

15. Modeling the Mixing Behaviour of a Novel Fluidized Extracorporeal Immunoabsorber. E.A. Grovender, C.L. Cooney, R. Langer and **G.A. Ameer**. *Chemical Engineering Science*, 56(18), pp 5437-5441, 2001.

A Taylor-Couette flow hemofilter, referred to as vortex flow plasmapheretic reactor (VFPR), has been designed to treat blood plasma with a fluidized-bed of small porous particles (~ 100 micron). Previously, the ability of this extracorporeal bioreactor to remove heparin and beta-2-microglobulin from whole blood has been demonstrated using immobilized enzymes and monoclonal antibodies. The VFPR employs an unsupported track-etched membrane, attached to the outer cylinder, to prevent contact between blood cells in the innermost annular compartment and the fluidized particles in the outer, active compartment. Taylor vortices in the innermost annular compartment induce undulations in the membrane, which drive the particle fluidization within the active compartment and potentially minimize cell polarization at the membrane's surface. To gain a better understanding of this novel device and to provide a framework for the development of an immunoabsorption model, the mixing pattern within a prototype device was characterized through residence time distribution experiments and mathematical analyses. A mathematical compartmental model was developed using the tanks-in-series approach to describe the mixing behavior within each physical compartment of the VFPR. Under clinically feasible process conditions, the macroscopic mixing behavior of the bulk fluid within the active compartment could be characterized as a single well-mixed control volume.