Technology Licensing Opportunity

UNIVERSITY OF SASKATCHEWAN

An Efficient Hemodialysis Filter

A novel nanofabricated hemodialysis membrane which is biocompatible and has improved efficiency for treatment of End Stage Renal Disease (ESRD) patients. The membrane has universal appeal for renal dialysis centers and can be applied to other industries pursuing filtration processes. The membrane will reduce morbidity and mortality while increasing the quality of life of ESRD patients.

Building a Better Filter

- **Bio-compatible**
- **Consistent pore size**
- **Highly efficient**

Available for Licensing or Collaboration

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Patents:

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Need for an improved filter: End Stage Renal Disease (ESRD) patients undergo hemodialysis 3 times a week, with each visit scheduled for 3-4 hours. This treatment continues until a suitable kidney donor is found; however, the morbidity and mortality rates are high amongst these patients. A major problem of hemodialysis is the bio-incompatibility of the currently used polymeric membranes which have been shown to activate inflammatory mediators. Additionally, the pores of the polymeric membranes, being inconsistent in size and shape are inefficient in filtering out middle molecule uremic toxins (Fig. 1A).

Market: One dialysis filter is typically used per session at a cost of $40 to $80. The global market in 2014 was just over $6 billion and projected to grow to $7.8 billion by 2020 (GlobalData, 2015).

The Shoker/Hedayat Filter: Our solution to building a better hemodialysis filter is nano-fabricating a highly efficient filter, with consistently sized pores out of a biocompatible material (Fig. 1B). The filter is designed to optimize the relationship between pore diameter and convective pressure to clear larger uremic toxins. A possible application of the Shoker/Hedayat filter is its use in series with existing standard hemodialysis filters to remove uremic toxins.

Prototype Results: The current Shoker/Hedayat filter prototype has a surface area of 0.9 m^2 and has been successfully tested with arterial flow at 500 ml/minute and arterial pressure at -10 to +30 mmHg and venous pressure at 60-160 mmHg. The ability of the filter prototype to withstand the convective pressure required to effectively eliminate middle molecule uremic toxins while providing a good flow rate (500ml/min) encourages further optimization for the removal of small molecule toxins.

Call for Collaboration: Drs. Shoker and Hedayat are encouraged by the performance of the Shoker/Hedayat Filter prototype and are looking for a partner that will assist with further prototype fabrication in order to test the optimum parameters for hemodialysis.

Figure 1

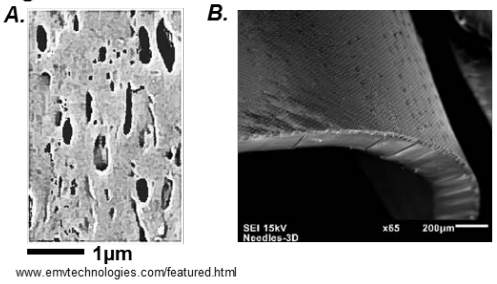

Figure 1. Photomicrograph of a polysofone membrane (A) and the Shoker/Hedayat membrane (B)

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Figure 2

A.

B.

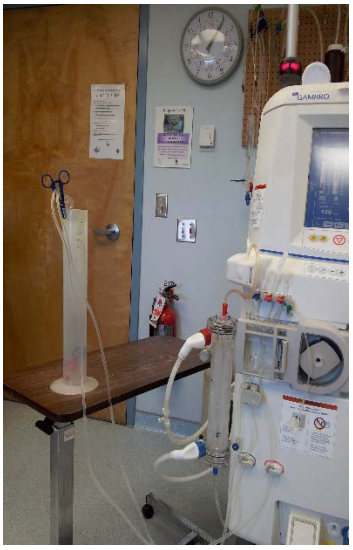

Figure 2. Shoker/Hedayat Filter inside a hemodialysis cartridge (A) and in situ in a hemodialysis machine (B)

Publications:

Hedayat A, Elmoselhi H, Shoker A. Structural Delineation of the Exeltra Plus 210 Hemodialyzer's capillary pores as targets to ameliorate its filtration. British Journal of Applied Science and Technology, 2014; 4(11):1622-1633.

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Hedayat A, Elmoselhi H, Peace R, Shoker A. Study of uremic toxin fluxes across nanofabricated hemodialysis membranes using irreversible thermodynamics. Computational and Structural Biotechnology Journal, March 2013; 6(7): e201303005.

Hedayat A, Elmoselhi H, Shoker A. Principles of manufacturing efficient hemodialysis membranes using nanotechnology. World Research Journal of Nephrology, January 2013; 1(1): 1-9.

Hedayat A, Szpunar J, Kumar N.A.P. Kiran, Peace R, Elmoselhi H, and Shoker A, Morphological Characterization of the Polyflux 210H Hemodialysis Filter Pores, *International Journal of Nephrology*, 2012 (2012) 1-6.

Hedayat A, Elmoselhi H, Shoker A. Theoretical application of irreversible (non-equilibrium) thermodynamic principles to enhance solute fluxes across nanofabricated hemodialysis membranes. International Journal of Nephrology, Volume 2012, Article ID 718085. Doi: 10.1155/2012/718085