Nanoporous Ceramic Filter Offers Hope To Kidney-dialysis Patients

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Kidney dialysis is a form of renal replacement therapy used to provide an artificial replacement for lost kidney function due to renal failure. Dialysis is a life support treatment and not a disease treatment. Dialysis provides filtration of toxins in the blood to ensure the survival of the patient. More than ten million Americans have kidney problems and roughly 370,000 of them suffer from kidney failure. The average survival rate of a dialysis patient is only 5 years. Every 24 hours the kidneys filter about 200 quarts of fluid, returning 198 quarts of purified fluid to the bloodstream and excreting 2 quarts in the form of urine. The toxins removed from the body fall into two categories. There are extracellular toxins which are removed in the first half hour of dialysis and the remainder of the 4 hour treatment rids the blood of intracellular toxins.

William Van Geertruyden, who holds three degrees in materials science and engineering from Lehigh, has developed a new type of dialysis filter that, he says, represents the first major breakthrough in 30 years for dialysis patients. Van Geertruyden, who earned a Ph.D. from Lehigh in 2004, has filed a patent application on a ceramic filter that he believes is dramatically superior to the traditional polymer, or rubber-like, filter used in dialysis. Last September, his company, EMV Technologies, LLC, received a $195,000 Small Business Technology Transfer grant from the National Institutes of Health (NIH) to verify the feasibility of the new filter. The new ceramic filter has the potential to make kidney dialysis much more efficient, says Van Geertruyden, and to reduce by 30 minutes to one hour the time required for a dialysis treatment. The new ceramic filter promises to double the amount of toxins removed during dialysis and to double the glomulellar filtration rate (GFR), or rate of toxin removal. GFR is 100 percent in a normal person but only 15 percent at best for a dialysis patient, a rate that has changed little in the past 30 years.

The ceramic filter's secret lies in its pores, which are organized in orderly rows and columns and which measure mere nanometers in diameter. One nm is one one-billionth of a meter. These nanopores correspond more closely to the nano-sized toxins in the blood than do the larger pores of the standard dialysis filter. These polymeric pores vary in size and, when viewed with a microscope, appear in random arrangements of ovals, circles, slits and other shapes. The goal is to double the amount of toxins removed during dialysis and to double GFR. If they can improve the efficiency of filtration, using the new ceramic filter, they can improve mortality rate and quality of life. The new filter could also alleviate the stress resulting from the fast blood flow required to remove toxins and finish a dialysis treatment in four hours.

Because of an aging population, and partly because of the growing incidence of diabetes and high blood pressure, the number of kidney-dialysis patients in the U.S. is expected to jump to 620,000 in three years. This will place more strain on the hospitals and clinics equipped to do dialysis. Having this new technology available will be beneficial to all patients in need of dialysis presently and in the future.

1. http://www.medicalnewstoday.com/
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3. Burr, Renee A. (2003). All about dialysis. There are several forms of kidney dialysis. Knowing what to expect from each can help you choose the right one, *Diabetes Forecast,* 56(7):70-2, 2003 Jul.