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Progress in liquid chromatography of synthetic polymers

Dusan Berek

Polymer Institute SAS, Slovakia

High performance liquid chromatographic (HPLC) methods represent the most important tool for molecular characterization of synthetic polymers. Mean molar masses and molar mass distributions of linear and branched homopolymers are easily determined by size exclusion/gel permeation chromatography (SEC/GPC). As by-products, several other useful data can be assessed with SEC/GPC. Recent progress in SEC/GPC comprises improved instrumental hardware and data processing procedures. High sample throughput of the ultra-fast SEC/GPC allows acceleration of analyses, which is especially important in combinatorial material chemistry and in production control. Still, further improvements of the SEC/GPC method are needed, which include its hardware, especially columns and detectors, and also standardization of sample preparation, measurements, and data processing. SEC/GPC exhibits excellent intra-laboratory repeatability, which evokes a notion of its high reliability. Recent series of the round robin tests, however, revealed surprisingly poor inter-laboratory reproducibility of results. Evidently, accuracy of many SEC/GPC results may be rather limited. In most cases, SEC/GPC does not enable precise molecular characterization of complex polymer systems, which possess more than one distribution in their molecular characteristics. Typically, polymer mixtures, copolymers and functional polymers exhibit besides molar mass distribution also distribution in their chemical structure while e.g. stereo-regular polymer species show also molecular architecture distribution. To assess above distributions, new HPLC procedures are developed. These are based on the controlled combinations of entropic (exclusion) and enthalpic (interaction) retention mechanisms within the same HPLC column or in a series of independent separation systems. These approaches are denoted as “coupled polymer HPLC” and “two-, or multi-dimensional polymer HPLC”, respectively. Enthalpic retention mechanisms in HPLC of synthetic polymers include adsorption, partition, phase separation and ionic effects. We shall review recent progress and also problems in SEC/GPC, as well as in coupled and two-dimensional polymer HPLC procedures, and outline anticipated future developments in these fields.

Biography

Dusan Berek is working at Polymer Institute, Slovak Academy of Sciences in Bratislava. He served as elected member of the Presidium of the Slovak Academy of Sciences, President of the Slovak Chemical Society, Chairman of the Czecho-Slovak and Slovak National Committee of Chemistry for IUPAC. He is an author and co-author of two monographs and 250+ scientific papers published in refereed periodicals, proceedings and chapters of books.

dusan.berek@savba.sk

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