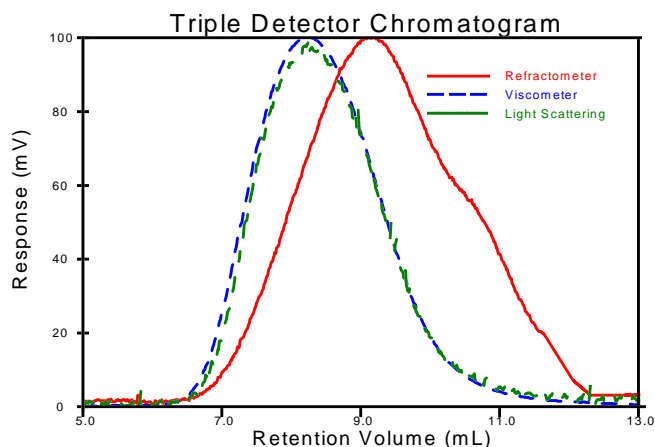


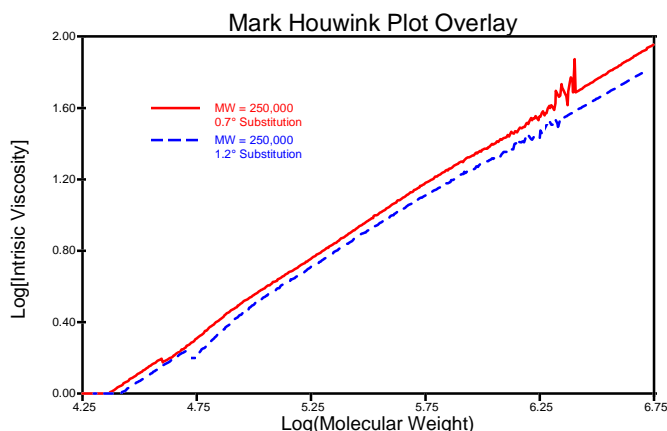
Detectors

Viscotek Laser Refractometer
 Viscotek Differential Viscometer
 Viscotek RALLS Detector

Sodium carboxymethylcellulose, or CMC, was introduced commercially to the United States almost thirty years ago. It is used in a wide variety of applications, such as pharmaceuticals, cosmetics, textiles, food, and paper, where suspending, binding, stabilizing, thickening, and film-forming properties are required.[†]



The degree of substitution (carboxymethyl groups per anhydroglucose unit) is an important factor in CMC performance. This can easily be distinguished through triple detection. The illustration below shows two Mark-Houwink plots for two standards of identical molecular weight, but with different degrees of substitution.

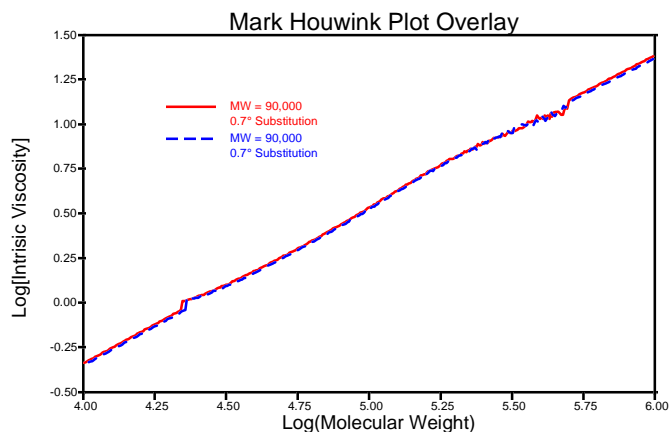


The molecular structure of the two standards is similar, as indicated by the shape of the plots. However, the standard with 1.2° substitution falls below the standard with 0.7° substitution. At the same molecular weight, it has a lower intrinsic viscosity, which is inversely proportional to density: it is more heavily substituted.

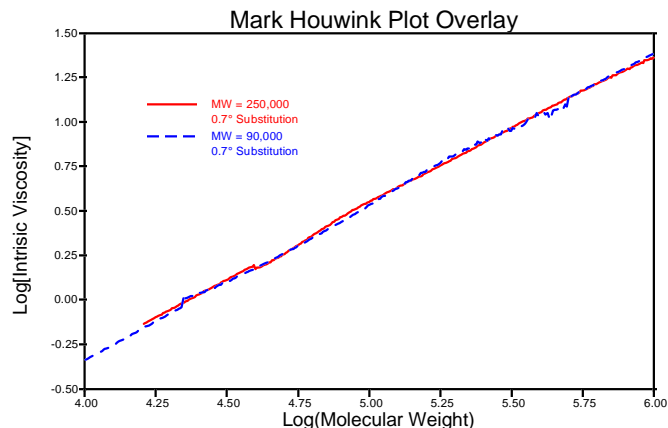
Run Conditions

Solvent: Water
 Columns: 30 cm TSK GMPWXL
 Concentration: Approximately 0.05 %
 Injection Volume: 100 μ L
 Flow Rate: 1.00 mL/min

Two individual injections of carboxymethylcellulose of 90,000 molecular weight and 0.7° substitution were made, with excellent reproducibility. This is seen in the Mark-Houwink plot below. The plots overlay exactly.



A final comparison was made between two samples of different molecular weight and the same degree of substitution. The structure of the two samples is shown to be practically identical by the Mark-Houwink plots below:



Aside from molecular structure, many other properties are available from the SEC³ Triple Detector system, including full molecular weight and intrinsic viscosity distributions. Radius of gyration values can be calculated directly from knowledge of the molecular weight and intrinsic viscosity. The Triple Detector System can accurately determine R_g down to 0.5 nm. Note that molecular sizes under 10 nm cannot be determined by traditional multi-angle techniques without the addition of the viscometer detector.

[†] J. I. Kroschwitz, ed., *Encyclopedia of Polymer Science and Engineering*, Vol. 3, John Wiley & Sons, Inc., 1985.