Supporting information

SI #1. *Estimation of boundary layer thickness and time for boundary layer development*

From laminar boundary layer theory,[1] using an average mass transfer coefficient of 0.023 cm/min obtained from the fitting procedure, we can construct the following correlation for the mass transfer coefficient:

$$k_{\mathrm{m}} = 7.03\left(\frac{D^2 Q}{h^2 d^2}\right)^{\frac{1}{3}}. \tag{S1}$$

Here, h = 640 μm and d = 1.1 cm are the depth and diameter, respectively, of the QCM-D device, D is the diffusivity of MBP equal to 3.5 x 10^{-11} m^2/s,[2] and Q = 400 μl/s is the volumetric flow rate through the QCM-D chamber. The approximate concentration boundary layer thickness, δ_{m}, is [1]

$$\delta_m \sim \frac{D}{k_m} = 0.142\left(\frac{h^2 d^2 D}{Q}\right)^{\frac{1}{3}}. \tag{S2}$$

For the parameters above, the boundary thickness is about 9 μm. The characteristic time for diffusion of MBP over 9 μm is $\delta_m^2 / D \approx$ 2.3 seconds, which is extremely short compared to the kinetic time scales being examined in the QCM-D experiments.

SI #2. ***Non-dimensionalized equations with fitting parameters***

Equations

Using $\underline{C}_{\mathrm{C}}^{*} = \frac{C_{\mathrm{C}}}{C_{\mathrm{ch}}}$, $\underline{C}_{\mathrm{D}}^{*} = \frac{C_{\mathrm{D}}}{C_{\mathrm{ch}}}$ and $\underline{t}^{*} = \frac{t}{t_{\mathrm{ch}}}$, we get

$$\frac{d\underline{C}_{\mathrm{C}}}{d\underline{t}} = \alpha\beta\left(\frac{\gamma\theta_{\mathrm{f}} - \underline{C}_{\mathrm{C}}}{\alpha + \theta_{\mathrm{f}}}\right) - \delta\underline{C}_{\mathrm{C}}. \qquad (7')$$

$$\frac{d\underline{C}_{\mathrm{D}}}{d\underline{t}} = \delta\underline{C}_{\mathrm{C}} \qquad (8')$$

$$\underline{C}_{\theta} = \underline{C}_{\mathrm{C}} + \underline{C}_{\mathrm{D}} \qquad (9')$$

$$\theta_{\mathrm{f}} = 1 - \frac{C_{\mathrm{ch}}}{C_{\mathrm{Csat}}}\underline{C}_{\mathrm{C}} - \frac{C_{\mathrm{ch}}}{C_{\mathrm{Dsat}}}\underline{C}_{\mathrm{D}} \qquad (3')$$

Fitting Parameters

$$\alpha = \frac{k_{\mathrm{m}}}{k_{1}}$$

$$\beta = k_{-1}t_{\mathrm{ch}}$$

$$\gamma = \frac{k_{1}C_{\mathrm{A0}}}{k_{-1}C_{\mathrm{ch}}}$$

$$\delta = k_{2}t_{\mathrm{ch}}$$

SI #3. Raw QCM data

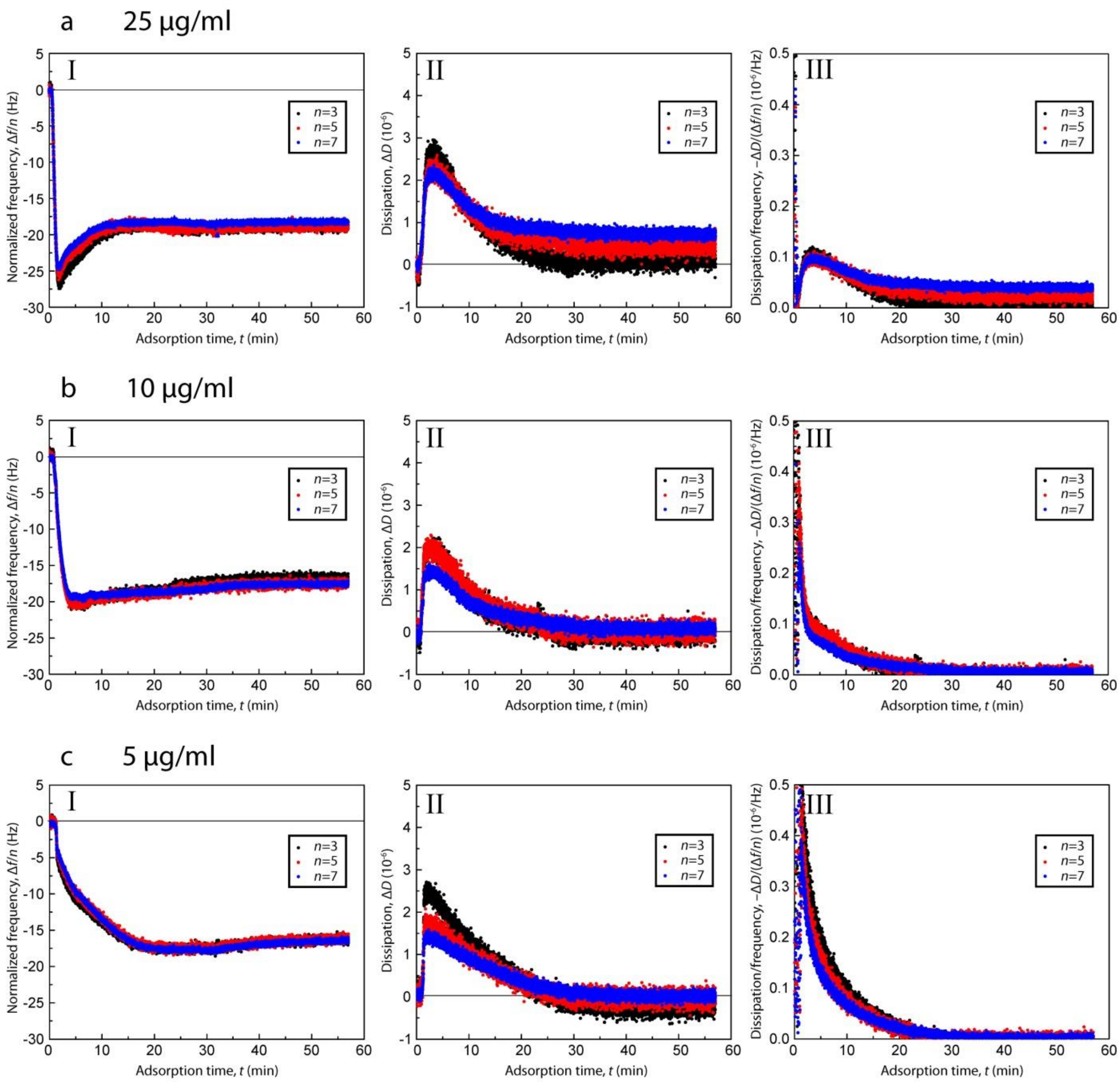

Figure S1. Series of raw QCM-D data at MBP concentrations of (a) 25 μg/ml, (b) 10 μg/ml, and (c) 5 μg/ml. (I) Normalized frequency shift, $\Delta f/n$, (II) Dissipation, ΔD, and (III) ratio between frequency and dissipation, $\Delta D/(\Delta f/n)$, have been shown. *n* indicates overtone numbers.

SI references

1. Leal, L. G., *Advanced Transport Phenomena: Fluid Mechanics and Convective Transport Processes*. Cambridge University Press: New York, 2007.

2. Stadler, A. M.; Stingaciu, L.; Radulescu, A.; Holderer, O.; Monkenbusch, M.; Biehl, R.; Richter, D., Internal Nanosecond Dynamics in the Intrinsically Disordered Myelin Basic Protein. *Journal of the American Chemical Society* **2014,** 136, (19), 6987-6994.