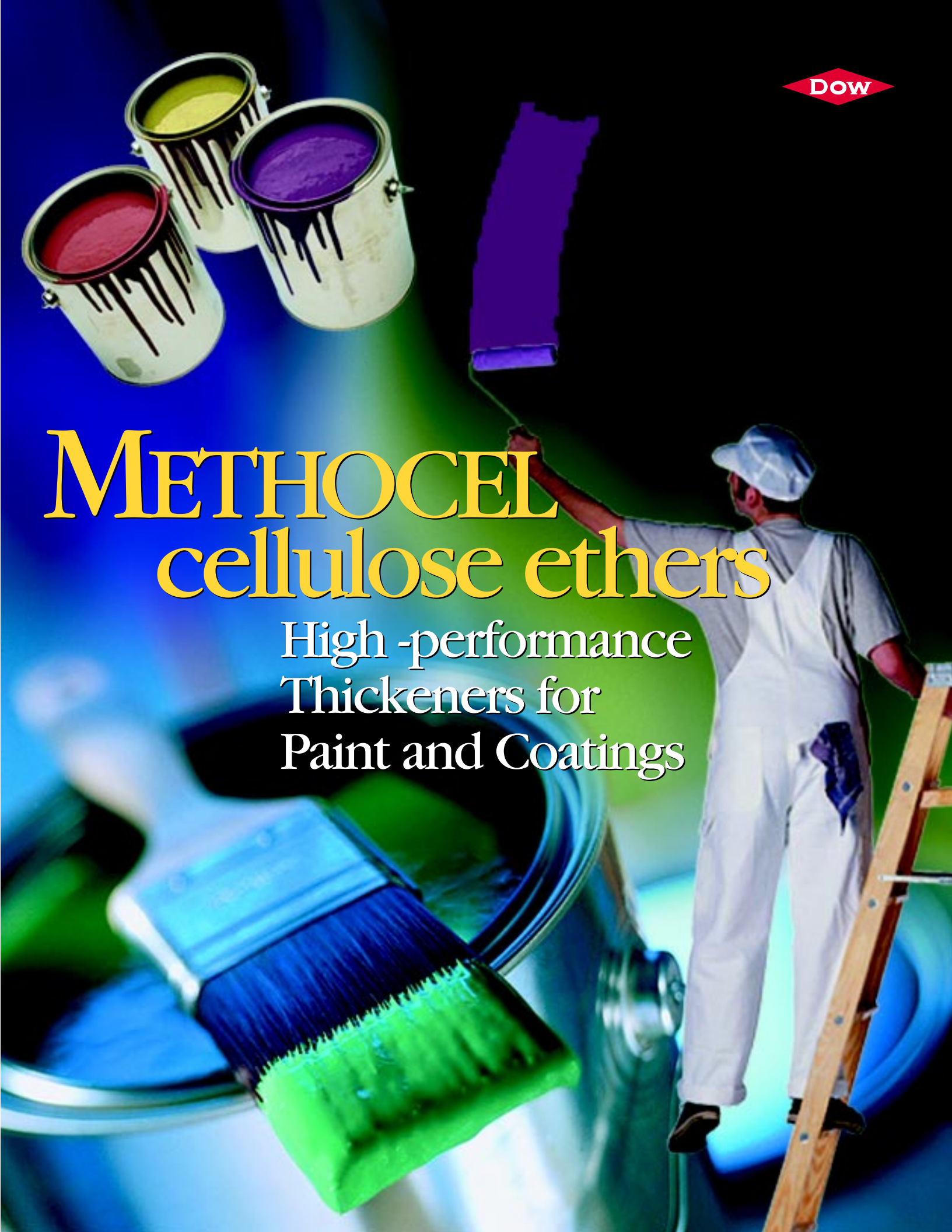

Dow
METHOCEL
cellulose ethers
High -performance
Thickeners for
Paint and Coatings

Use METHOCEL Cellulose Ethers to Get the Thickening Properties You Need, with the Service You Require to Develop New Paint Formulations

METHOCEL* brand cellulose ether products include a family of water-soluble synthetic polymers that function very effectively as thickeners for latex paints. Paint formulators demand a variety of properties in thickeners-viscosity, rheological control, and good film and application properties. The superiority of METHOCEL in these areas has been recognized for years. Now, new data also shows that METHOCEL cellulose ethers have outstanding compatibility with universal color systems, and when used in combination with associative thickeners.

Compatibility with universal color systems

Universal colorants like the popular Nuance® Universal Color System supplied by Nuodex (a subsidiary of Hüls America), and other colorant systems from Harshaw and Color Corporation of America have presented a challenge for formulators concerned with color acceptance. Dow has recently conducted extensive studies showing that METHOCEL products show excellent color acceptance with many of the most widely-used latexes and the Nuance system.

Compatibility with associative thickeners for formulation flexibility

Recent studies also show that METHOCEL cellulose ethers can be used as co-thickeners with many associative thickeners. Using METHOCEL with associative thickeners often gives better high-shear rheology. The benefits of associative thickener technology, like improved flow, leveling, and film build, are not diminished when using METHOCEL. And other improvements, like increased spatter resistance are frequently realized.

Stable viscosities for consistent performance

Paints thickened with METHOCEL have excellent shelf stability and maintain uniform viscosity and pigment suspension regardless of age or pH. The reason for this superior performance is that METHOCEL polymers resist enzyme degradation.

Easy application, durable film properties

Latex paints thickened with METHOCEL exhibit excellent application properties. They load brushes and rollers well, spread, flow and level easily, and can be recoated shortly after application.

Film properties include good adhesion despite scrubbing, rain, condensation, and other types of moisture; freedom from pinholes; and film uniformity over surfaces of varying porosity.

Nationwide distribution assures reliable delivery

Most METHOCEL cellulose ether products are made, marketed, and sold domestically through a network of local distributors. So if you are concerned about inventory problems, or need precisely-timed delivery of raw material for continuous production, you can be confident with Dow. We'll make sure you get the product you need through our distribution network. Contact your Dow representative for your nearest distributor.

Dow technical support helps you solve formulating problems

If you ever have a formulation problem, we won't leave you to solve it alone. An experienced support team at Dow is always ready to provide appropriate technical assistance for any formulation questions that arise.

Superior rheological control and improved application and film properties from an easy-to-use thickener

METHOCEL J products and METHOCEL K products are hydroxypropyl methylcellulose polymers that provide superior rheological control, improve paint film properties, and make paint easier to apply. Easy to use METHOCEL products are compatible with both dry and slurry pigment systems and offer excellent enzyme resistance.

The ratio of methoxy (OCH_3) substitution to hydroxypropyl ($OCH_2CH(OH)CH_3$) substitution in the cellulose polymer determines the individual properties of METHOCEL cellulose ether, including its solubility, thermal gelation temperature, and enzyme resistance. Each of the repeating anhydroglucose units in cellulose has three hydroxyl groups available for reactions to give ether linkages.

The degree of substitution (DS) is important and also helps determine the physical and chemical properties of METHOCEL products. The average degree of substitution in METHOCEL is 1.65–2.0.

The typical hydroxypropyl methylcellulose (HPMC) repeating structure found in J and K series METHOCEL products is shown in Figure 1.

The relationships of the J and K type METHOCEL products in terms of percent hydroxypropyl and methoxy substitution is shown in Figure 2.

Figure 1: Hydroxypropyl methylcellulose

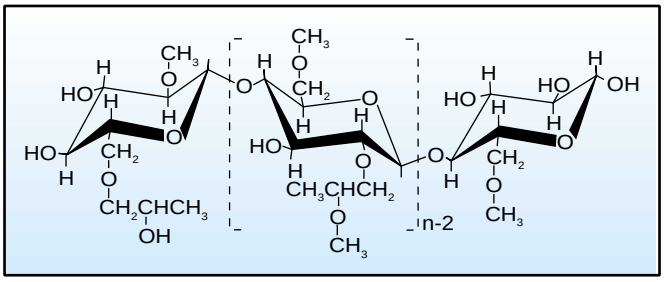
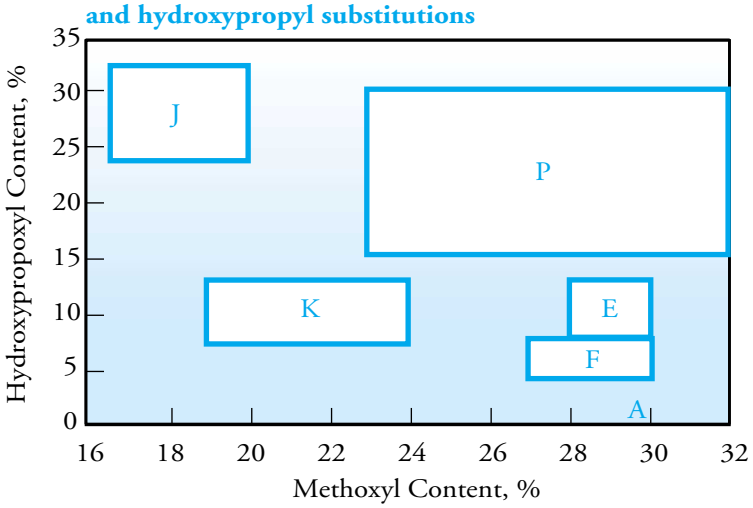


Figure 2: METHOCEL cellulose ethers—methoxyl and hydroxypropyl substitutions



METHOCEL cellulose ethers can be easily added to paint formulations as a stock solution or via a glycol or water slurry

Solution Preparation

Surface-treated METHOCEL products ("S" included in product designation) are dispersed and wetted in water by stirring. Then the solution pH is raised to above 8.5–9.0 with an alkaline material such as ammonium hydroxide. The alkaline solution allows rapid dissolution and hydration of the METHOCEL powder.

Slurry Preparation

Some paint formulators prefer to use a slurry of METHOCEL in either water or in a water-miscible organic solvent. Aqueous slurries of surface-treated METHOCEL can be made in up to a 10% concentration and have a useful life of up to 35 minutes.

Alcohols, glycols, and glycol ethers are solvents useful for preparing slurries of METHOCEL. Slurries will contain 5–8 parts of solvent to one part of METHOCEL cellulose ether.

Foam Control

Foaming of solutions made with METHOCEL can be easily controlled by a number of commercial defoamers. The defoamers listed below have been found to be very efficient. Defoamer concentration will range from 25–1000 ppm based on solution weights.

Defoamer Producer

Polyglycol P1200 (The Dow Chemical Company)
Hodag PV-22, PV-108 (Hodag Chemical Company)
Colloid 581B (Colloids, Inc,)
Nopco NDW, NXZ (Nopco Chemical Company)
Drew L-475 (Drew Chemical)

METHOCEL products can be matched to your process demands

METHOCEL J5MS, J12MS, J20MS, J40MS, J75MS-N, K4MS, K15MS

Equipment, operating temperatures, solubility profile, cost, and compatibility with other ingredients all make selecting the proper METHOCEL* product important. Consider these factors when choosing a METHOCEL product:

- J-series products, available in viscosity grades of 5,000 to 75,000 centipoise (cps), are all surface treated to allow easier formulation. Surface treatment retards hydration of METHOCEL and gives you the option of working with a thickener slurry or a thickener solution. Surface-treated METHOCEL products are easily dispersed in water with mild agitation and will not build viscosity until the solution is made alkaline (pH of 8.5–9.0). Thus, the point of viscosity development can be easily controlled.
- METHOCEL J75MS-N cellulose ether is the preferred thickener when maximum thickening per pound of product is important. This METHOCEL product affords a paint film with higher scrubbability and resistance to water spotting than products thickened with lower viscosity grades of METHOCEL.
- Increasing molecular weights in the J-series of METHOCEL (J5MS, J12MS, J20MS, J40MS and J75MS-N) results in corresponding increasing viscosity of 2% aqueous solutions of METHOCEL products.
- Molecular weight of cellulose ether thickener also affects rheology, spatter resistance, and foaming tendency of paint. An in-depth study of the "Effect of Molecular Weight on Performance of Cellulosic Thickeners in Latex Paints" has been published by a Dow researcher, D. M. Blake, in *The Journal of Coatings Technology*, Vol. 55, Number 701, pages 33–42, June 1983.
- Use of an intermediate viscosity grade of the J-series (J12MS, J20MS, or J40MS) will often afford a reasonable balance between cost and rheological properties. METHOCEL J5MS used in latex paint, for example, affords good leveling, one-coat coverage, and good color development.
- Surface-treated METHOCEL K-series products are used in latex paint formulations in a manner similar to METHOCEL J products.
- METHOCEL K products will not thermally gel until temperatures reach 150°F. The thermal gel temperature for the J-series of METHOCEL products is lower at 130°F.

METHOCEL products can be matched to your viscosity requirements

METHOCEL cellulose ethers increase the Stormer viscosity of latex paint formulations.

Five different viscosity grades of METHOCEL were used to formulate a latex paint to similar Stormer viscosities. The results of the paint formulation study are detailed in Table 1. The data in Table 1 show that the amount of thickener required to maintain a certain Stormer viscosity decreases as the molecular weight and the viscosity of the thickener increases.

The thickener of highest molecular weight, that is, METHOCEL J75MS-N, is the preferred choice if cost per gallon is the only criterion. A detailed study of the effect of molecular weight of thickeners made from METHOCEL on other paint properties has been reported by a Dow researcher, D. M. Blake, in the June 1983 issue of *The Journal of Coatings Technology,* Volume 55, Number 701, pages 33–42.

In summary, the study found that the molecular weight of the METHOCEL products did affect the paint's high-shear rheology, spatter resistance and foaming tendency. However, the molecular weight had no affect on low-shear rheology, scrub resistance, or color acceptance.

Table 1 - Thickener Loadings and Stormer Viscosities of Test Paints

Test Paint	Thickener† Viscosity (nominal, cps)	Thickener† Loading (lb/100 gal)	Stormer Viscosity (Kreb units)
A	5,000	6.0	98
B	12,000	4.8	98
C	20,000	4.2	95
D	40,000	4.0	96
E	75,000	3.2	95

†METHOCEL cellulose ether

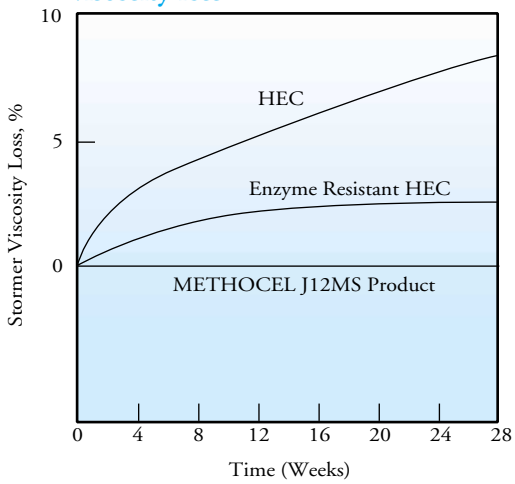
High enzyme resistance of METHOCEL reduces risk of viscosity loss

Enzymes are excretions from fungi and bacteria that reduce complex structures like cellulose into simple sugars that the microorganism can then use for nourishment. Cellulase enzyme in latex paint formulations can produce cleavage of cellulose-type thickeners and decrease product viscosity. The enzyme problem can be minimized by using good housekeeping to prevent contamination of paint components, by adding a preservative to control any microorganisms, or by using a highly substituted cellulose ether product that is more resistant to enzyme attack.

Cellulose ethers with a degree of substitution (DS) of at least 1.0 are more resistant to enzyme attack. Derivatives of METHOCEL hydroxypropyl methylcellulose with an average 1.65–2.0 DS are therefore much more resistant to enzyme attack than hydroxyethyl cellulose (HEC) thickeners, which typically have a DS of only 0.8–1.0.

Figure 3 shows the excellent enzyme resistance of METHOCEL J12MS as compared to the significant viscosity loss incurred by latex paint using a hydroxyethyl cellulose thickener.

Figure 3: Enzyme catalyzed viscosity loss

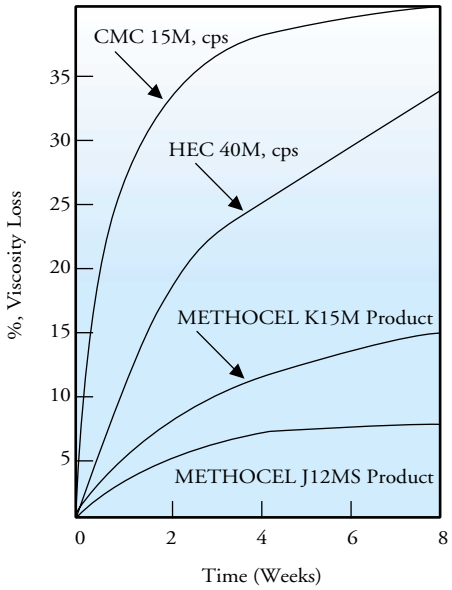


Contamination of latex paints by microorganisms can occur and the use of an antimicrobial preservative is common practice. Addition of 0.05 to 0.1 weight percent of DOWICIL* 75 preservative or DOWICIDE* A antimicrobial will normally control any microorganism contamination. Other phenol-containing preservatives must be used with caution because of possible gelling reactions with METHOCEL cellulose ethers.

Rethickening after viscosity loss

Batches of latex paint that have suffered viscosity losses due to enzyme contamination can be rethickened to achieve a proper viscosity and marketability. Addition of preservatives will kill any active microorganisms, but enzymes already present in the paint can continue to degrade the cellulose ether thickeners. The inherent enzyme resistant characteristics of thickeners made from METHOCEL affords latex paints long-term viscosity stability. Figure 4 details the viscosity stability of rethickened PVA latex paints with carboxymethyl cellulose (CMC), a hydroxyethyl cellulose (HEC), and thickeners made from two METHOCEL cellulose ethers.

Figure 4: Viscosity loss in rethickened paint



*Trademark of The Dow Chemical Company

Excellent color compatibility

Derivatives of METHOCEL hydroxypropyl methylcellulose have been used to thicken latex paints for years. Color development in latex paints thickened with METHOCEL products has generally been excellent and readily achieved.

However, with the widespread use of universal colorants, there are a few particular pigment systems that may hinder the full development of color until the paint undergoes shear. In these few cases, the dispersant on a particular pigment may leave the pigment and associate with the thickener made from METHOCEL. As a result, pigment will begin to agglomerate and paint color will appear to be lighter in color until shear (brushing or rolling) is applied.

Organic orange and calbizol violet are the two colors most often associated with acceptance problems. Color types that are most compatible with METHOCEL products, marketed under different names by different companies, are listed below.

A study of both a flat interior latex paint base and an interior semigloss latex paint tint base with 30 different latexes has been published by D. M. Blake in *Journal of Water Borne Coatings*, (pp. 2-13, August 1988). Results show that METHOCEL can be used with universal colorants and many latexes with excellent color acceptance. The Nuance® color system is the colorant system of choice. The latexes evaluated included acrylics, vinyl acrylics, and polyvinyl acetates from eight different manufacturers.

Color	Brand Name	Chemical Type	Supplier
Orange	Aurasperse W-2090	Pyrazolone Orange	Harshaw/ Fitrol
	Aurasperse W-2013	Molybdate Orange (contains lead)	Harshaw/ Fitrol
	Aurasperse W-2080	Dinitraniline Orange	Harshaw/ Fitrol
Violet	Monastral Scarlet RW-252-P	Monastral Violet	Ciba-Geigy
	Monastral RW-768-P	Quinacridone Red B	

Note: To be successful in tinting any paint thickened with any METHOCEL product, the temperature of the paint should not be greater than 43°C (110°F).

Competitive products in latex paints

All viscosity measurements done using Brookfield RVT Viscometer, Spindle #4 at 20 RPM. Concentration is 1% on dry basis—except where noted otherwise.

METHOCEL product	Viscosity, cps	Natrosol product	Viscosity, cps
J75MS	2,800	HHR	2,900
		H4R	2,400
J40MS	1,760	HR	1,950
J20MS	1,000	MHR	1,000
J12MS	700	MR	530

METHOCEL product	Viscosity, cps	Cellosize product	Viscosity, cps
J75MS	2,800	QP 100,000	2,560
J40MS	1,760	QP 52,000	1,860
		QP 30,000	1,550
J12MS	700	QP 15,000	850
J5MS[Δ]	5,100	QP 4,000[Δ]	4,650

[Δ]Concentration 2% on dry basis

Typical Physical Properties of METHOCEL Products

Physical Appearance	White to slightly off-white powder
Apparent Density g/cc	0.25–0.70
Browning Temperature	190°–200°C (374°–392°F)
Charring Temperature	225°–230°C (437°–446°F)
Specific Gravity	1.39
Bulking Value, gal/lb	0.086

Note: Typical properties—not to be considered sales specifications.

General Properties of Aqueous Solution† of METHOCEL Products

Specific Gravity, 20°/4°C (All Types)	
1%	1.0007
5%	1.0111
10%	1.0245

Refractive Index (2%) $n_D^{20^\circ}$ (All Types)
1.336

Bulking Value Factor		
METHOCEL J	ALL	0.725 cc/g (0.087 gal/lb)
METHOCEL K	4,000 cps	0.717 cc/g (0.086 gal/lb)
	15,000 cps	0.724 cc/g (0.087 gal/lb)

Freezing Point, All Types, 2%
0°C

Surface Tension, 25°C	
METHOCEL J	48–52 dynes/cm
METHOCEL K	50–56 dynes/cm

Interfacial Tension (Paraffin Oil), 25°C	
METHOCEL J	26–30 dynes/cm
METHOCEL K	26–28 dynes/cm

†2% METHOCEL product in water

Typical Latex Formulations

Interior vinyl acrylic latex paint

Ingredients		A Lbs/100 Gallons	B Lbs/100 Gallons
Water		250.0	250.0
Dispersant		8.0	8.0
Defoamer		2.0	2.0
DOWICIL 75 Preservative		1.32	1.32
Surfactant		5.0	5.0
Rutile TiO_2 (Dry)		250.0	-
Rutile TiO_2 (Slurry)		-	387.6
Aluminum Silicate		100.0	100.0
Calcium Carbonate		135.0	135.0
Ethylene Glycol		25.0	25.0
Coalescing Agent		10.0	10.0
Water	Slurry	168.6	31.0
METHOCEL J20MS	Slurry	5.0	5.0
Vinyl Acrylic Latex (55%)		250.0	250.0
PVC, 69% Viscosity, KU 95-102			

Exterior acrylic latex paint

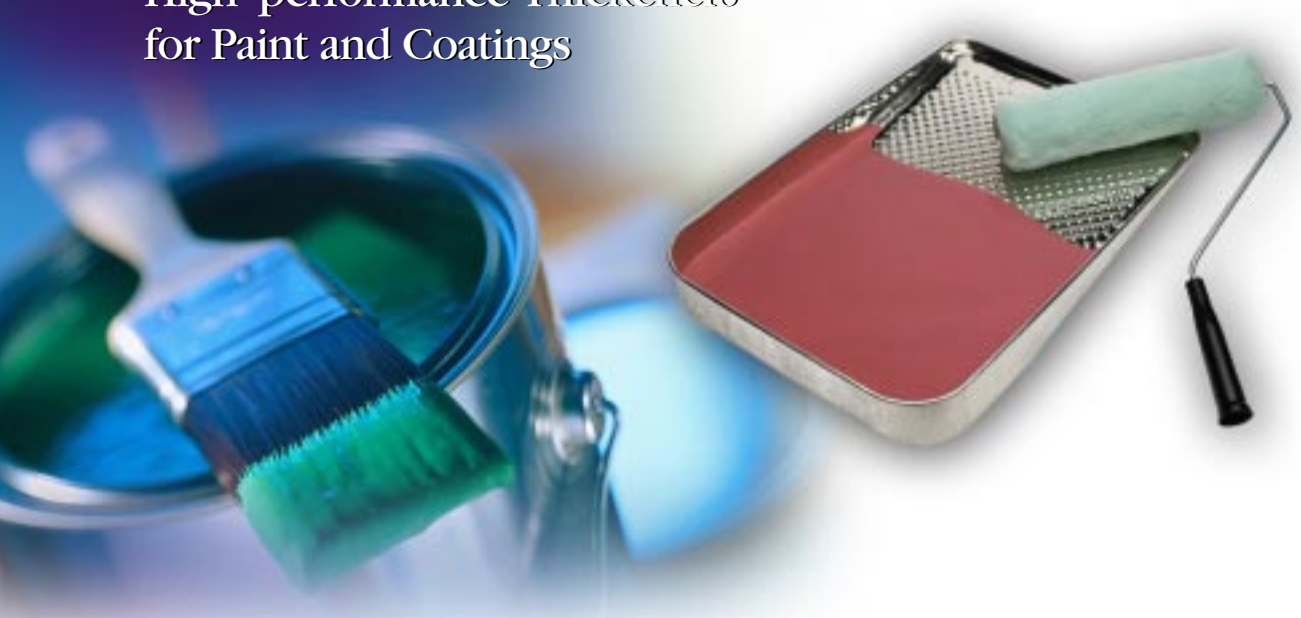
Ingredients		A Lbs/100 Gallons	B Lbs/100 Gallons
Water		54.0	54.0
Dispersant		14.2	14.2
Surfactant		2.5	2.5
Dispersant		3.9	3.9
Propylene Glycol		60.0	60.0
Defoamer		1.0	1.0
Rutile TiO_2 (Dry)		250.0	-
Rutile TiO_2 (Slurry)		-	326.8
Zinc Oxide		25.0	25.0
Aluminum Silicate		94.9	94.9
Acrylic Latex (50%)		425.2	425.2
Water		15.0	15.0
Coalescing Agent	Premix	10.0	10.0
Defoamer	Premix	1.0	1.0
Propylene Glycol	Premix	38.8	38.8
Mildewcide		2.0	2.0
METHOCEL J20MS	Slurry	4.0	4.0
Water	Slurry	162.4	85.6
PVC, 35% Viscosity, KU 97-101			

Ethylene vinyl acetate latex paint

Ingredients		A Lbs/100 Gallons	B Lbs/100 Gallons
Water		300.0	214.78
Dispersant		10.8	10.8
Defoamer		2.0	2.0
DOWICIL 75 Preservative		1.0	1.0
Surfactant		5.0	5.0
Aluminum Silicate		120.0	120.0
Calcium Carbonate		125.0	125.0
Rutile TiO_2 (Dry)		200.0	-
Rutile TiO_2 (Slurry)		-	310.00
Ethylene Glycol	Premix	25.0	25.0
Coalescing Agent	Premix	10.0	10.0
Ethylene - Vinyl Acetate Latex (55%)		250.0	250.0
METHOCEL J20MS	Slurry	4.0	4.0
Water	Slurry	87.2	62.42
PVC, 60% Viscosity, KU 110-111			

METHOCEL cellulose ethers

High -performance Thickeners for Paint and Coatings



For more information, complete literature, and product samples, you can reach a Dow representative at the following numbers:

From the United States and Canada ..... call 1-800-447-4369
..... fax 1-517-832-1465

From Mexico call ..... call 95-800-447-4369
..... fax 95-517-832-1465

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Or you can contact us on the Internet at **www.methocel.com**

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