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The chromatographic performance of flow-through particles: a Computational Fluid Dynamics study

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Abstract

The performance of flow-through particles has been studied by computational fluid dynamics. Computational fluid dynamics simulations was used to calculate the flow behaviour around and inside the particles rather than estimate it. The obtained flow field has been used to accurately simulate plate heights generated by flow-through particles and compare them to standard fully porous particles. The effects of particle size, particle porosity and microparticle size on the intra-particle flow and plate heights is investigated. It is shown that the intra-particle flow generates mass transfer enhancement which lowers the total plate height. An empirical model is proposed for the mass transfer enhancement and it is compared to previously proposed models. Kinetic plots are constructed for the flow-through particles. Counter-intuitively, columns packed with flow-through particles have a higher flow resistance which counters the advantages of lower plate heights. Flow-through particles offer no significant gain in kinetic performance over fully porous particles.

Keywords: flow-through particles, perfusion chromatography, Computational Fluid Dynamics, mass transfer, kinetic plots

Contents

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