HPLC CHARACTERIZATION OF POLYMERS: TEMPERATURE GRADIENT INTERACTION CHROMATOGRAPHY

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Liquid chromatography (LC) has been used widely for the characterization of natural and synthetic macromolecules that are often heterogeneous in molecular weight, molecular architecture as well as in chemical composition. Among numerous variations of LC technique, size exclusion chromatography (SEC) has been the most popular method for the analysis of the molecular weight distribution of synthetic polymers. SEC separates the polymer molecules according to the size of polymer molecules in the elution solvent. Therefore, SEC is often inefficient in the separation of copolymers, polymer mixtures, branched polymers, polymers with different stereoregularity or end-group difference, and so on. Furthermore, the resolution SEC is limited due to the band-broadening problem.

In contrast to SEC, interaction chromatography (IC) utilizes mainly the enthalpic interaction, adsorption or partition of solute molecules to the stationary phase, thus IC can be used efficiently for the applications in which SEC does not work well. Furthermore, the band broadening is far less serious in IC than SEC, thus IC shows far better resolution than SEC.

In this tutorial lecture, IC methods for the characterization of polymers will be discussed with an emphasis on the temperature gradient interaction chromatography (TGIC) that was developed in our laboratory. In TGIC the column temperature is varied during the elution in a pre-programmed manner to control the solute retention. The hyphenation of IC with other chromatography techniques and/or mass spectrometry makes the separation technique much more powerful.