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Modeling of flow and mass transfer phenomena in a Hemodialyzer to study the effects of blood purification parameters

Soghra Mamaghani

Azad Islamic University of Tabriz, Iran

Abstract:

Change in the rate of blood toxic substances have made dialysis as the best treatment method for patients with renal failure. Changing in the structure and geometry of dialyzer hollow fibers, blood and dialysate flow rate can help optimization of dialysis operations and control of prevention of filtration of large molecular weight minerals.

In this study, filtration of substances with different molecular weights was simulated in a polyflux 210H dialysis hollow fiber with three-layer membrane. Momentum equations were used to obtain dialysate and blood flow parameters like velocity and pressure at pulsatile flow. Dialysis membrane was simulated as porous region by Using Darcy model afterward mass transfer equations were employed for determination of toxins concentration in the blood side and dialysis fluid side. Finally, these groups of the equations were solved in COMSOL 5.2a software as coupled and then the concentration values were explored.

In the oscillatory flow, increased blood flow rate was effective in filtration of all molecules with low molecular weight; however, it didn't cause decreased filtration in the molecules with high molecular weight. Hence with increase of the blood flow rate from 200 to 400 ml/min filtration of urea increased by 33.83 %, but albumin decreased by 17.28.

Change in the thickness of blood adjacent layer in the three-layer membrane had insignificant effect on the minerals filtration, so that increase of the diameter from 8 to 10 caused was decreased filtration of substances with different molecular weights.

Biography:

Soghra Mamaghani has completed her Master at the age of 26 years from Azad Islamic University and Phd studies from Science and Research Branch, Islamic Azad University of Tehran.

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