

Advanced processes based on chromatography and allied techniques to produce single enantiomers

Malte Kaspereit

Institute of Separation Science & Technology, University
Erlangen-Nuremberg, Erlangen, Germany

A short abstract:

The production of highly pure single enantiomers is a relevant but also challenging task in the production of pharmaceuticals and fine chemicals. Industrially, most enantiopure substances are produced by a non-selective synthesis of racemates, i.e. the 50/50 mixture of both isomers. In this case, the enantiomeric form with the desired physiological effect has to be isolated from the racemic mixture by a subsequent separation using, for example, chemical and biochemical conversions, crystallization, or chromatography. The overall yield of this approach is 50% only. Overcoming this limit requires combining the separation with an isomerization (racemization) of the undesired enantiomer.

In the presentation, different process concepts are discussed that are based upon techniques like chromatography, crystallization, membrane separations, and racemization reactions for the production of single enantiomers from racemic mixtures. Particular focus is on preparative-scale chromatography, which represents a fast and efficient “work horse” for extremely difficult chiral separations. The potential of various clever chromatographic operating modes like recycling schemes and simulated moving bed (SMB) chromatography is discussed. Finally, several process combinations are presented that purposefully combine chromatography with other separation methods and racemization reactions. Using different examples, it is demonstrated how such processes can be developed based on combined experimental and theoretical methods, and which performance is achievable.