll EM 7000 FQ 6000 – 8000 mPa·s

Bermocoll EBM

is an ethyl methyl hydroxyethyl cellulose, excellent resistance against enzymatic attack

We developed **Bermocoll EBM** in order to combine the properties of HEC and MHPC. Bermocoll EBM can be used in all types of Latex paints ranging from low to high PVC. The performance advantages are most apparent in flat, and semi-gloss interior as well as exterior paints.

Bermocoll EBM is extra biostable and we offer it in different viscosity grades.

Bermocoll EBM is low foaming, with good storage stability in paint, and good color acceptance.

A comparison in water solution of different cellulose ethers shows a typical performance of Bermocoll EBM, MHPC, and biostable HEC. Fig. 5 and Fig. 6.

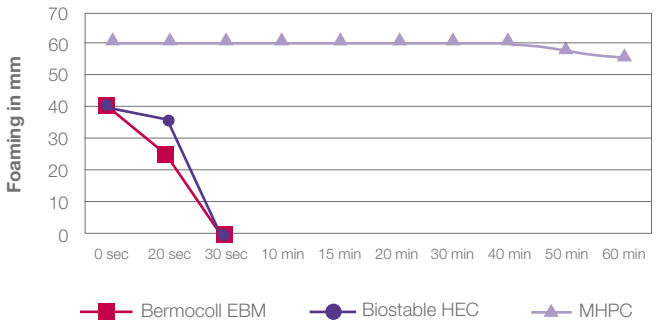


Fig. 5
Foaming of 0.1% polymers in water at 20°C.
The foam tests were performed according to a method in which a graduated cylinder containing 200 ml of 0.1% polymer solution is rotated at a specific speed, 40 rpm for 60 seconds. The foam height is then measured immediately and after varying times. Bermocoll EBM is very low foaming in comparison with other cellulosic derivatives.

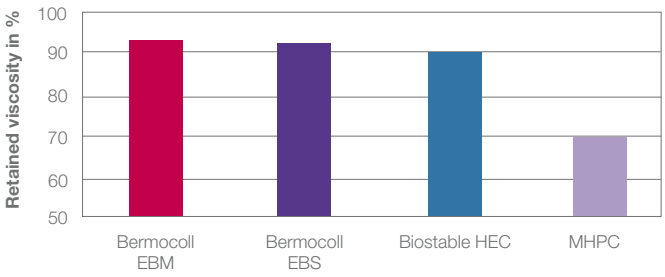


Fig. 6
Enzyme resistance at 20°C.
Viscosimetric determination of the resistance to enzymatic degradation of cellulose derivatives, at 20°C. Bermocoll EBM has excellent enzymatic resistance.

Typical properties of Bermocoll EBM

Physical data

Appearance	Whitish powder
Particle size	98%<500 µm
Water content	Max 4%
Salt content	Max 6%
pH (1% solution)	Neutral

Viscosity at 20°C
(Brookfield LV) 1% solution

Bermocoll EBM 1000	500 – 800 mPa·s
Bermocoll EBM 3000	2000 – 3000 mPa·s
Bermocoll EBM 5500	5000 – 6500 mPa·s
Bermocoll EBM 8000	7000 – 9000 mPa·s

Bermocoll EHM

is a non-ionic associative ethyl hydroxyethyl cellulose

Bermocoll EHM is a non-ionic associative ethyl hydroxyethyl cellulose-based polymer with enhanced enzymatic resistance. We developed it in order to improve the rheological properties in Latex paints.

Bermocoll EHM combines the performance of low viscosity ethyl hydroxyethyl cellulose with the rheological properties of synthetic associative thickeners. In addition to ethyl and hydroxyethyl substituents of EHEC, the Bermocoll EHM molecule also contains hydrophobic groups, which can associate with hydrophobic surfaces within the paint.

Bermocoll EHM provides the following property improvements to a Latex paint:
- Enhanced brushing viscosity
- Good leveling
- Outstanding spatter resistance
- Good tinting reproducibility

We know that a high application viscosity is essential for good film build and hiding power. That's why our Bermocoll EHM contributes to the medium and high shear viscosity to a much greater extent than regular cellulose ethers.

Bermocoll EHM product range

Bermocoll EHM 200
- Low viscosity grade
- High thickening efficiency
- Excellent spatter resistance

Bermocoll EHM 300
- High thickening efficiency
- Very good spatter resistance
- Low influence of surfactants

Bermocoll EHM 500
- Very high thickening efficiency
- Good spatter resistance
- Surfactants may be needed to modify the flow

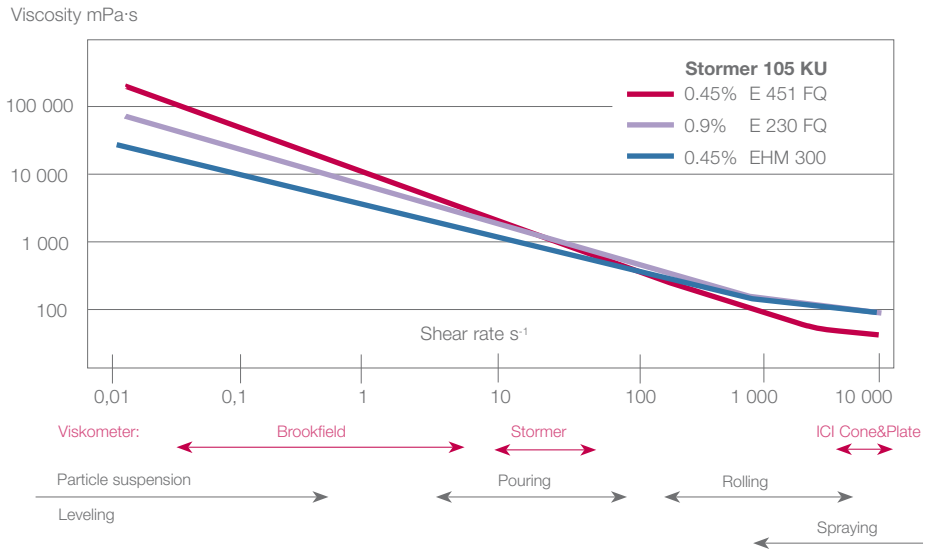


Fig. 7
Viscosity vs. shear rate in paint.
Depending on the paint formulation, particularly the binder, the addition level of Bermocoll EHM required to reach a specified Stormer viscosity can vary. This applies to all associative thickeners. Other ingredients, such as dispersants, surfactants and coalescing agents, also influence properties such as thickening efficiency, leveling, gloss and stability.

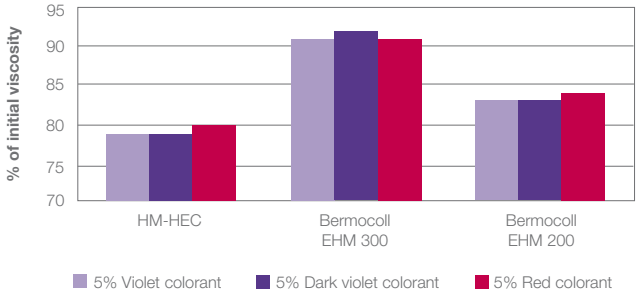


Fig. 8
Influence of colorants in flat paint based on Acronal S 559.
Bermocoll EHM 300 is less susceptible to viscosity drop through the addition of surfactants or colorants than other hydrophobically modified cellulose ethers.

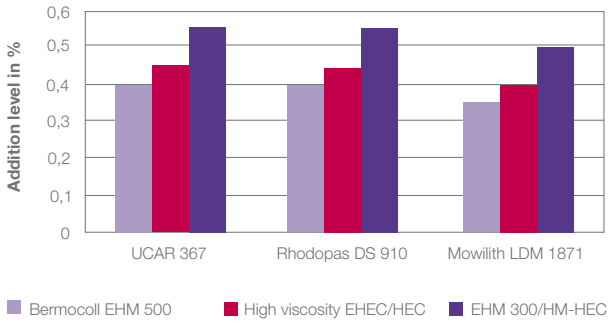


Fig. 9
Addition level to reach Stormer viscosity 100 KU, with different binders.
The efficiency of Bermocoll EHM 500 is normally considerably higher than other high molecular weight cellulose ethers and hydrophobically modified cellulose ethers. Bermocoll EHM 500 is most suitable for use with binders that have weak association (low thickening effect).

Typical properties of Bermocoll EHM

Physical data

Appearance	Whitish powder
Particle size	98%<500 µm
Water content	Max 4%
Salt content	Max 6%
pH (1% solution)	Neutral

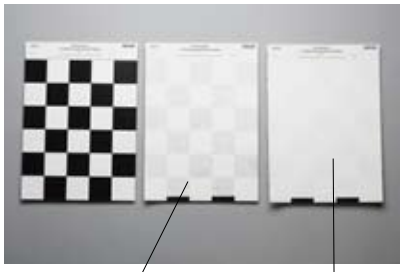
Viscosity at 20°C (Brookfield LV) 1% solution

Bermocoll EHM 200	350 – 700 mPa·s
Bermocoll EHM 300	1700 – 3000 mPa·s
Bermocoll EHM 500	7000 – 10000 mPa·s

Color acceptance

Leveling of a paint

Hiding power – with roller



Low ICI viscosity
Poor hiding power

High ICI viscosity
Good hiding power

Test methods for paint

Color acceptance
A colorant sometimes fails to disperse completely in a base-paint due to poor compatibility, which can be the fault of the colorant, the paint or both. A colorant is added to the paint and then the paint is applied to a white chart. A rub-out test is performed and after drying, the paint is judged for color differences.

Leveling of a paint
A measure of its ability to flow out after application and to obliterate any surface irregularities such as brush marks.
The paint is pre-sheared and then applied to a sealed chart with the Leneta leveling test blade. The draw-down is dried in a horizontal position.

Hiding power – with roller
A contrast card is painted to see how well the paint covers the surface. The hiding power is dependent on the ICI viscosity (application viscosity); higher ICI viscosity gives better hiding power due to a thicker paint layer.

Enzyme resistance
Viscometric determination of the resistance to enzymatic degradation of cellulose derivatives. After inoculating a cellulase enzyme solution, the degradation of the cellulose ether is followed by continuous viscometry. The enzyme resistance of the cellulose ether is calculated as the percentage of viscosity retained after 60 minutes.

Spatter resistance

Scrub resistance

Gloss

Sag resistance

Spatter resistance

Determination of the spatter of a water-based paint. Paint is rolled on wallpaper and any spatter is collected on a chart placed horizontally directly below the rolled surface.

Scrub resistance

This method is an accelerated procedure for determining the resistance of paints to erosion caused by scrubbing.

Gloss

Gloss is a term used to express the capacity of surfaces to reflect directed light.
The gloss is measured at three different angles 20°, 60°, and 85°.

Sag resistance

This method is used to determine the sag resistance of aqueous coatings.
The paint is applied to a chart with anti sag meter with either 3–12 mils or 4–24 mils.
The chart is placed immediately in a vertical position with the thinnest stripe at the top and left to dry.

Rheology/ viscosity

Rheology of coatings

Rheology is the science of deformation and flow of materials. Every material is influenced by external forces. For paint, these forces can range from gravitational forces, which influence phenomena such as sedimentation, leveling and sagging, to the very high shear forces that act on the paint when it is brushed, rolled or sprayed. Viscosity is a measure of a material's resistance to flow.

Rheometer

A defined shear stress is applied and the resulting flow or deformation of the material is recorded. The methods used are stress/strain sweep and frequency sweep in oscillatory mode and viscosity, creep/recovery, yield stress and relaxation in rotational mode.

Cone and plate viscometer (ICI viscometer)

Standard test for dynamic viscosity measurement performed at high shear rate, 10,000 or 12,000 s^{-1}, known as application viscosity.

Brookfield viscosity, type LV

This viscometer is used to determine the viscosity of water solutions of cellulose derivatives. The cellulose derivative is dissolved in 1% or 2% buffered solution, depending on the viscosity grade of the derivative.

Stormer viscometer

Standard test for dynamic viscosity measurement performed at mid shear region, 10–50 s^{-1}. The viscosity is noted in Krebs Units, KU.

Causes and cures

Latex paint problems related to Bermocoll

	Problem	Cause	Cure
Manufacturing	Lump formation during dissolving of Bermocoll	• Wrong type of Bermocoll used • pH of water too high • pH of solution too high	• Use FQ grade • Add acetic acid • Add Bermocoll directly after adding water – then add alkaline ingredients, e.g. pigment dispersant
	Too slow dissolving	• Neutral or acid water • Temperature too low	• Increase pH
	Too fast dissolving	• pH too high • Hard water/high pH • Temperature too high	• Decrease pH
	Foam development during grinding	• Surface active products (Bermocoll, surfactants, pigment dispersant)	• Add the right foam suppressor before surface active products
	Final viscosity too low	• Inadequate amount of Bermocoll	• Post addition of slurry of Bermocoll or polyurethane thickener
	Final viscosity too high	• Incorrect amount or type of Bermocoll	• Use lower addition level • Use lower viscosity grade
Application	Spatter from roller	• Too elastic thickener	• Use Bermocoll low viscosity grade or EHM grade • Use polyurethane thickener in combination with Bermocoll
	Brush resistance too low	• Low application viscosity	• Use Bermocoll low viscosity grade or EHM grade
	Poor open time	• Insufficient water retention	• Increase Bermocoll addition level • Add glycol
	Poor hiding power	• Low application viscosity	• Use Bermocoll low viscosity grade or use EHM grade
Dried film	Poor gloss	• Cellulose ethers not suitable in high gloss paints	• Use polyurethane thickener
	Poor leveling	• Rheological character of the paint	• Use polyurethane thickener or Bermocoll EHM thickener
	Inadequate wet scrub resistance	• Water sensitivity of film	• Reduce surface active ingredients
Storage	Drop in viscosity	• Enzymatic degradation • Bacterial contamination	• Use Bermocoll EBS or EBM grades • Clean production equipment • Change bactericide
	Increase in viscosity	• Insufficient amount of dispersant • Interaction Bermocoll/Latex	• Increase pigment dispersant • Use non-ionic surfactants
	Separation	• Low shear viscosity too low	• Increase Bermocoll addition or use higher viscosity grade
	Syneresis	• Insufficient colloidal stabilization	• Add non-ionic surfactants or use lower viscosity grade of Bermocoll

About us

Cellulosic Specialties

Our Bermocoll locations worldwide

- Head office
- Research and development
- Business and service centers
- Production site

www.bermocoll.com

Cellulosic Specialties – the small company with multinational resources
Cellulosic Specialties is part of AkzoNobel Functional Chemicals, one of the business units within AkzoNobel. We have a unique technology base and experience of cellulose derivatives, with more than 50 years of development, manufacturing and sales of these products.

Today, our customers can be found in more than 90 countries. The combination of a multinational group's large resources and a small company's close proximity to its customers has given us a unique position. Our research and product development has always been guided by our customers and their requirements. We want you to look upon us as a responsive and responsible business partner, and to regard us as your preferred supplier of cellulosic specialties.

Tomorrow's Answers Today
At AkzoNobel, we believe the future belongs to those smart enough to challenge it. We believe that real progress belongs to those who not only think with courage, but also have the courage to deliver on the thought. Tomorrow's answers, delivered today. We are driven by the knowledge that what is good enough for our customers today may not necessarily be good enough for them tomorrow.

For a sustainable future
Another integral part of our daily work involves the protection of human and animal health and of the environment by ensuring that our products can be safely used throughout their entire lifecycle. Backed up by our commitment to Product Stewardship, Responsible Care® and Reach, we believe that supplying the right chemistry goes beyond just selling products.

Our efforts have been rewarded. The ISO 9001 and the ISO 14001 certification awarded for R&D, production, marketing and distribution of Bermocoll are only the first steps on the road to fulfilling our ambitions – to meet customers' request for competitive, environmentally sound, and profitable products today and tomorrow.

Bermocoll products

Additives for water-based paint

Product type	Product name	Viscosity (mPa·s)*	%	Performance
Regular Cellulosic Thickeners	Bermocoll E 230 FQ	260 – 360	2%	High shear viscosity – low spatter
	Bermocoll E 320 FQ	1850 – 2650	2%	High shear viscosity – low spatter
	Bermocoll E 351 FQ	4250 – 6000	2%	Balanced low and high shear viscosity
	Bermocoll E 411 FQ	850 – 1200	1%	Balanced low and high shear viscosity
	Bermocoll E 431 FQ	1700 – 2400	1%	Low shear viscosity – economical
	Bermocoll E 451 FQ	2550 – 3600	1%	Low shear viscosity – economical
	Bermocoll E 481 FQ	4250 – 6000	1%	Low shear viscosity – economical
	Bermocoll EM 7000 FQ	6000 – 8000	1%	Low shear viscosity – economical
Biostable Cellulosic Thickeners	Bermocoll EBS 351 FQ	5000 – 6000	2%	Balanced low and high shear viscosity
	Bermocoll EBS 411 FQ	850 – 1200	1%	Balanced low and high shear viscosity
	Bermocoll EBS 431 FQ	1700 – 2400	1%	Low shear viscosity – economical
	Bermocoll EBS 451 FQ	3000 – 4000	1%	Low shear viscosity – economical
	Bermocoll EBS 481 FQ	4000 – 6000	1%	Low shear viscosity – economical
	Bermocoll EBM 1000	500 – 800	1%	Balanced low and high shear viscosity
	Bermocoll EBM 3000	2000 – 3000	1%	Balanced low and high shear viscosity
	Bermocoll EBM 5500	5000 – 6500	1%	Low shear viscosity – economical
	Bermocoll EBM 8000	7000 – 9000	1%	Low shear viscosity – economical
Associative Cellulosic Thickeners	Bermocoll EHM 200	350 – 700	1%	Efficient – improved paint quality
	Bermocoll EHM 300	1700 – 3000	1%	Efficient – improved paint quality
	Bermocoll EHM 500	7000 – 10000	1%	High efficiency – improved paint quality

* Viscosity of aqueous solutions at 20°C (68°F)
Measurements mPa·s, with Brookfield viscometer type LV at speed of 12 rpm

Europe/Middle East/Africa

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