**Haemocatharsis membrane filters –**

**A novel methodology to assess their performancE**

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**ABSTRACT**

The optimum performance of haemocatharsis membrane-filters/modules (HC-M) is an overarching goal in the treatment of *end-stage renal disease (ESRD) patients*, directly impacting on their survival.

These filters, comprised of numerous hollow-fiber ultrafiltration-type membranes (encased in a cylindrical shell), serve to separate/remove toxic compounds from the patient’s blood (and transfer them from the fiber-lumen to an external counter-currently flowing liquid/dialysate) in frequent haemocatharsis clinical-sessions. Extensive R&D work in recent decades has resulted in significant imrovements regarding HC-M material, design and operation. Such development work as well as HC-M testing in accord with international standards (ISO, EU) is performed *in vitro,* aiming to determine key process/performance parameters (e. g. membrane effective permeance, clearance of toxicants, ultrafiltration coefficient). However, significant weaknesses have been identified recently [1, 2], in such standards and practices, that lead to inaccurate/unreliable results.

In this presentation, a novel and facile methodology is outlined, regarding development of reliable tools for comprehensive performance simulation of particular HC-M and process, which involves two steps: **i)** *Determination of fluid-mechanical parameters of a particular HC-M*, using a specifically designed experimental in vitro protocol [1,3]. The minimum number of key parameters required to fully describe the flow field, include the membrane permeance K and friction coefficients of counter-currently flowing liquids in lumen- and shell-side (ff and fs). **ii)** *Determination of the complete mass transfer HC-M characteristics* [4], by appropriate modeling and solution of the respective problem, employing the above-mentioned fluid mechanical parameters. This approach is validated for the case of a common toxicant (urea) present in Newtonian aqueous solution (instead of blood, as is often done in the literature), using new detailed experimental data on the transfer and axial concentration profiles of urea in the dialysate [4]. A single intrinsic-parameter value (i.e. the unknown effective solute-diffusivity in the membrane) needs determination to achieve satisfactory fitting of all data to the model.

Progress on extension and implementation of the new methodology to human plasma and blood haemofiltration will be presented. In such model adaptation, account should be taken of oncotic-pressure and membrane-fouling effects, associated with blood flow in the lumen of HC-M fibers.

**KEYWORDS:** Haemocatharsis, Haemofiltration membrane-module, performance assessment, flow parameters, mass transfer

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