RESEARCH OVERVIEW

The end-use application of most macromolecules is determined not only by their chemical identity but also, and sometimes more importantly, by the distributions and sequences of key physical and physicochemical parameters. The ability to determine these distributions is gained through separation science, by enlisting the aid of a large number of separation methods in combination with spectroscopic, hydrodynamic, etc. methods of detection.

Research in our lab focuses on separation science of both natural and synthetic polymers, as well as on using polymers to probe fundamental mechanisms and relative advantages of various separation methods and detection techniques. In the former case, emphasis is placed on determining structure-property relations, such as the measurement of the molar mass, long-chain branching, and chemical composition distributions of polymers and copolymers and the relation of these to biocompatibility, bio- and mechanochemical degradability, etc. We use separation science to probe areas as dissimilar as the measurement of parameters directly related to docking, binding, biomolecular recognition, and mimicry, as well as to study the influence of polymeric architecture and dilute solution conformation on macromolecular behavior and degradation. In all of this, our principal, though not only, tool is size-exclusion chromatography coupled to a multiplicity of detection methods, where the latter may include refractometry, viscometry, static and dynamic light scattering, infrared spectroscopy, and mass spectrometry.

Additionally, we use polymers to determine the limitations and to extend the use of novel separation and detection methods. This may include the study of determinate errors or biases in certain techniques, the measurement of fundamental properties of separation media, or exploring the hitherto untapped potential of new on-line detectors and of the synergy that is created by coupling a variety of chromatographic methods and detection techniques.
Left: Ultrasonic degradation of an 8-arm star polystyrene, monitored by SEC with differential refractive index detection. Right: Angular and molar mass dependence of the depolarization behavior of a dilute solution of brominated polystyrene (PSBr), measured by SEC with depolarized multi-angle light scattering detection.

RECENT PUBLICATIONS


André Striegel obtained his Ph.D. in chemistry from the University of New Orleans. He then did postdoctoral research on plant polymers and dendrimers at the U.S. Department of Agriculture’s National Center for Agricultural Utilization Research in Peoria, Illinois. From 1998 until 2004 he was a research scientist at Solutia Inc., at their Springfield, Massachusetts R&D center, and received a Solutia Technical Achievement Award in 2003. He is the recipient of the first American Chemical Society Division of Analytical Chemistry Award for Young Investigators in Separation Science.