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Dusan Berek

Polymer Institute of the Slovak Academy of Science, Slovakia

Molecular characterization of synthetic polymers with help of liquid chromatography

The most important tool for molecular characterization of synthetic polymers is High-performance liquid chromatographic (HPLC) methods. Mean molar mass (MM) and molar mass distribution (MMD) of linear and branched homopolymers is easily determined by gel permeation (size exclusion) chromatography (GPC/SEC). GPC/SEC provides several other useful data such as limiting viscosity numbers, constants of viscosity law, sizes of macromolecules in solution - and even extent of preferential solvation of polymers in mixed solvents. Recent progress in GPC/SEC comprises improved instrumental hardware and data processing procedures. High sample throughput of the ultra-fast GPC/SEC enables acceleration of analyses, which is especially important in combinatorial material chemistry and in production control. Still, further improvements of the SEC method are needed, which include its hardware, especially columns and detectors, standardization of sample preparation, measurement and data processing. GPC/SEC 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, an accuracy of many GPC/SEC results may be rather limited. In most cases, GPC/SEC 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 beside MMD also distribution in their chemical structure. To assess the above distributions, new HPLC procedures are developed. These are based on the controlled combinations of entropic (exclusion) and enthalpic (interaction) retention mechanisms within one column or in a series of independent separation systems. These approaches are denoted "coupled polymer HPLC" and "two- or multi-dimensional polymer HPLC", respectively. Enthalpic retention mechanisms in HPLC of synthetic polymers include adsorption, partition, phase separation. We shall review recent progress and problems in GPC/SEC, as well as in the couple and two-dimensional polymer HPLC procedures and outline anticipated future development.

Biography

Dusan Berek is employed at Polymer Institute, Slovak Academy of Sciences in Bratislava. 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. Corresponding member of the Central European Academy of Sciences and member of the Learned Society of the Slovak Academy of Sciences. Author or co-author of two monographs and 300+ scientific papers in extenso published in refereed periodicals, proceedings and chapters of books, as well as 60+ patents (four of them were licensed) - cited more than 3,000x. Presented over 130 invited plenary, key and main lectures, as well as over 900 regular lectures and poster contributions on symposia and conferences, as well as during lecturing tours to over fourty countries. Elected "Slovak scientist of the year 1999" and "Slovak innovator of the year 2002".

dusan.berek@savba.sk

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