Effect of viscoelasticity on the flow pattern and the volumetric flow rate in electroosmotic flows through a microchannel

최영진[1,*], 이원민[1,2], 손희상[1], 박흥목[1]
[1]서강대학교 화학공학과 이동현상연구실; [2]한국화약
(wanggk@hanmail.net*)

Many lab-on-a-chip based microsystems process biofluids such as blood, saliva and DNA solutions. These fluids are viscoelastic and show extraordinary flow behaviors, not existing in Newtonian fluids. Adopting appropriate constitutive equations these exotic flow behaviors can be modeled and predicted reasonably using various numerical methods. In the present paper, we investigate viscoelastic electroosmotic flows through a rectangular straight microchannel with and without pressure gradient. It is shown that the volumetric flow rates of viscoelastic fluids are significantly different from those of Newtonian fluids under the same external electric field and pressure gradient. Moreover, when pressure gradient is imposed on the microchannel there appear appreciable secondary flows in the viscoelastic fluids, which is never possible for Newtonian laminar flows through straight microchannels. The retarded or enhanced volumetric flow rates and secondary flows affect dispersion of solutes in the microchannel nontrivially.