Dusan Berek, Arch Chem Res 2019, Volume 3
DOI: 10.21767/2572-4657-C2-017

Retention mechanisms in liquid chromatography of non-charged synthetic macromolecules

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Liquid chromatography (LC) provides information on both average values and distributions of molecular characteristics of synthetic polymers, their molar mass, chemical structure and physical architecture. Gel permeation (size exclusion) chromatography, GPC/SEC, is commonly employed for determination of polymer molar mass. Its basic retention mechanism is steric exclusion controlled by the changes of conformational entropy of coiled macromolecules entering the pores of the column packing. However, GPC/SEC cannot give quantitative information about polymer when two molecular characteristics mutually depend as in copolymers or in polymer blends. In this case, the entropic retention mechanism is to be coupled with the enthalpic retention mechanisms. The ambition is to suppress molar mass effects so that separation depends only on other molecular characteristic. Yet, one should keep in mind that all enthalpy based processes in a LC column are accompanied with large changes of conformational entropy of macromolecules. The most common enthalpic retention mechanism employed in coupled LC methods is adsorption, the distribution of macromolecules between a volume of its solution and a surface of column packing. It is as a rule controlled by eluent polarity. The appropriate stationary phase is bare silica gel. Another LC retention mechanism is absorption (enthapic partition), the distribution of macromolecules between the volumes of mobile and stationary phase. The practically applicable volume of LC stationary phase is formed by the chemically attached appropriate groups, usually C18 alkyls on a carrier, mainly silica gel. Both adsorption and enthalpic partition retention mechanisms are exploited either isocratically or with a mobile phase gradient. Direct practical application of the third enthalpic retention mechanism, polymer phase separation is rather difficult. Sample is precipitated on the column inlet and then gradually dissolved and eluted. However, solubility of polymers strongly depends on their molar mass so that the molar mass effect is difficult to suppress.

Results and Conclusions:

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4. Clementi L A, Meira G R, Berek D, Ronco L I and Vega J R (2015) Molar mass distributions in homopolymer blends from multimodal chromatograms obtained by SEC/GPC with a concentration detector. Polymer Testing 43:58-67.
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Biography

Dusan Berek, employed 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 Committees of Chemistry for IUPAC. Corresponding member of the Central European Academy of Sciences and Academician of the Learned Society of the Slovakia. 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 (five of them were licensed) - cited more than 3,000x. Presented over 140 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.

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