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Separation of parent homopolymers from diblock copolymers by liquid chromatography under limiting conditions of desorption. Block copolymers with highly adsorptive blocks

Synthetic block copolymers represent an important group of advanced materials with numerous specific applications. Polymer chains with different chemical or physical characteristics are bonded together in the block copolymers to obtain required properties. Most block copolymers however, contain free, non-attached chains, their parent homopolymers, which form expensive ballast. The separation and molecular characterization of parent homopolymers from the block copolymers is an analytical challenge. The selectivity of exclusion based gel permeation chromatography, which is commonly applied for separation of macromolecules according to their size, usually does not enable separation of parent homopolymers from the block copolymers. Coupled liquid chromatography methods, CLC that combine exclusion with interaction separation mechanisms may solve the problem. A novel, high selectivity CLC approach is liquid chromatography under limiting conditions of desorption, LC LCD. LC LCD column is packed with polar, porous, adsorptive material. Eluent suppresses sample adsorption. The multicomponent polymers are separated due to the action of a zone of appropriate liquid barrier injected into a column before sample solution. The molecules of the barrier permeate the packing pores and elute slowly, while the pore-excluded macromolecules tend to proceed fast. The barrier promotes adsorption of interactive polymer chains within the column and decelerates their elution. Then non-interactive chains elute freely. As result, macromolecules with distinct polarities are efficiently separated based on the difference in their adsorptivity. Numerous parent homopolymers were separated from their block copolymers with help of LC LCD. However, high polarity polymer chains such as poly(4-vinyl pyridine) and poly(N-vinyl pyrrolidone) are fully retained within common bare silica gel column packing's even using the strongest desorbing eluents available. To solve the problem, various less polar adsorptive column packing's were tested. We will show that silica gel with bonded poly(ethylene oxide) chains enables to efficiently separate above parent homopolymers from their block copolymers.

Recent Publications

1. Berek D (2017) Separation of parent homopolymers from nonpolar block copolymers by means of liquid chromatography under limiting conditions of enthalpic interactions. *Macromolecular Chemistry Physics* 218:137-142.
2. Berek D (2016) Critical assessment of "critical" liquid chromatography of block copolymers (2016) *Journal of*

Separation Science 39(1):93–101.

3. Berek D and Macova E (2015) Liquid chromatography under limiting conditions of desorption 6: Separation of a four-component polymer blend. *Journal of Separation Science* 38(4):543-549.
4. Rollet M, Pelletier B, Altounian A, Berek D and Maria S (2014) Separation of Parent Homopolymers from Polystyrene-*b*-poly(ethylene oxide)-*b*-polystyrene Triblock Copolymers by Means of Liquid Chromatography: 1. Comparison of Different Methods, *Analytical Chemistry* 86:2694–2702.
5. Siskova A, Macova E and Berek D (2012) Liquid chromatography under limiting conditions of desorption 4: Separation of blends containing low-solubility polymers. *European Polymer Journal* 48(1):155-168.

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 forty countries. Elected Slovak scientist of the year 1999 and Slovak innovator of the year 2002.

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