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[1]Université de technologie de Compiègne (UTC), Compiègne, France, [2]Université Sidi Mohamed Ben Abdellah (USMBA), Fès, Morocco, [3]Polyclinique Saint-Côme, Compiègne, France.

Objectives: Water's scarcity is a major problem even in Europe with climate changes. Hemodialysis is a treatment with a high economic and ecological impact, especially regarding water consumption. The reject from the reverse osmosis (RO) system of the water treatment loop is about 250 L/dialysis session. This mildly salted water is usually wasted. The aim of this work is to evaluate the desalination of RO rejects by electrodialysis, to promote its re-use.

Methods: A 2^3 full factorial design was applied to desalination of a model solution (NaCl, conductivity of 2 mS/cm) to study the effects of flow rate (Q), initial feed concentration (C) and applied voltage (E) on the demineralization rate and specific energy consumption (SPC).

Results: Optimal conditions (E and Q) for desalination were established with the model solution. The same operating conditions were applied to desalinate RO rejects with total dissolved salts (TDS) circa 1.3 g/L. Reducing conductivity of RO rejects from 1.96 mS/cm to 0.1 mS/cm was obtained with a low SPC (1.37 Wh L-1). The process efficacy was also evaluated by ionic flux transport and current efficiency.

Discussion: Electrodialysis can satisfy a high demineralization rate with low energy consumption. The duration of the treatment depends on the conductivity target.

Conclusion: Treatment of RO rejects is feasible with electrodialysis. The process can be adapted upon the standards for irrigation or sterilization.

Acknowledgements: This study was partially supported by ITE from Alliance Sorbonne Université (IDEX SUPER).

K5- COMPARISON OF DIFFERENT HOLLOW FIBRE HAEMODIALYSIS MODULE CONFIGURATIONS BY A CFD MULTISCALE APPROACH

Cancilla N[1], Gurreri L[1], Marotta G[2], Ciofalo M[1], Cipollina A[1], Tamburini A[1], Micale G[1]

[1]Dipartimento di Ingegneria, Università degli Studi di Palermo, Viale delle Scienze Ed. 6, 90128 Palermo, Italy, [2]Medtronic, Via Camurana 1, 41037 Mirandola, Modena, Italy.

Objectives: The study aims to predict 3-D flow and solute concentrations fields both for blood and dialysate and overall performance parameters (such as dialysate pressure drop and clearance) for different hollow-fibre haemodialysis modules.

Methods: A multiscale approach was used. At small (unit cell)-scale, dialysate flow and mass transfer around straight cylindrical fibres arranged in regular lattices were simulated. At module-scale, hydraulic permeabilities and mass transfer coefficients derived from small-scale simulations were used to define two different porous media representative of blood and dialysate, sharing the same volume and exchanging solute. Simulations involved different module configurations, sharing the same membrane area but differing in geometry and inlet-outlet arrangement. Literature values of solute diffusive permeability for commercial PES membranes were used.

Results and discussions: For given blood and dialysate flow rates (300 and 450 mL/min, respectively), different module configurations yielded very different dialysate-side flow patterns and pressure drops, moderately different Sherwood numbers but similar values of the clearance. For urea, this ranged between 209 and 235 mL/min in most configurations, indicating that almost all the membrane area was active in most configurations. For a typical commercial geometry, the predicted clearances at different blood flow rates exhibited a satisfactory agreement with experimental measurements (maximum discrepancy <2%).

Conclusions: Using commercial membranes properties, dialysate-side mass transfer resistance is small compared with blood-side and membrane contributions. As membranes with higher diffusive permeability will be developed, the influence of dialysate-side resistance will become larger and an accurate prediction of the dialysate flow field will become more important.

K6- HOW µCT-SCANNING PROVIDES US WITH A VALIDATED PORTFOLIO OF HAEMODIALYSERS WHEN DECREASED ANTICOAGULATION IS NEEDED

Vanommeslaeghe F[1], Josipovic I[2], Boone M[2], Van Biesen W[1], Eloot S[1]

[1]Nephrology department, Ghent University Hospital, Gent, Belgium, [2]Centre for X-ray Tomography, Physics and Astronomy, Ghent University, Gent, Belgium.

Objectives: While systemic anticoagulation is most widely used in haemodialysis (HD), contraindications to its use might occur in particular settings. In this case, membranes with heparin grafting or with improved biocompatibility claim their suitability. To quantify the performance of different dialysers with decreased anticoagulation, fiber blocking was assessed by micro-computed tomography (µCT).

Methods: Different cross-over designs included ten maintenance HD patients being dialysed at midweek using either Evodial 1.3 (Baxter), FX800 (Fresenius Medical Care), or Solacea™ 19H (Nipro) in different dialysis modes, i.e. pre and post-dilution haemodiafiltration (pre-HDF, post-HDF), and HD. Anticoagulation was given as half the regular dose (1/2), quarter (1/4) or without anticoagulation (zero). Dialyser fiber blocking was quantified in the dialyser outlet potting using a 3D µCT scanning technique.

Results: The percentage open fibres post-dialysis (i.e. >70% fiber surface area) was for HD with 1/2 anticoagulation lower in FX800 than in Solacea™ (95[74;98] versus 100[99;100]), and for HD with zero anticoagulation 80[77;89] for Solacea™ and 95[65;98] for Evodial. From 1/4 to zero anticoagulation in Solacea™, fiber patency was decreased for pre-HDF and HD, i.e. from 96[87;99] to 76[61;85] with pre-HDF and from 99[97;99] to 80[77;89] with HD. Comparing the results for zero anticoagulation, post-HDF (i.e. 94[82;97]) performed as good as HD and pre-HDF.

Conclusion: Beside the heparin-grafted Evodial dialyser, the biocompatible Solacea™ dialyser provides promising results for use in conditions where systemic anticoagulation is contraindicated. Surprisingly, pre-HDF, although diluting the blood, was not more effective for fiber patency in case of zero anticoagulation than post-HDF and HD.

K7- A KINETICS BASED ALGORITHM TO TREAT ACUTE NEONATAL HYPERAMMONAEMIA

Snauwaert E[1], De Rudder J[2], Verloo P[1], Dhont E[1], Raes A[1], Van Biesen W[2], Eloot S[2]

[1]Department of Pediatrics, Ghent University Hospital, Gent, Beglium, [2]Department of Nephrology, Ghent University Hospital, Gent, Belgium.

Objectives: Acute neonatal hyperammonaemia is associated with poor neurological outcomes and high mortality. Kinetic modelling was performed to develop an algorithm to achieve a fast decline in serum ammonia.

Methods: Four hyperammonemic patients underwent 11 haemodialysis sessions, i.e. 5 with the 4008/FXPaed (Fresenius Medical Care), and 6