



Agilent 356-LC RI Detector

Speed and Simplicity for the Determination of Epoxy Resins

Technical Overview

Introduction

The 356-LC RI Detector in combination with Agilent Galaxie Software provides a fast and automated approach to epoxy resin analysis.

Epoxy resins are used widely in industry because of their strong adhesive properties, chemical resistance, mechanical toughness and high electrical insulation. Consequently they are often found in adhesives, stabilizers, sealants, varnishes and paints. Epoxy resins consist of bridged diepoxide oligomers of increasing molecular weight and there are various types corresponding to different molecular weight (MW) distributions and oligomeric profiles. The physical properties of epoxy resins are determined by their MW distribution and so their composition needs to be closely monitored during production.

Gel permeation chromatography (GPC) is a well established technique for characterizing the molecular weight distribution of epoxy resins and monitoring their physical properties. Furthermore, epoxy resins typically lack a suitable chromophore, hence refractive index detection is a common method of analysis.

This note describes the use of a 356-LC RI Detector and Galaxie Software using Agilent size exclusion columns and polystyrene calibration kit to automate the characterization of epoxy resins.



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The epoxy resins were Epikote 1001, 1004, 1007 and 1009, prepared in tetrahydrofuran (THF) at a concentration of 0.5% w/v. GPC separation was achieved using two Agilent PLgel 5 μ m MIXED-D columns (300 x 7.5 mm) at a flow rate of 1 mL/min in stabilized THF, at 35 °C. The 356-LC RI Detector was controlled using Galaxie Software at a temperature of 35 °C and data analyses were performed using Agilent Cirrus GPC Software for Galaxie.

The MIXED-D columns were calibrated using an EasiVial pre-weighed Calibration Kit (PS-M) that comprised three vials each containing four polystyrene standards across a MW range of 162 to 371,100. A Galaxie sequence was used to collect the data (Figure 1) and was analyzed automatically using Cirrus GPC to produce the calibration curve (Figure 2).

The 356-LC RI Detector has a very low cell volume that minimizes peak dispersion and improves resolution between peaks. This has exposed compositional differences in the oligomeric profile between the four epoxy resin samples (Figure 3). Further analysis, using Cirrus GPC Software for Galaxie (shown in Figure 4), has highlighted differences in their molecular weight distributions, which is an indication of their physical properties.

Agilent provides the complete solution to epoxy resin analysis by using Galaxie Software to control the 356-LC RI Detector for automated data collection. When used in combination with Cirrus GPC Software, EasiVial PS-M Calibration Kit and PLgel MIXED-D columns, epoxy resins can be characterized rapidly and simply.

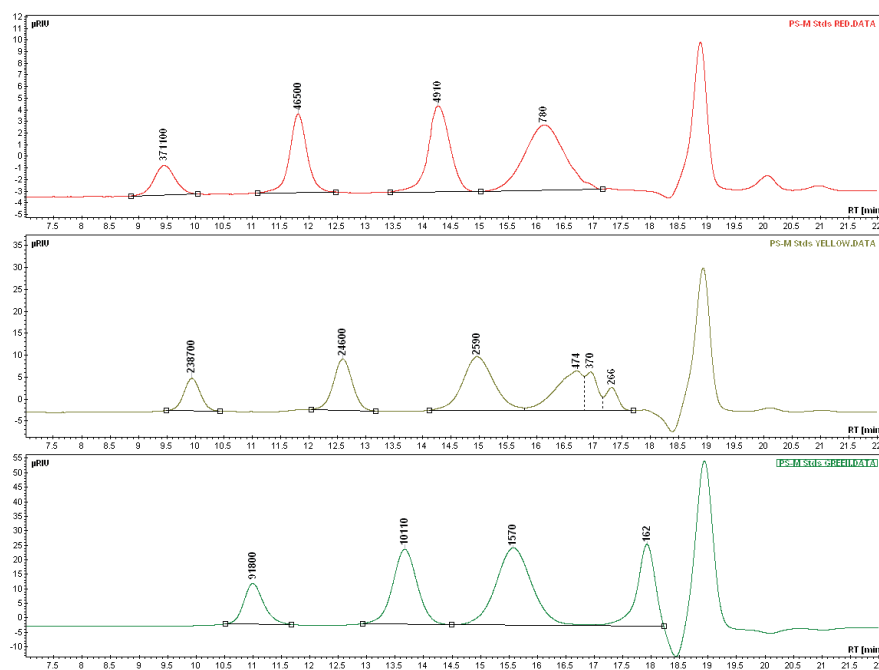


Figure 1. PLgel MIXED-D Column calibration using EasiVial calibration standards (100 μ L) and a 356-LC RI Detector

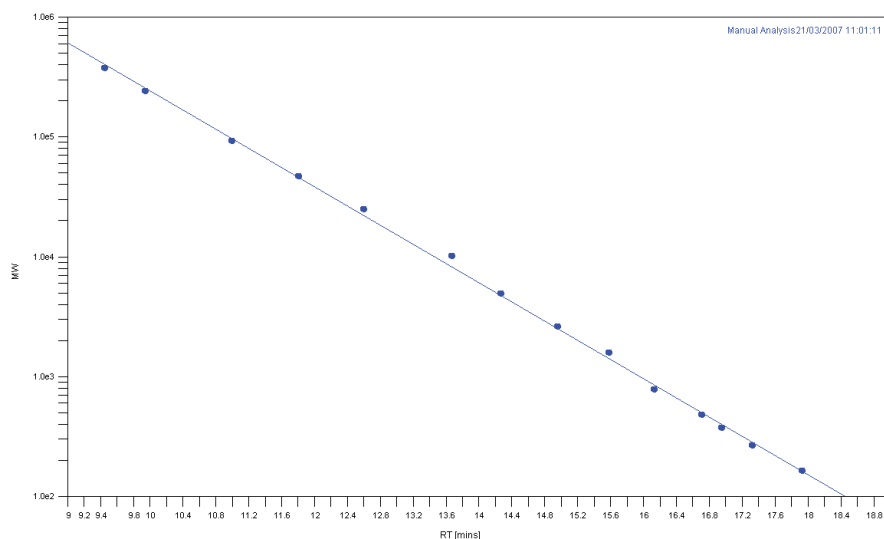


Figure 2. EasiVial PS-M calibration curve using Cirrus GPC Software for Galaxie Software

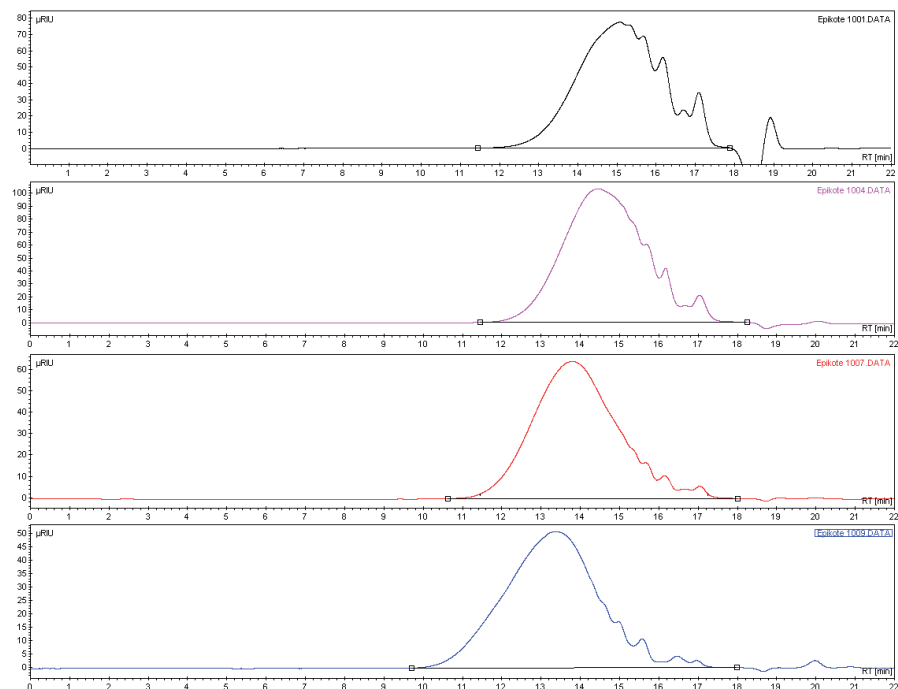


Figure 3. Epoxy resin analysis (100 μ L) using a 356-LC RI Detector and Galaxie Software

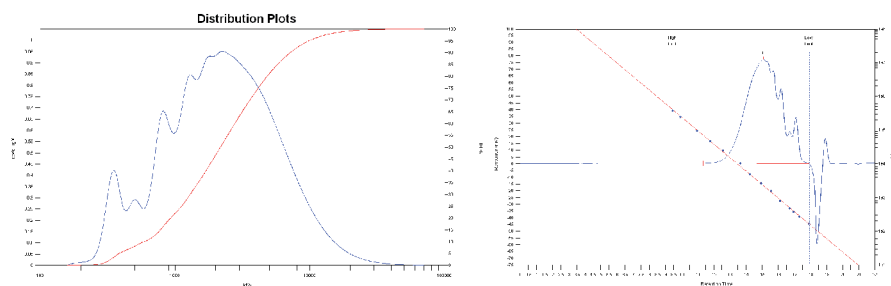


Figure 4. Epikote 1001 data analysis and MW distribution using Cirrus GPC Software for Galaxie Software

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