Blood Purifying in the Artificial Kidney: A Numerical Simulation

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Abstract:

The artificial kidney uses the principle of hemodialysis to purify the blood of patients with kidney disease. In this study, a mathematical model of hemodialysis is proposed and numerical method is used to solve the Navier-Stokes and mass transfer equations on this model, which are governing equations of dialysate and blood flow. The results show that the maximum mass transfer occurs in the entrance of model. We can also use streamlines to predict the vortex appearance and by changing several parameters such as effective length of mass transfer avoid creation of vortex and to be on the safe side. Velocity vectors also show that the velocity magnitude increases as we come closer to the membrane. On the other hand, Streamlines concentration near the membrane show a favorable agreement with other results. Presented results can lead us to a best solution in designing an effective artificial kidney.

Key words:

Computational Fluid Dynamic, Artificial Kidney, Hemodialysis, Mass Transfer, Porous Media