New generation chiral stationary phases for high efficient ultrafast chiral separations by liquid chromatography

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This contribution retraces the revolution that has characterized the field of chiral separations by liquid chromatography in the last few years thanks to the design and preparation of new chiral particles suitable for high efficient, ultrafast enantioseparations.

Examples of ultrafast chiral separations have been achieved by using different chiral selectors anchored to silica particles of different geometries and properties. Not only chiral selectors traditionally considered "fast" (e.g., Pirkle type Whelk-O1 CSPs), but also the "slow" ones (such as macrocyclic antibiotics-based CSPs) have been successfully employed to this scope. Latest generation chiral particles include both sub-2 μm fully porous ones (FPPs) and second-generation superficially porous particles (SPPs) of diameter as small as 2 μm. The combination of very short columns (1 cm or even 5mm) and high flow rates has allowed to perform the separation of enantiomers in seconds or even in fractions of seconds in normal- and reversed-phase (NP and RP) chromatography, Hydrophilic interaction chromatography (HILIC) and supercritical-fluid chromatography (SFC).

Current knowledge about ultrafast chiral separations through liquid chromatography will be revised, with particular reference to the fundamentals of mass transfer through chiral particles and to some aspects that should be further developed for the advancement of the field. Particular emphasis will be given to SFC, where the potential of new generation chiral stationary phases (CSPs) is enormous.