Synthetic skin membrane – transport simulation

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Transport experiments: Strat-M membrane + Franz diffusion cell

Two layers of polyethersulfone with different porosity

Polyolefin (PE, PP) layer

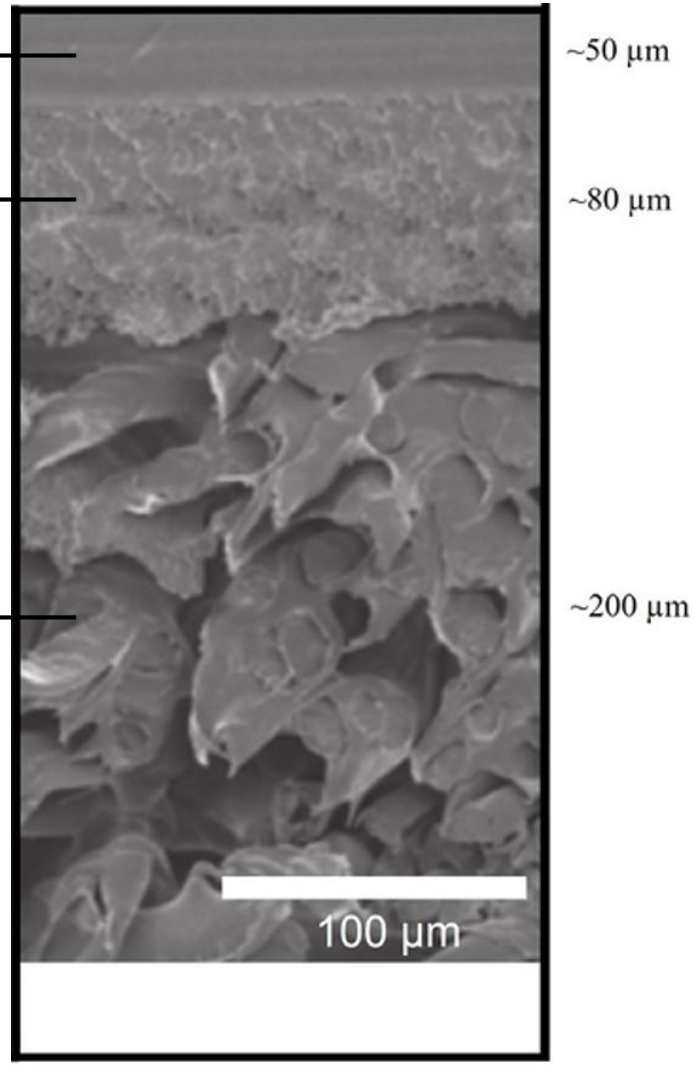


Figure 1 Scanning electron microscopic image of a Strat-M cross-section

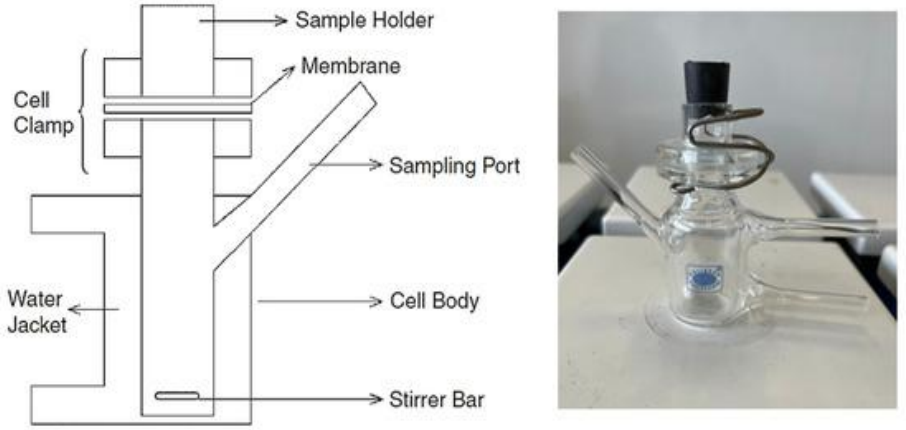


Figure 2 Schematic representations of Franz dissolution apparatus

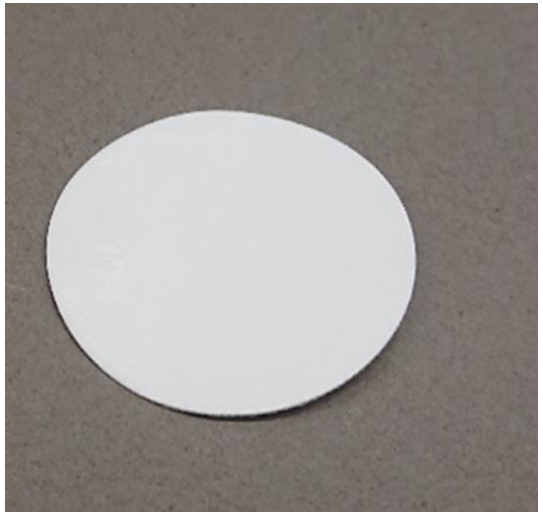
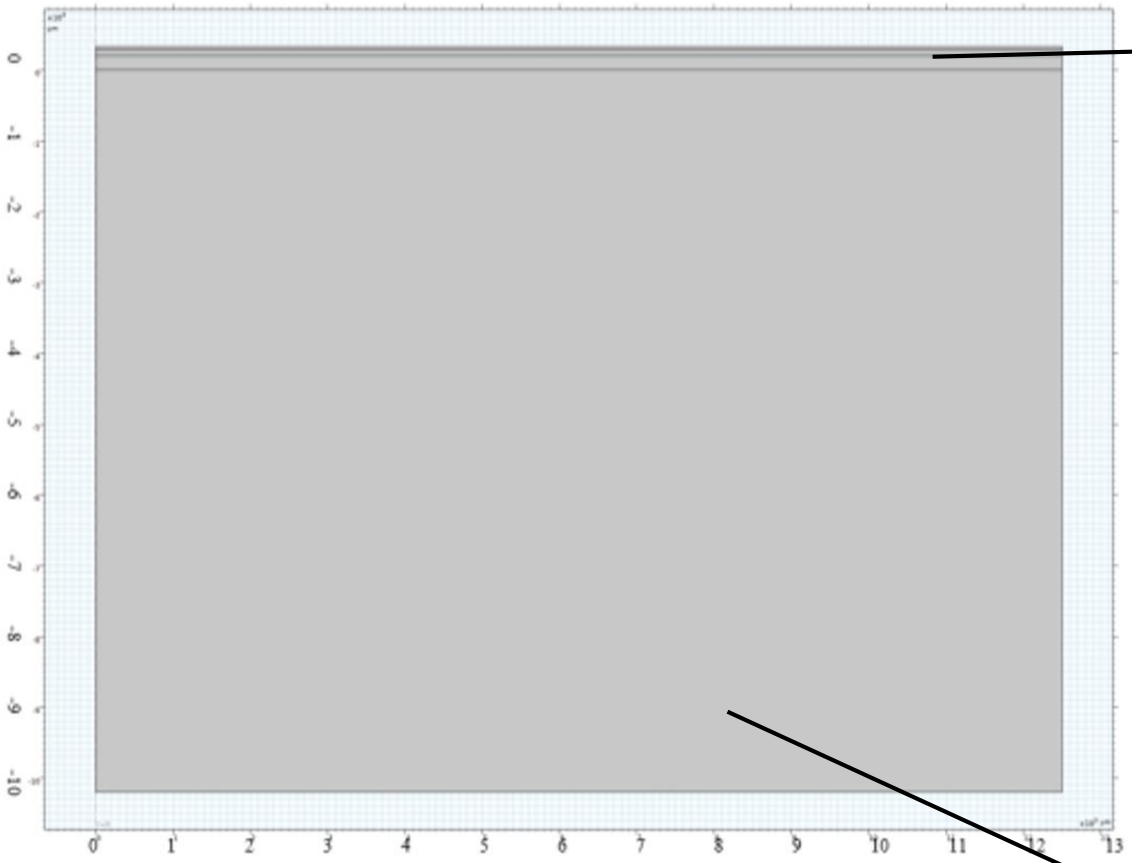
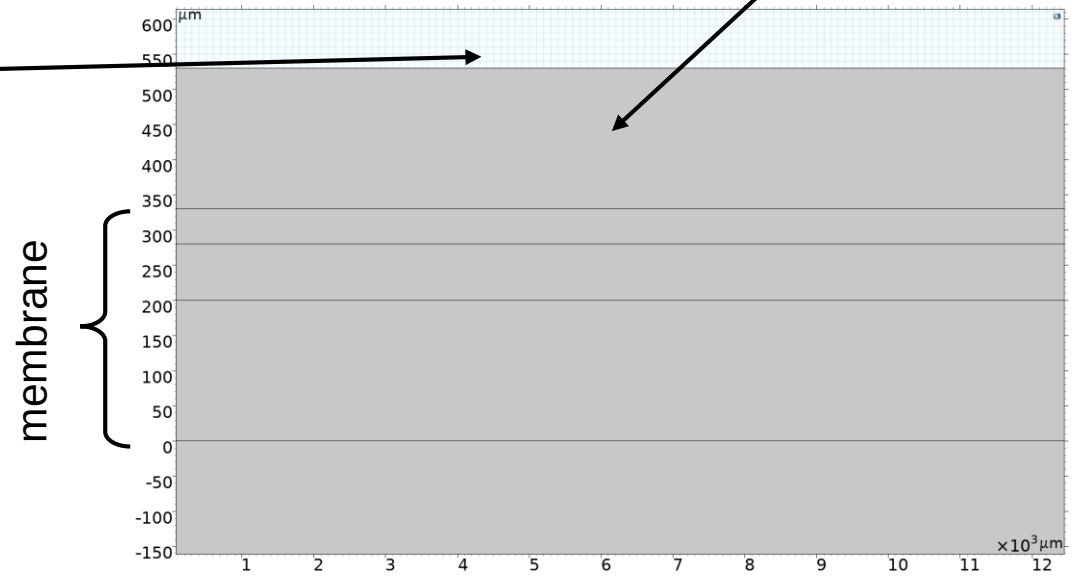


Figure 3 Strat-M membrane, 25 mm in diameter

Model in COMSOL – geometry: 2D axisymmetric





- Three rectangles = membrane
- Formulation geometry = either absent (constant concentration boundary condition) or add another rectangle on top

Figure 4 Model geometry in milimetre

Receptor compartment of Franz diffusion cell

Parameter estimation study in COMSOL

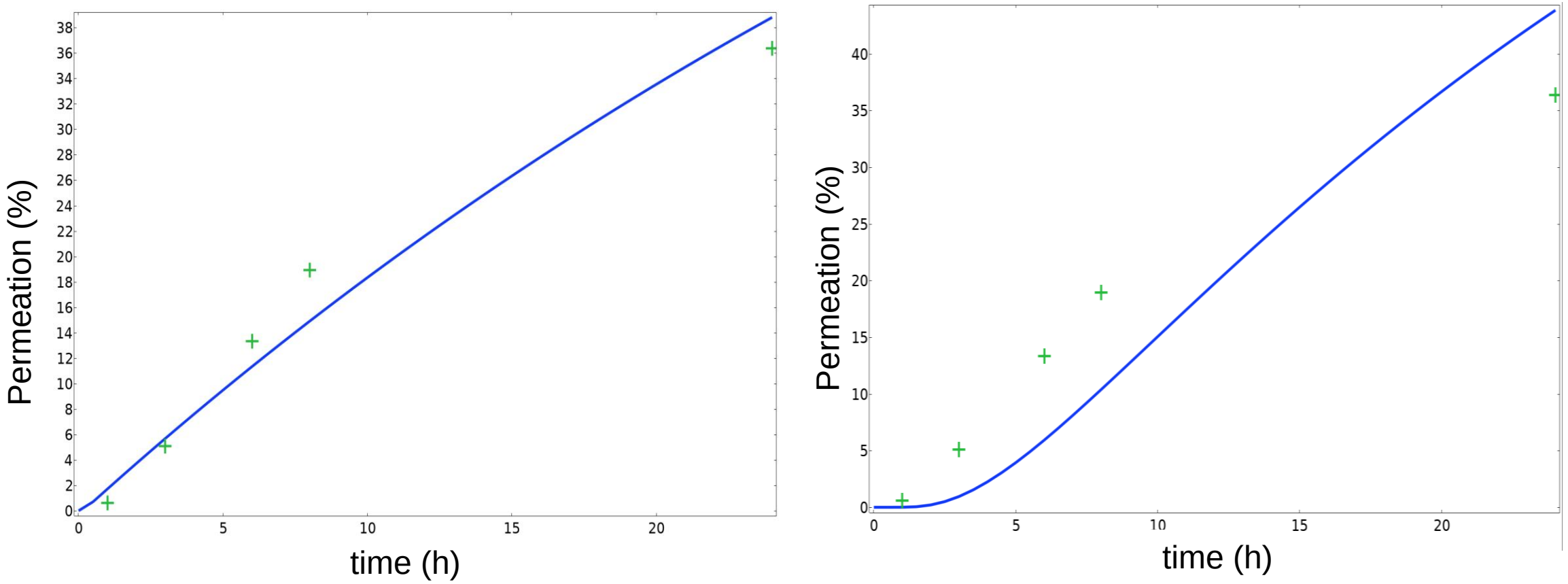
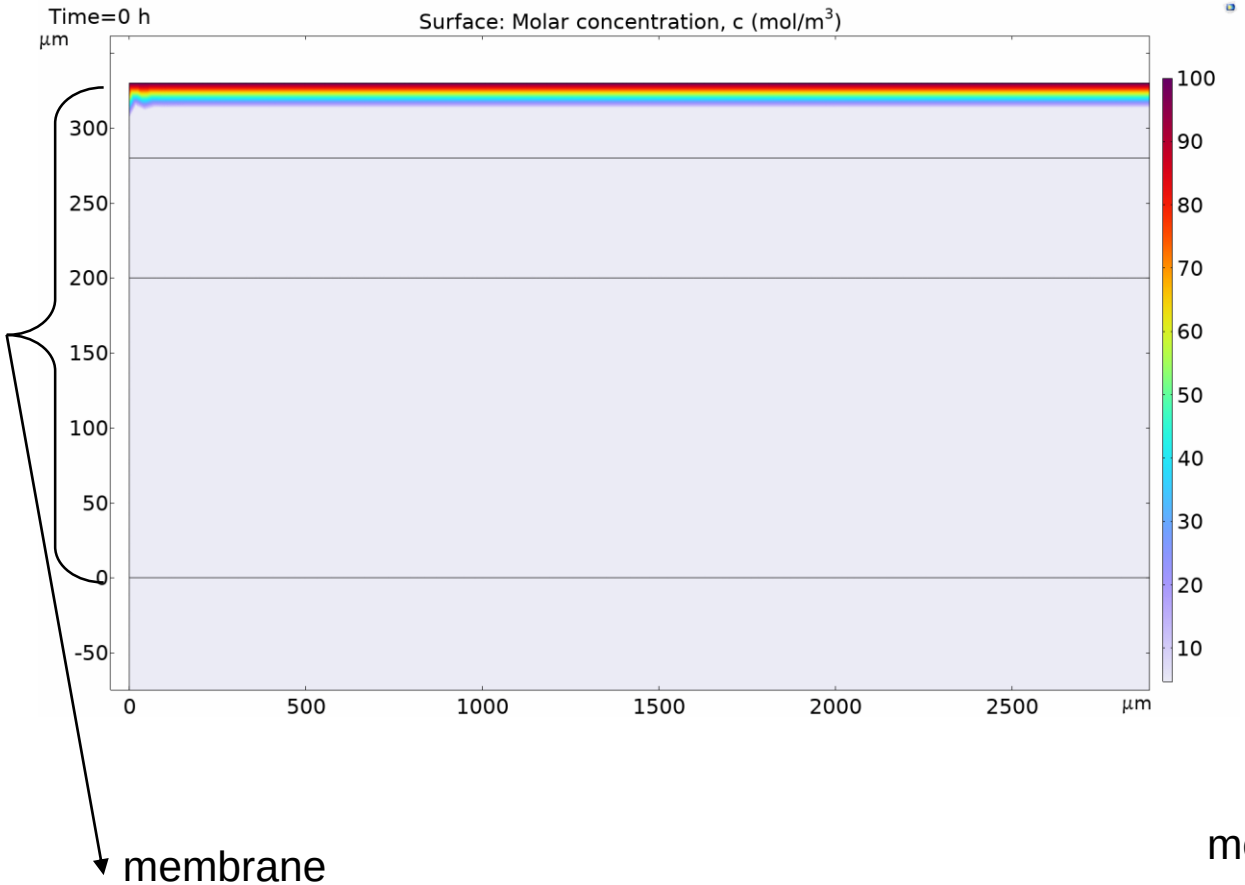


Figure 5 Permeation profile for constant concentration condition (left) and for initial finite concentration in donor compartment (right). Blue line – model data. Green crosses – experimental data from literature (https://doi.org/10.3390/pharmaceutics17070921)

Estimated parameter: diffusion coefficient $D = 3.90 \cdot 10^{-11}$ m^2/s (left), $D = 1.21 \cdot 10^{-12}$ m^2/s (right)

2D concentration profile in membrane



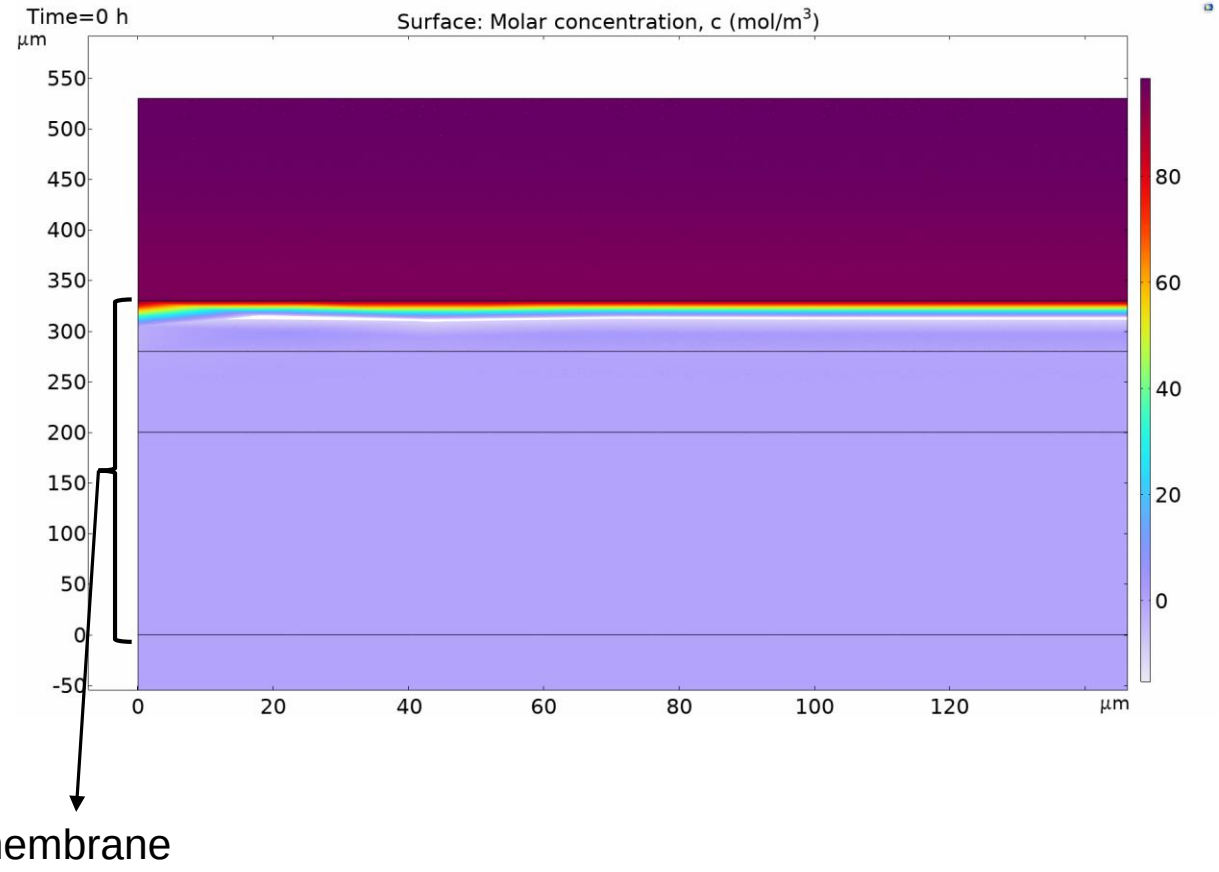


Figure 6 Concentration profile in membrane animation for constant concentration boundary condition (left) and for finite initial concentration in donor compartment (right)

1D membrane concentration profile

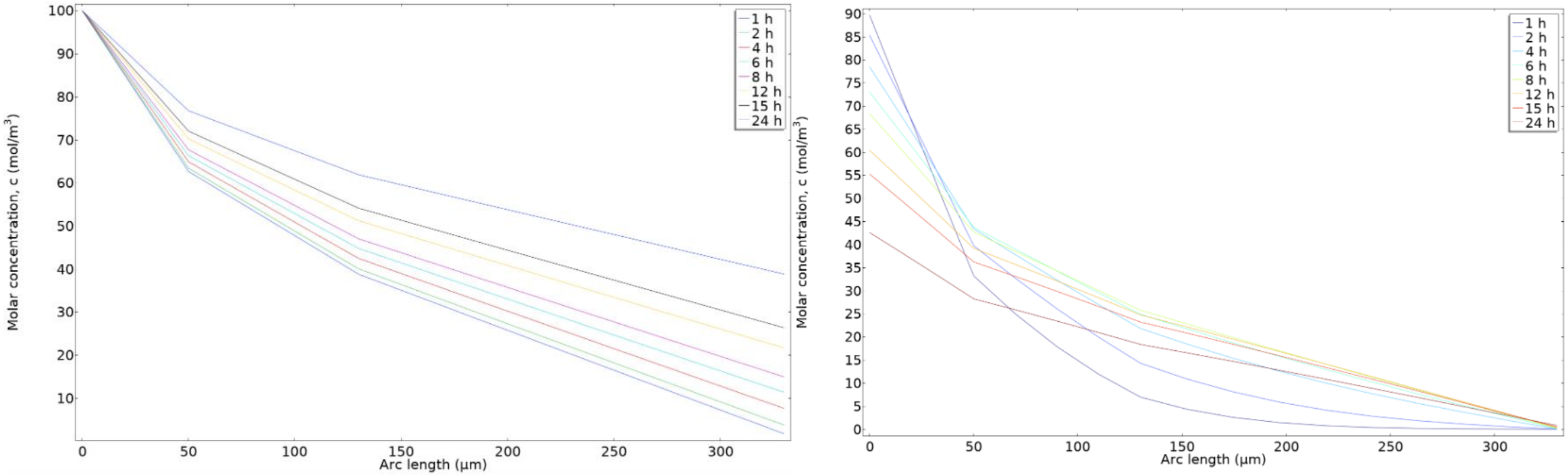


Figure 7 Concentratin profiles in membrane – constant concentration (left), finite concentration donor compartment (right) for some selected times. This profile was derived from data on previous page using COMSOL results tool Cut Line