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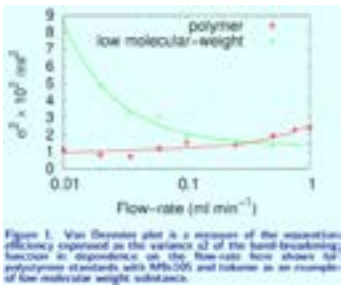
Models of chromatography separation and their application for improving the SEC resolution

Statement of the Problem: The efficiency of chromatographic separation, i.e., resolution depends on construction of the chromatograph, in the first place on the detectors cells volume and, for polymer of given molecular weight, strongly on operational variables, as concentration and flow-rate. For the increase of the separation power of the system, it is necessary to understand its nature. As recognized by Giddings, two kinetic processes, viz., tortuous and obstructed flow of eluent through and around the particles of packing and the flow profile in the mobile phase whose dispersive effect is controlled by transverse diffusion, may combine to reduce and control band broadening (referred to as dispersion). To avoid it, the individual molecule has to sample the complete range of linear flow velocities in a random way as it moves along the column; this is achieved by transverse diffusion. Its importance is estimated by experiment with variable flow-rate and molecular weight of the analyte.

Methodology & Theoretical Orientation: In the theory of chromatographic separation and band broadening, BBF is called the elution curve of an analyte uniform in molecular weight and chemical composition. The concentration and flow-rate is important and its influence on BBF is examined on the basis of the equilibrium model based on the concept of theoretical plate on which the equilibrium is formed between molecules of the analyte moving together with MP and those anchored on the surface by enthalpic attractive forces or penetrated into the pores by entropic process basically of Brownian diffusion into pores of the stationary phase (SP).

Findings: With decreasing flow-rate, the efficiency of separation of polymer increase, of low-molecular weight substances decreases. For polymers, the statistical properties of BBF approach to theoretical ones.

Conclusion & Significance: The statistical properties of BBF can be theoretically analyzed on the bases of the theoretical model based on the combination of the longitudinal shift of mobile phase followed by a creation of equilibrium of the analyte in the mobile and stationary phases, which makes possible to find optimal flow-rate, for polymers being much lower than usually used.



Recent Publications

1. Harper C (2009) The neuropathology of alcohol-related brain damage. Alcohol Alcohol 44:136-140.
2. Netopilík M, Janata M, Svitáková R, Trhlíková O, Berek D, Macova E, Limpouchová Z and Procházka K (2016) Chromatographic study of the conformational behavior of graft copolymers with a broad distribution of grafting densities in dilute solutions in selective solvents for grafts. J. Liquid Chromatogr. 39:50–58.

3. Kratochvíl P and Netopilík M (2017) The effect of nanoparticle non-uniformity on the ratio of radius of gyration and hydrodynamic radius Int. J. Polym. Anal. Charact. 22:112-117.
4. Samad A Al, Bethry A, Koziolová E, Netopilík M, Etrych T, Y Bakkour, J Coudane, F El Omar and B Nottelet (2016) PCL–PEG graft copolymers with tunable amphiphilicity as efficient drug delivery systems Journal of Materials Chemistry B 4:6228-6239.

Biography

Miloš Netopilík has completed his PhD at Institute of Macromolecular Chemistry and Postdoctoral studies at Virginia Polytechnic Institute and Technical University. Now, he works on the theory of separation at Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic. He has published more than 68 papers in reputed journals.

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