Analysis of Polythiophenes via Conventional GPC

Application Note

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Introduction

Polythiophene is a class of polymer that contains a sulfur heterocycle in the polymer backbone. Figure 1 shows the chemical structure of the general thiophene monomeric repeat unit. Polythiophenes are of paticular interest as a result of the their ability to conduct when electrons are doped into or from the conjugated backbone pi-orbitals.
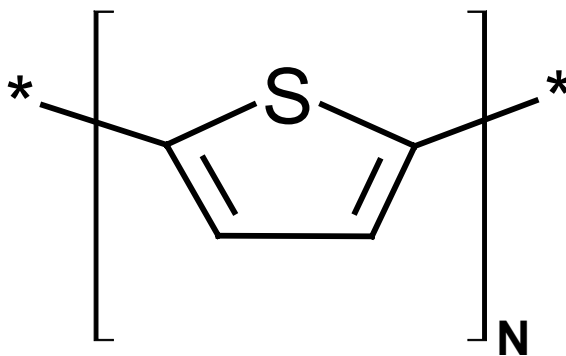

Figure 1. General structure of the thiophene monomeric repeat unit

A recent highlight of the study of this class of materials was the award of the 2000 Nobel Prize in Chemistry to Heeger, MacDiarmid and Shirakawa for "The discovery and development of conductive polymers".

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Methods and Materials

Analysis of polythiophene materials can easily be achieved by gel permeation chromatography (GPC) with high efficiency Agilent PLgel 5 µm MIXED-D (300 x 7.5mm) columns in conjunction with the Agilent PL-GPC 220 instrument equipped with RI detection.

The polythiophene samples were prepared using a Agilent PL-SP 260VS sample preparation module at 0.2% (w/v) in trichlorobenzene at 150 °C for 2 hours and injected without further treatment.

Conditions

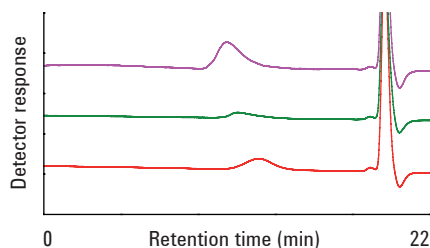|	
Sample:	Polythiophene
Column:	2 x PLgel 5 µm MIXED-D, 300 x 7.5 mm (part number PL1110-6504)
Eluent:	1,2,4-Trichlorobenzene
Flow Rate:	1.0 mL/min
Inj Vol:	100 µL
Sample Conc:	2.0 mg/mL
Temp:	120 °C
Calibrants:	Agilent PS-M EasiVial
Detector:	PL-GPC 220 (Differential Refractive Index)

Figure 2. Overlaid RI raw data chromatograms obtained from a series of polythiophene samples

Results

Figure 2 shows the overlaid chromatograms obtained via RI detection for the series of polythiophene samples and Figure 3 is the overlaid calculated molecular weight distribution from these samples.
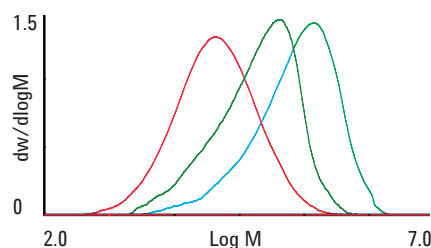

Figure 3. Overlaid molecular weight distributions obtained from a series of polythiophene samples

Conclusion

This note demonstrates how the structure of this new class of important materials can be elucidated using GPC with PLgel columns and the PL-GPC 220.

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