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Foreword

Chromatographic monoliths fall into two categories of inorganic (mostly silica) and organic (mostly methacrylates). Both share the wonderful properties of avoiding frits and providing high permeability via abundant, relatively uniform, unchanging, flow-through macropores. With packed columns, in contrast, interstitial pores depend on particle diameter (0.35–0.40), permeability drops rapidly as smaller particles are selected for higher chromatographic efficiency, and the particles to various degrees are not locked permanently into place. Depending on the type of monolith selected, how it is functionalized, the bed or column shape (often capillary, tip, or disc), and the chromatographic conditions, one or more of many overlapping advantages can be achieved: ease of column preparation (in the laboratory of the specialist, however), more applicable to large or huge solutes such as antibodies and viruses (thanks to the large through-pores and the associated convection that efficiently brings solutes of all sizes to the surfaces of these pores), potential for nearly flow-independent capacity (same reasons), negligible nonspecific binding (with the right methacrylate, a property that is essential for larger solutes), high binding capacity (even for the organic monoliths in spite of their absence of mesopores), fast separations (good for unstable solutes, high throughput, or processing of large sample volumes-especially impressive with monolith discs), long column lengths (a consequence of the high permeability: very high resolution is the very important benefit, and this arises from high N/pressure drop), attractive as an enzyme reactor (can be an ideal situation for the kinetics of an immobilized enzyme as a functional group), high pH stability (organic monoliths), no requirement for ultra-pressure pumps (which are expensive), wide flow rate range (helps to set up multidimensional separations), potential to cut off the top of a contaminated column (thanks to the absence of frits), and resistance to clogging (thanks to the macropores and high flow rates). (Of course, one does not always need these advantages, and packed columns in general are easier or less expensive to prepare, especially for a diversity of functional groups. Packed columns also are well established, so most HPLC is done with packed columns.) In this thematic issue we have a broad update on recent progress in the field of monoliths that exploits and extends its advantages. The articles collectively cover column preparation, characterization and applications of monoliths.

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