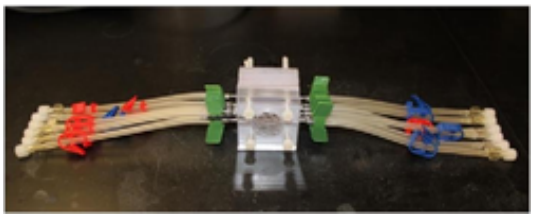
Technology Offer

Electroosmotic Cell enabling Mobile and Home Dialysis

Reference Number 42-00018

Challenge

The prevalence of chronic kidney disease in the U.S. is estimated to be at approximately 14%, which corresponds to 39 million adults. Patients with end stage renal disease (ESRD) and requiring renal replacement therapy (RRT) have increased from approximately 10,000 in 1973 to 615,000 in 2011. Renal replacement therapy options are limited to hemodialysis and peritoneal dialysis or renal transplantation. Hemodialysis utilizing classical separation membranes requires high volumes of dialysate (approx.120-200 liters per 4 hour session) and causes annual direct treatment costs of approximately US$ 87.000 per patient. Current hemodialysis is able to provide no more than 10-15% of clearance rates achieved by the native kidneys thus massively reducing the prognosis of affected individuals. During dialysis solute clearance has to be achieved through transfer of low molecular weight products such as urea and creatinine from the blood into the dialysate by diffusion and, to a lesser extent, by convection. Accurate control of volumes and solutes status in the patient, in the dialysate compartment, as well as of the substitution fluid used, is required. At the same time, the concentrations of ions, such as calcium, hydrogencarbonate,sodium and potassium, have to be controlled.



Electroosmotic Cell enabling Mobile and Home Dialysis

Technology

The presented technology uses electroosmotic flow - an electro–kinetic phenomenon - as an alternative way to achieve liquid flow through surface charged porous membranes. Electroosmosis, combined with the ability to control ion concentrations offers an appealing alternative technique to the state of the art separation methods because of its potential to achieve high membrane flux without any pressure difference. In lab-based electroosmotic batch experiments ion transport (e.g. sodium, creatinine) and transport of uncharged molecules (such as urea) through the membrane structure have been achieved in continuous mode operation. Electroosmosis under plasma conditions showed active transport of urea and creatine, while other relevant markers, e.g. vitamine B12, myoglobin, albumin, beta-2-microglobulin, were retained. The charge flow did not influence protein deposition negatively. The experimental results indicate that an area in the dimension of several 100 cm² will be sufficient for a continuous hemodialysis unit. The technology allows a reduction in size of dialysis equipment, reduces the amount of dialysate volume and electrolyte concentrations can be actively controlled. So that the proprietary technology enables home and mobile dialysis.

Commercial Opportunity

The technology is available for in-licensing.

Development Status

Within laboratory experiments the proof of concept was demonstrated. Validation data, specifications and prototypes for scale up exepriments are available.

Patent Situation

The following patent application is pending: EP 14821194.9. The Chinese and US patent, CN 105873664 and US 15/107,663, are granted.

Further Reading

M. Lenninger, N. Schweibert, J. Leierer, G. Weigel, L. Loacker, H. Neuwirth, G. Mayer, T. Bechtold: "Separation of metabolic products by electroosmotic dialysis in the plasma model"; Electrochimica Acta, doi.org/10.1016/j.electacta.2017.11.194

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