# Analysis of Starches by Gel Permeation Chromatography with Viscometry using the Agilent 390-MDS

Application Note


## Authors

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## Introduction

Starches are composed of a mixture of the glucose polymers amylose and amylopectin in a ratio of about 30:70 depending on the source. Starches are primarily used as thickening agents in cooking and to provide strength in textiles and papermaking, however, the industrial applications of starches are ever increasing due to their strength, toughness and biodegradation properties. For these materials, the molecular weight distribution of the polymers determines many of their final properties and therefore the end-use suitability.

Gel permeation chromatography (GPC) with Universal Calibration, employing a viscometer in combination with a differential refractive index detector, may be used to determine accurate molecular weights for biopolymers, such as starches, that are independent of the standards used in the column calibration. Two starches were analyzed using these techniques, as the thickening properties of the different samples were found to be subtly different.


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## Methods and Materials

**Conditions**

| | |
|---|---|
| Samples: | Two samples of starch |
| Columns: | 3 x Agilent PLgel Olexis, 300 x 7.5mm (part number PL1110-6400) |
| Eluent: | DMSO/DMAc (4:1) (0.1% LiBr) |
| Flow Rate: | 1.0 mL/min |
| Column Temperature: | 60 °C |
| Detector Train: | 390-MDS incorporating Viscometer and DRI |
| Detector Temp: | All detectors set at 60 °C |

## Results and Discussion

Figure 1 shows chromatograms of two different starches detected by refractive index and viscometry, Figure 2 their molecular weight distributions and Figure 3 the overlaid Mark-Houwink plots.

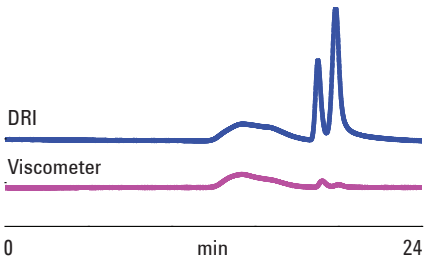


***Figure 1. Chromatograms for a starch sample***

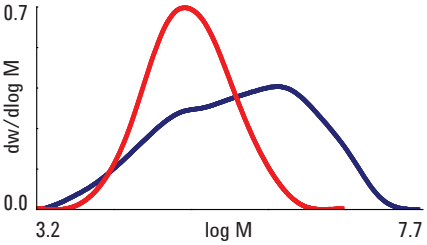


***Figure 2. Overlaid molecular weight distributions (MWD) for the two starch samples. Differences in MWD account for the different physical properties of the starches***

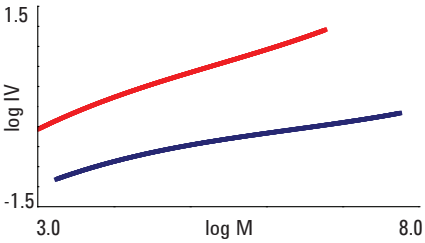


***Figure 3. Overlaid Mark-Houwink plots for the two starch samples reveals marked differences in their structure***

## Conclusion

The two samples of starch analyzed by the Universal Calibration technique employing the 390-MDS and PLgel Olexis columns showed stark differences in molecular weight distributions, with one of the samples having a bi-modal distribution. This accounted for the different thickening properties of the two materials. The variations in the Mark-Houwink plots indicated that the materials were structurally very different, presumably due to fact the samples were obtained from two separate sources.

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