

Supplement to

Mass transfer characteristics of haemofiltration modules – Experiments and modeling

Table S1 presents the “corrected” *exact external pressures* at inlet/outlet of the Haemofiltration (HF) module, after subtracting or adding static pressure differences. Subscripts 1 to 4 designate the location of stream inlet or outlet, $P_1/P_{\text{Blood in}}$, $P_2/P_{\text{Blood out}}$, $P_3/P_{\text{Dialysate in}}$, $P_4/P_{\text{Dialysate out}}$. These data are needed for complete fluid-mechanical characterization of the HF module employed in the mass transfer experiments (manuscript refs [12, 13])

Figure S1 depicts typical recordings of blood- and dialysate-side inlet flow rates for the three cases studied, indicating the prevailing steady-state conditions.

In **Figures S2 to S5**, the measured urea concentration C_D profiles for Cases II and III (for the blood-side and dialysate-side flow fields) are contrasted with theoretical profiles representing several levels of contributions of solute diffusion, by varying the parameter λ within three orders of magnitude (i.e. from 10^{-2} to 10^0).

As a test on the accuracy of experimental data, checks on the closure of urea mass balance for these experiments was performed; such an example is provided at the end of this document.

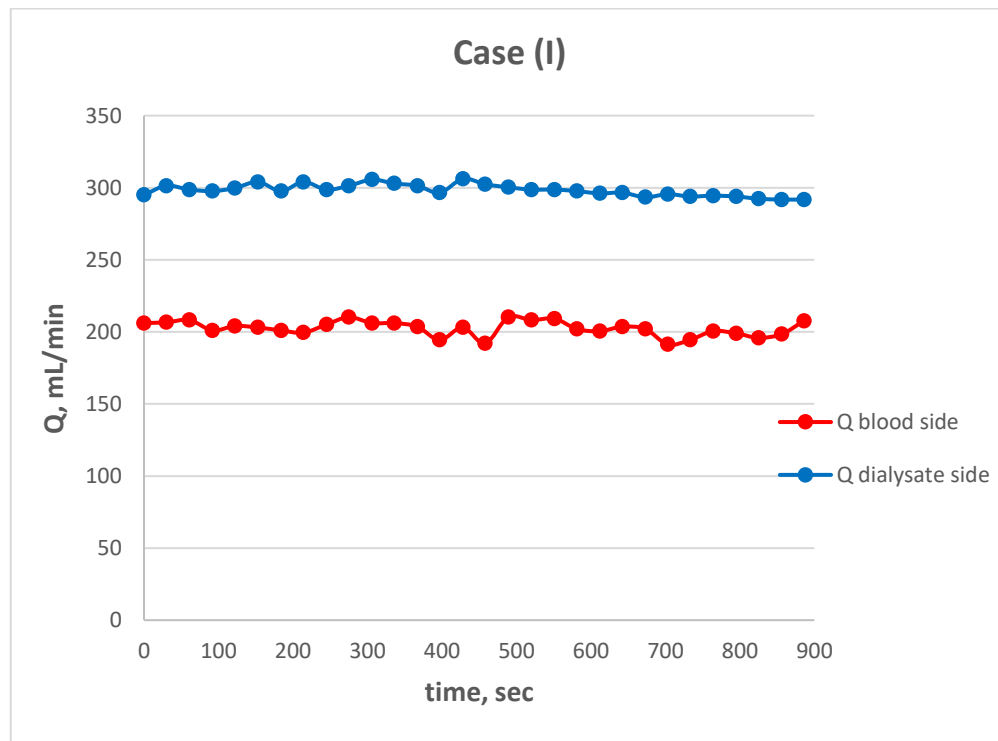
Table S1. Characteristic pressure differences for: (a) *Mode #3*, (b) *Mode #4*.

(a)

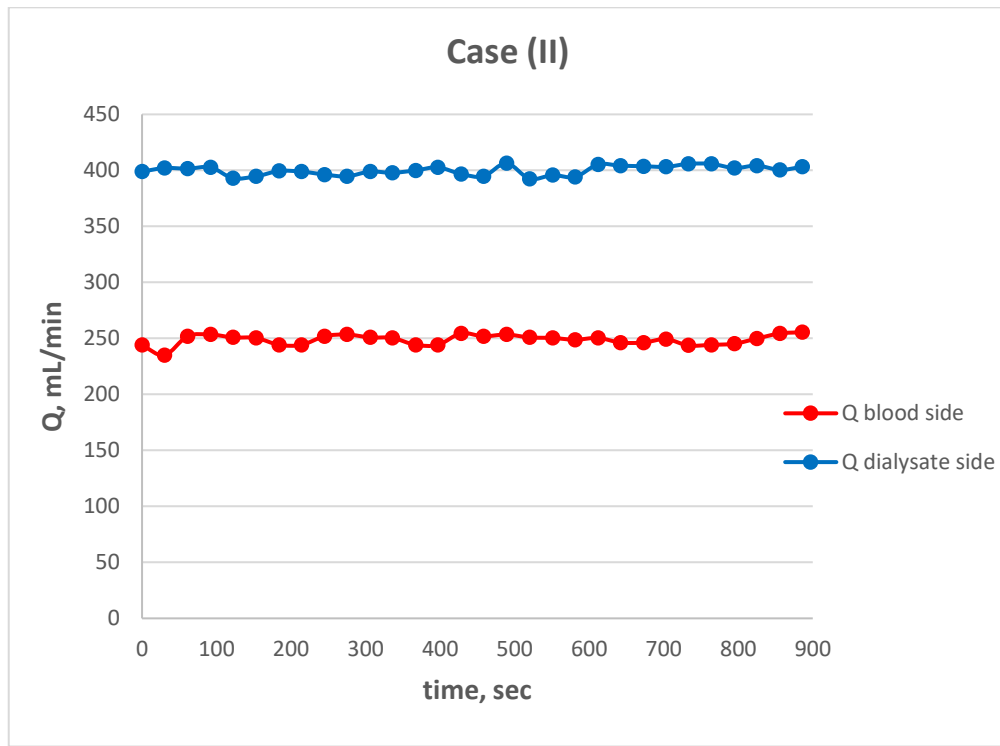
| Q_{Blood} (mL/min) | $\Delta P = P_1 - P_4$ [$P'_1 - P'_4 + 0.06$] (psi) | $\Delta P = P_1 - P_2$ [$P'_1 - P'_2 + 0.54$] (psi) | $\Delta P = P_2 - P_3$ [$P'_2 - P'_3 - 0.07$] (psi) |
|--------------------------------|---|---|---|
| 200 | 0.84±0.05 | 0.48±0.03 | 0.31±0.04 |
| 250 | 1.29±0.01 | 0.63±0.05 | 0.40±0.03 |
| 300 | 1.64±0.01 | 0.81±0.04 | 0.42±0.02 |
| 350 | 1.93±0.02 | 0.96±0.04 | 0.52±0.01 |
| 400 | 2.41±0.08 | 1.21±0.07 | 0.61±0.01 |
| 450 | 2.88±0.01 | 1.47±0.04 | 0.67±0.01 |
| 500 | 3.38±0.06 | 1.75±0.07 | 0.74±0.01 |

(b)

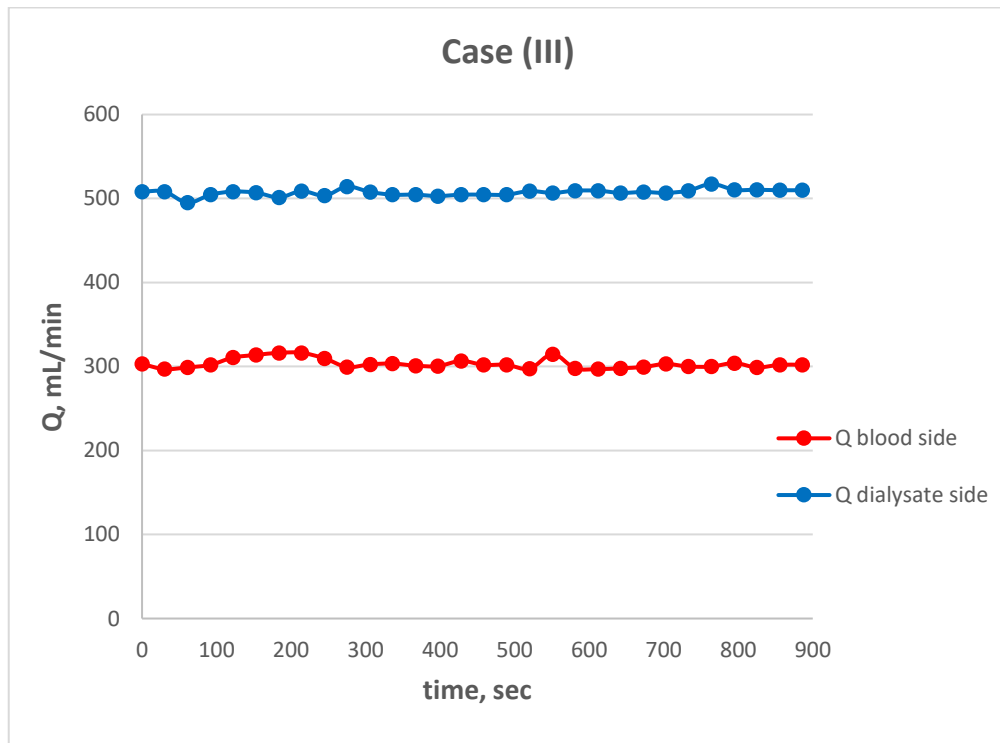
| $Q_{\text{Dialysate}}$ (mL/min) | $\Delta P = P_3 - P_2$ [$P'_3 - P'_2 - 0.07$] (psi) | $\Delta P = P_3 - P_4$ [$P'_3 - P'_4 - 0.36$] (psi) | $\Delta P = P_4 - P_1$ [$P'_4 - P'_1 - 0.06$] (psi) |
|------------------------------------|---|---|---|
| 200 | 0.64±0.01 | 0.15±0.03 | 0.28±0.01 |
| 300 | 1.22±0.01 | 0.27±0.01 | 0.42±0.01 |
| 400 | 1.96±0.00 | 0.46±0.01 | 0.56±0.00 |
| 450 | 2.23±0.01 | 0.53±0.01 | 0.64±0.00 |
| 500 | 2.78±0.02 | 0.69±0.01 | 0.71±0.01 |
| 550 | 3.20±0.02 | 0.81±0.02 | 0.75±0.01 |
| 600 | 3.69±0.02 | 0.94±0.02 | 0.84±0.03 |



(a)



(b)



(c)

Figure S1. Typical recordings of blood- and dialysate-side inlet flow rates for the three cases studied, indicating prevailing steady-state conditions. (a) Case (I), $Q_{\text{Blood}}/Q_{\text{Dialysate}}$: 200/300 mL/min. (b) Case (II), $Q_{\text{Blood}}/Q_{\text{Dialysate}}$: 250/400 mL/min. (c) Case (III), $Q_{\text{Blood}}/Q_{\text{Dialysate}}$: 300/500 mL/min.

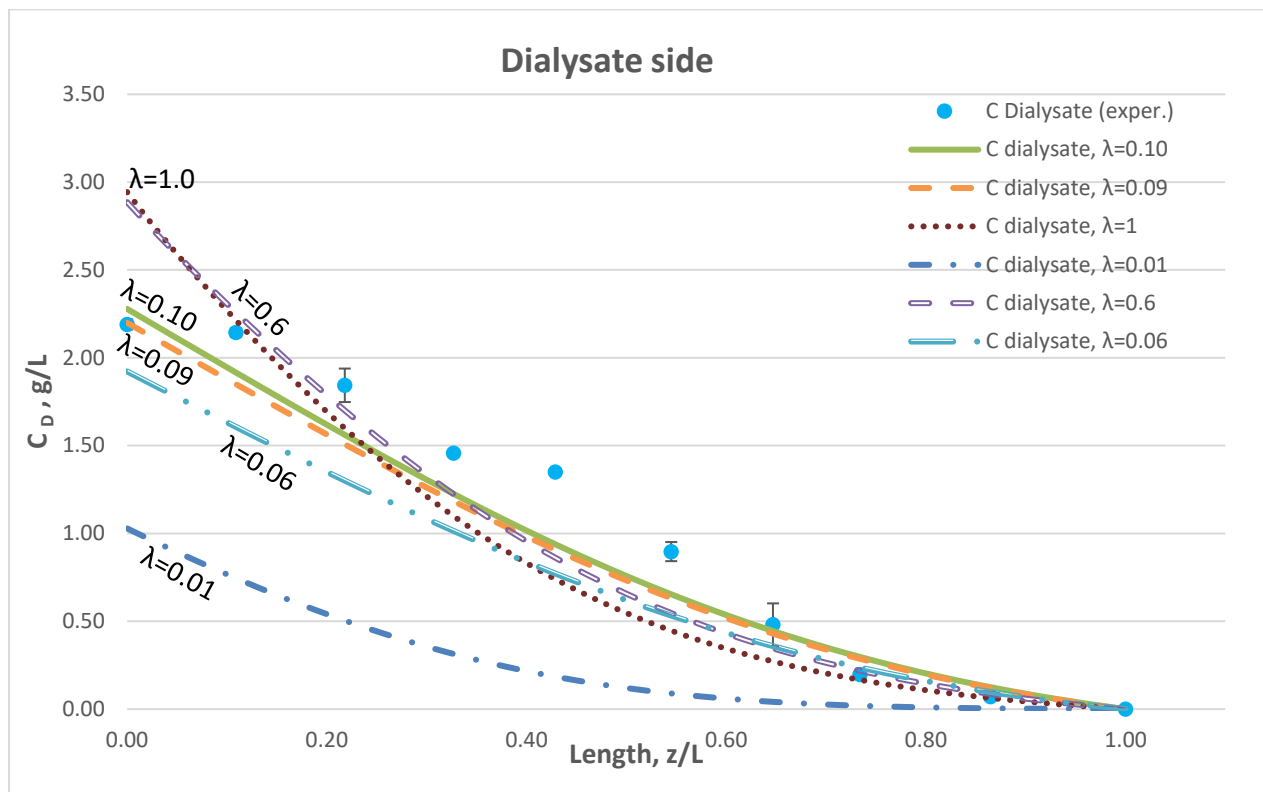


Figure S2. Dialysate-side urea concentration profile. Influence of the urea effective diffusion coefficient in the membrane (D_e) on the urea mass transfer process, under simultaneous trans-membrane liquid convection and solute diffusion. Case (II): $Q_{\text{Blood}}=250 \text{ mL/min}$, $Q_{\text{Dialysate}}=400 \text{ mL/min}$.

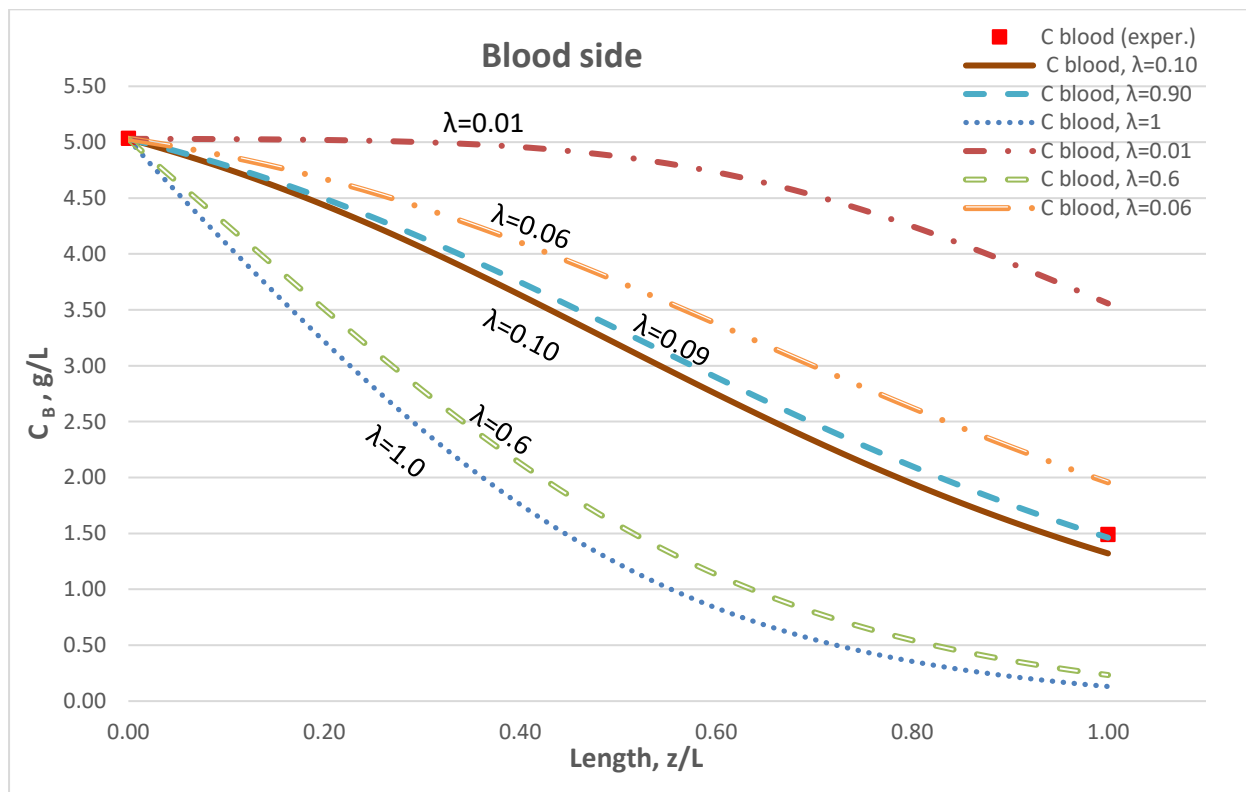


Figure S3. Blood-side urea concentration profile. Influence of the urea effective diffusion coefficient in the membrane (D_e) on the urea mass transfer process, under simultaneous trans-membrane liquid convection and solute diffusion. Case (II): $Q_{\text{Blood}}=250 \text{ mL/min}$, $Q_{\text{Dialysate}}=400 \text{ mL/min}$.

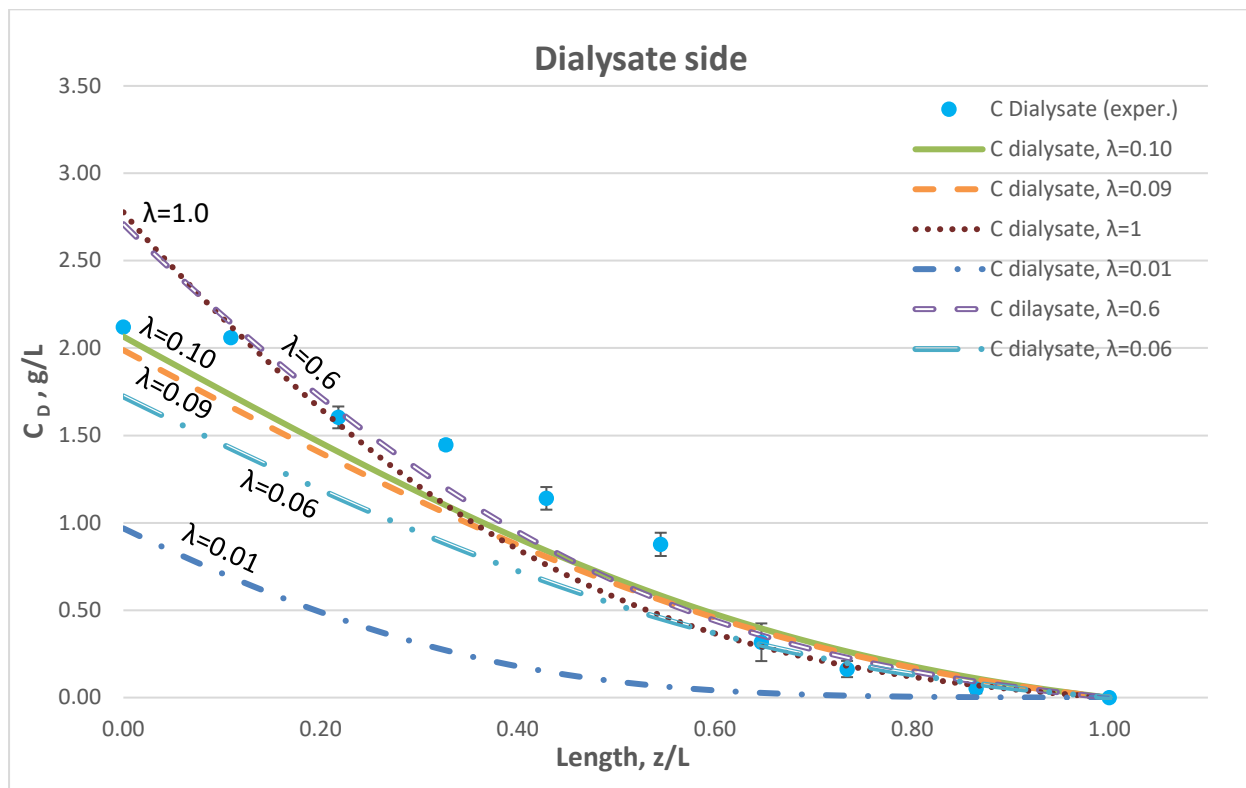


Figure S4. Dialysate-side urea concentration profile. Influence of the urea effective diffusion coefficient in the membrane (D_e) on the urea mass transfer process, under simultaneous trans-membrane liquid convection and solute diffusion. Case (III): $Q_{\text{Blood}}=300 \text{ mL/min}$, $Q_{\text{Dialysate}}=500 \text{ mL/min}$.

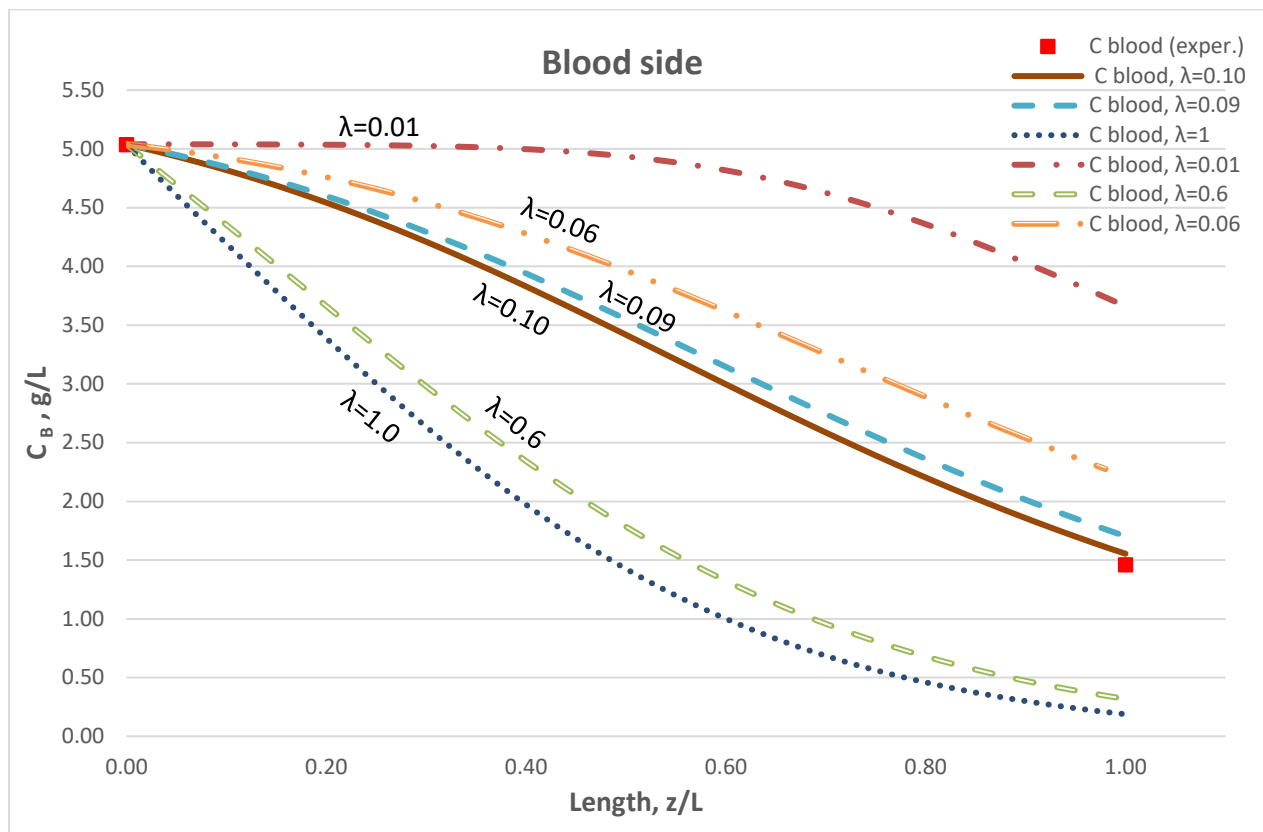


Figure S5. Blood-side urea concentration profile. Influence of the urea effective diffusion coefficient in the membrane (D_e) on the urea mass transfer process, under simultaneous trans-membrane liquid convection and solute diffusion. Case (III): $Q_{\text{Blood}}=300$ mL/min, $Q_{\text{Dialysate}}=500$ mL/min.

Closure of urea mass balance for the experiments

For each experiment of Cases I, II and III, closure of both volume- and mass-balance has been checked, including urea mass-balance closure corresponding to the experimental results depicted in Figures 6 - 8. For example, regarding Case I, Figure 6, by using the outlet/inlet values $C_{\text{Dout}} = 1.36$ and $C_{\text{Din}} = 0$, and the respective inlet/exit flow rates Q_D and blood-stream data (listed in Table A1) excellent closure is obtained (difference $< 2\%$), as shown below

$$C_{\text{Bin}} Q_{\text{Bin}} - C_{\text{Bout}} Q_{\text{Bout}} = C_{\text{Dout}} Q_{\text{Dout}} - C_{\text{Din}} Q_{\text{Din}}$$

$$(5.02 \cdot 200) - (1.36 \cdot 185.93) = (2.42 \cdot 314.07) - 0 \rightarrow 751.14 \approx 760.05$$