21st century chiral analysis

Chirality has a tremendous importance in many chemical and biochemical processes and it is continuously involved in our lives. Just to mention a few examples, consider that chiral molecules are stereoselective with regard to specific biological function, since enantiomers differ considerably in their physiological reactions with the human body. Also, the quality and safety of drugs inmany cases depend on their chirality. In chemical reactions and catalysis, asymmetric synthesis is a mature approach to the production of single enantiomers, although it is poorly suited to mass production and allows for only specific enantio selective reactions. These essential differences between chiral compounds have prompted the development of chiral analysis, however, it is clear that in the current 21st Century, chiral analysis will still need enormous efforts from the researchers and manufacturing industries to face the new challenges that will come from several areas (e.g., chemistry, biochemistry, pharmaceutical, environmental, agrifood) and different scales (analytical, preparative, industrial). This special issue (SI) of TrAC-Trends in Analytical Chemistryre-ports the latest advances in“Chiral Analysis”. Some of the most recognized experts in this field have collaborated in this SI in order to critically report innovative methodological and technological strategies, current trends and future perspectives in this field, including novel stationary phases, method developments and applications. Namely, this SI contains eighteen papers in which different aspects of chiral analysis using various modern methodologies widely applied in research, control laboratories and industry are considered. Thus, i) the discovery of new nano-materials has greatly contributed to the development of sensor based methods and this topic is highlighted in this SI; ii) nucleic-based enantiomeric sensing platforms are also discussed, describing the enantio selective properties of nucleic acid compounds and their use in chiral separation by electromigration and chromatographic techniques; iii and iv) in order to clarify enantio recognition mechanisms of polysaccharides, cyclodextrins, macrocyclic glycopeptides and other chiral selectors in liquid chromatography and CE, two review papers in this SI reported very recent studies considering this important topic; v) computational studies related to enantio selectivity in liquid chromatography are also presented; vi) while the thermo dynamics of the separation processes utilizing polysaccharide-based chiral stationary phases are also discussed including recent developments in the preparation and applications of these phases in high-performance liquid chromatography (HPLC); vii) among the recent developed chiral stationary phasesthe use of functionalized magnetic nanomaterials that could beused for compounds separation as well as for sample preparation are also discussed; viii) helical polyacetylene derivatives, promising candidates for enantio separations and sample preparation, are included too; ix) as well as the use of monolithic chiral stationary phases containing cyclodextrins, polysaccharides, proteins, antibiotics etc.; x) other novel chiral stationary phases based on cyclo-fructan derivatives and chiral porous materials, applied to the analysis of enantiomers by gas chromatography (GC) are also discussed in this SI. Some reviews considered the usefulness and the potential of different separation techniques in chiral analysis. Among them, xi) the last achievements in the field of supercritical fluid chromatography (SFC) discussing the modern instrumentation and the potential in chiral analysis are presented; xii) advances in multidimensional liquid chromatography discussing advantages and perspectives of this approach using HPLC, SFC and thin-layer chromatography are discussed; while the state of the art of chiral analysis utilizing microfluidic techniques such as xiii) capillary electrophoresis, xiv) nano-liquid chromatography and xv) capillary electrochromatography are also high lighted in this SI, describing how these techniques offer some advantages over the conventionalones, e.g., low flow rate, minute volumes of mobile phase and sample and small amount of stationary phases; xvi) the usefulness of mass spectrometry in chiral analysis is also discussed in this SI.

Some interesting applications of “Chiral analysis” in various fields are also reported in this SI, including xvii) the analysis of chiral drugs in environmental samples and forensic studies; xviii) and its use to investigate food safety, bioactivity, quality and traceability. As editors of this special issue devoted to “Chiral analysis”, we would like to thank all the authors for their suitable contributions, all reviewers for the time they devoted to the evaluation of the papers, and to those of Elsevier's team who contributed with their effort for the preparation of this special issue.

Muchas gracias a todos!
Grazie mille a tutti!

Alejandro Cifuentes, CIAL, CSIC, Madrid, Spain
Salvatore Fanali, Verona University, Italy