

Abstract Submitted
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Ionic separation in nanofluidic channels¹ XIANGCHUN XUAN, Department of Mechanical Engineering, Clemson University — Ionic species of equal electrophoretic mobility (or charge-to-size ratio) may not be separated in electroosmotic or pressure-driven flow along microfluidic channels. In nanofluidic channels, however, the enormous electric fields inside electrical double layers cause transverse species distributions yielding charge-dependent species speeds in the flow. Those species of equal mobility can thus be separated solely by charge (or equivalently, size). Here we develop an analytical model to optimize and compare the separation of such ionic species in electroosmotic (termed nanochannel electrophoresis) and pressure-driven (termed nanochannel chromatography) flows along nanochannels in terms of selectivity, plate height and resolution. Both planar and cylindrical geometries are considered. It is found that nanochannel chromatography offers a larger selectivity (good) while a larger plate height (bad) than nanochannel electrophoresis does. The maximum resolution of ionic separation is therefore comparable between the two nanofluidic approaches. The optimal channel half-height or tube radius is found within the range of 1 to 10 times the Debye length.

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