

## How to Prepare Aqueous Solutions of METHOCEL™

METHOCEL™, premium cellulose ethers, products are carbohydrate polymers which dissolve in cold water (and in some instances in certain organic solvents) by swelling and subsequent hydration. There is no sharp solubility limit such as occurs in the dissolution of ionizing salts. The concentration of Methocel in solution depends on the viscosity and chemical type of METHOCEL product used. Solutions of low-viscosity products can be made at 10% to 15% concentration. High viscosity products find a normal limit at 2 to 3% concentration.

Although METHOCEL™ powders are soluble in cold water, they must first be thoroughly dispersed in the water to prevent lumping. In some applications, dispersion can be accomplished at ambient temperatures or in cold water by using a high-shear mixer. However, if the powder is added directly to cold water without sufficient agitation, a lumpy solution may occur. Lumping results from incomplete wetting of the individual powder particles. Only part of the powder dissolves, forming a gelatinous membrane which shields the remaining powder from complete hydration. Several dispersion techniques are commonly used and are described below. Each has advantages in certain applications.

### DISPERSION IN HOT WATER

Often called the “hot/cold” technique, this method takes advantage of the insolubility of METHOCEL™ cellulose ethers in hot water. The powder is first dispersed by mixing thoroughly with 1/5 to 1/3 of the total required volume of water that has been heated to above 90°C (194°F). Mixing continues until all particles are thoroughly wetted.

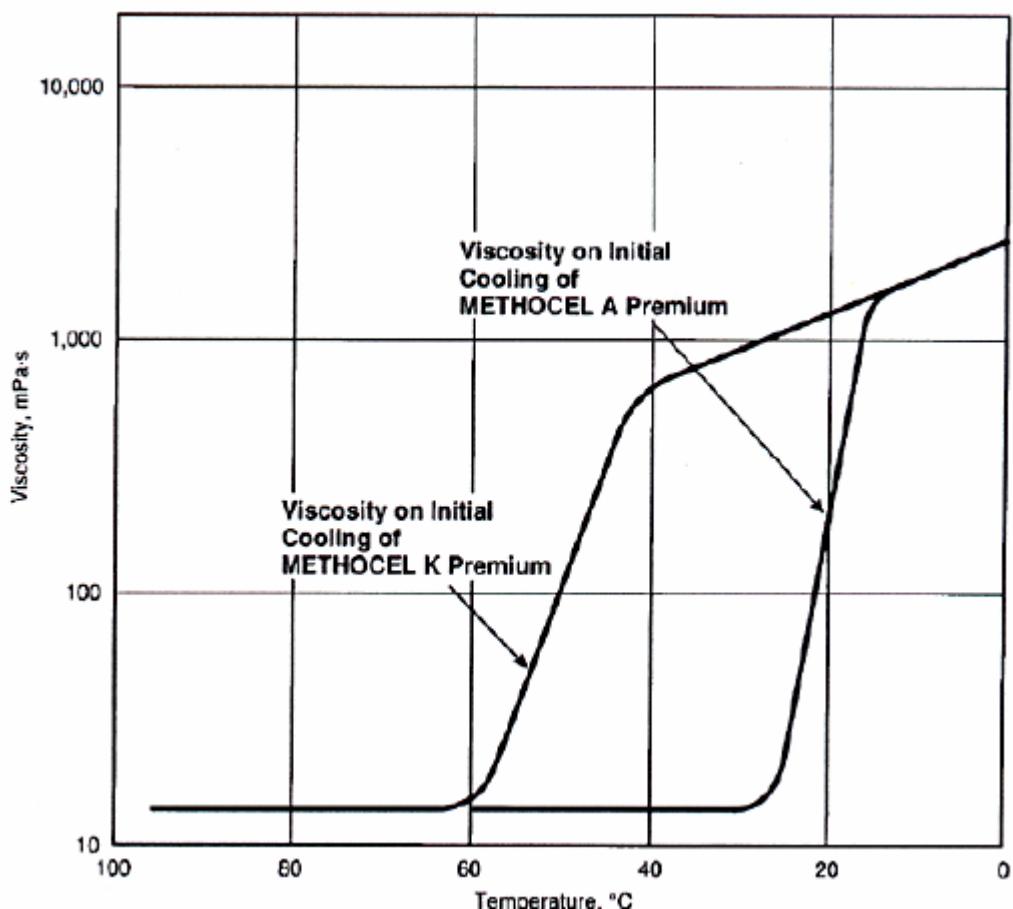
For complete solubilization, the remainder of the water is then added as cold water or ice to lower the temperature of the dispersion. Once the dispersion reaches the temperature at which that particular METHOCEL™ product becomes water soluble, the powder begins to hydrate and viscosity increases.

In some applications, it may be desirable to heat the entire volume of water, disperse the METHOCEL™ powder, then cool the mixture while agitating until hydration is complete. It is very important, however, to have adequate cooling after wetting with hot water to ensure complete hydration and viscosity development.

For improved clarity and reproducible control of viscosity, solutions of METHOCEL™ A cellulose ether products (methylcellulose) should be cooled to 0 to 5°C (32 to 41°F) for 20 to 40 minutes. In general, solutions of METHOCEL™ E, F and K (hypromellose) require cooling to 20 to 25°C (68 to 77°F) or below.

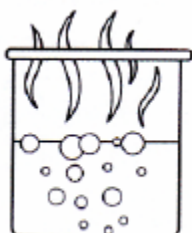
Because complete hydration depends on adequate cooling, METHOCEL™ E, F and K are frequently used in applications where cold water is not available. Figure 1 illustrates the effects of cooling hot slurries of METHOCEL™ A and K products. This figure shows that a slurry of METHOCEL™ K cellulose ether requires much less cooling for hydration than a slurry of METHOCEL™ A cellulose ether. Slurries of METHOCEL™ E and F also require less cooling than METHOCEL™ A (methylcellulose).

**Figure 1: Viscosity Development of METHOCEL A and METHOCEL K Slurried at 2% in Hot Water**

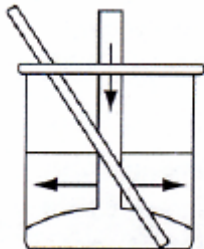


## DISPERSION TECHNIQUE

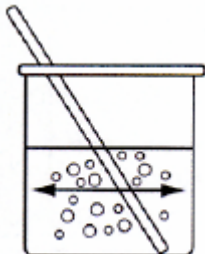
1. Heat approximately 1/3 the required volume of water to at least 90°C (194°F)



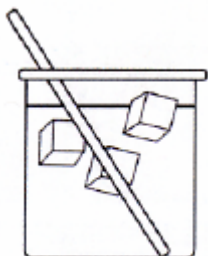
2. Add the METHOCEL™ powder to the heated water with agitation.



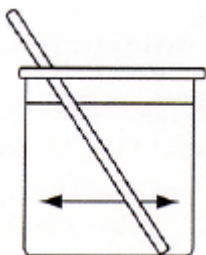
3. Agitate the mixture until the particles are thoroughly wetted and evenly dispersed.



4. For complete solubilization, add the remainder of the water as cold water (or ice) to lower the temperature of the dispersion. Once the dispersion reaches the temperature at which that particular METHOCEL™ product becomes water soluble, the powder begins to hydrate and viscosity increases.



5. Continue agitation for at least 30 minutes after the correct temperature is reached. The solution of METHOCEL™ cellulose ether is now ready to use.



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