

Supporting information

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Calculation PFS encapsulation

The extinction coefficient, ϵ , of the PFS anions at $\lambda=280$ nm was calculated by measuring the UV-VIS absorbance of several samples of PFS polyanions dissolved in MQ of known concentrations. Since the law of Lambert-Beer states: $A=\epsilon cd$, where A stands for absorption, c for concentration and d for the pathlength of the cuvet. The extinction coefficient could thus be calculated.

$$\begin{array}{l} A_{280(PFS)} = \epsilon_{PFS} c_{PFS} d \\ A_{280(CP)} = \epsilon_{CP} c_{CP} d \\ \epsilon_{PFS} = 2189 \\ \epsilon_{CP} = 24075 \\ \frac{A_{280(PFS)}}{A_{450(PFS)}} = 11.67 \\ \frac{A_{280(PFS)} + A_{280(CP)}}{A_{450(PFS)}} = 20 \\ \frac{A_{280(PFS)}}{A_{450(PFS)}} + \frac{A_{280(CP)}}{A_{450(PFS)}} = 20 \\ \frac{A_{280(CP)}}{A_{450(PFS)}} = 8.33 \\ A_{280(CP)} = 8.33 \cdot A_{450(PFS)} \\ A_{280(CP)} = 8.33 \frac{A_{280(PFS)}}{11.67} \\ 1.4 A_{280(CP)} = A_{280(PFS)} \\ 1.4 \epsilon_{CP} c_{CP} d = \epsilon_{PFS} c_{PFS} d \\ 15.4 c_{CP} = c_{PFS} \end{array}$$

There are 15.4 monomeric PFS units per capsid protein and 924 per T=1 particle. 7200 monomeric units were initially added, so 12.8% of the added PFS is encapsulated.

The concentration of PFS inside the T=1 capsids is approximately 330 times higher than the expected concentration when the PFS polyanions would be randomly distributed over the entire solution (C_{PFS}). The concentration of PFS inside the T=1 particles ($C_{PFS_T=1}$) is the number of moles of PFS inside the T=1 particles ($n_{PFS_T=1}$) divided by the total interior volume of all T=1 particles ($V_{PFS_T=1}$). Here $n_{PFS_T=1}$ is the number of moles of PFS added times the percentage that is encapsulated (12.8%). The total interior volume can be calculated by multiplying the number of T=1 particles in solution ($\#_{T=1}$), with the approximated interior volume of one T=1 particle ($V_{T=1}$). The interior volume is approximated by regarding the interior as a perfect sphere and assuming that the capsid wall thickness is the same as it is for the T=3 particles i.e. 10 nm, which leads to a capsid interior radius of 4 nm.

$$V_{T=1} = \frac{4\pi r^3}{3} = 2.68 \cdot 10^{-22} L$$

$$\#_{T=1} = \frac{C_{CP}}{60} N_A = 1.44 \cdot 10^{18}$$

$$V_{PFS_T=1} = V_{T=1} \cdot \#_{T=1} = 3.87 \cdot 10^{-4} L$$

$$n_{PFS_T=1} = n_{PFS} \cdot \%_{encapsulated} = 7.39 \cdot 10^{-6} mol$$

$$C_{PFS_T=1} = \frac{n_{PFS_T=1}}{V_{PFS_T=1}} = 1.91 \cdot 10^{-2} M$$

$$C_{PFS} = 5.76 \cdot 10^{-5}$$

$$Concentration_factor = \frac{C_{PFS_T=1}}{C_{PFS}} = 331$$

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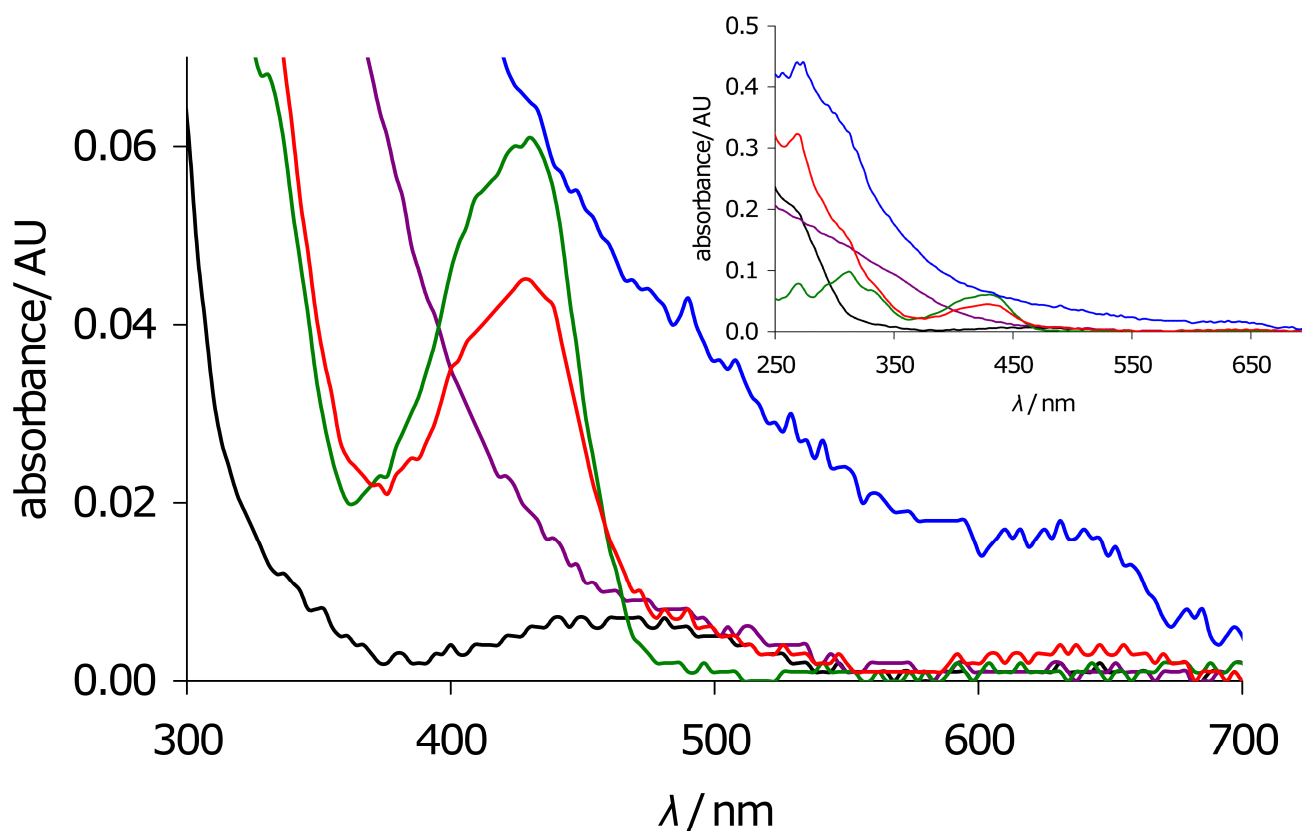


Fig. 1 UV-Vis absorbance spectra of PFS loaded capsids (black line), FeCl₃ (purple line), PFS loaded capsids oxidized with FeCl₃ (blue line), (NH₄)₃[Fe(CN)₆] (green line) and PFS loaded capsids oxidized with (NH₄)₃[Fe(CN)₆] (red line). Inset:

5 Oxidized PFS has a small absorption band at $\lambda=640$ nm. When the PFS loaded capsids are oxidized with FeCl₃, the absorption at $\lambda=640$ nm is larger than when the PFS loaded capsids are oxidized with (NH₄)₃[Fe(CN)₆]. This indicates that (NH₄)₃[Fe(CN)₆] is not as effective in oxidizing the PFS, as FeCl₃.

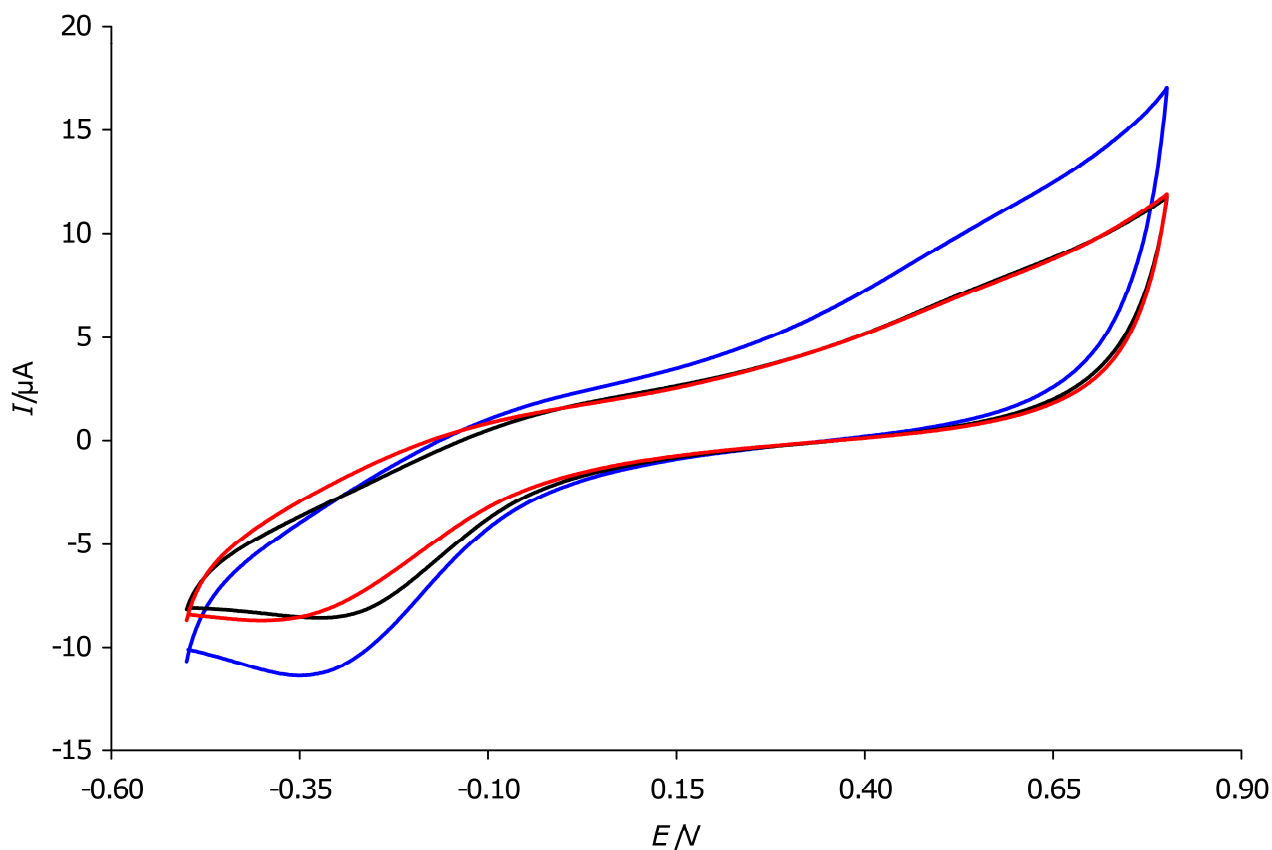


Fig 2. CV diagrams. Blue line: buffer, black line: free PSS in solution, red line: PSS loaded capsids.

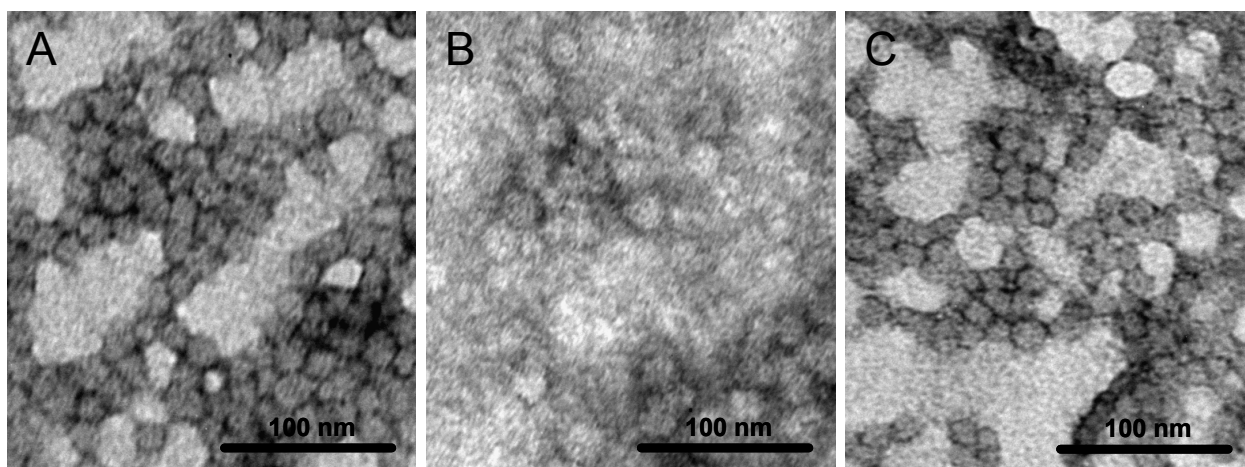


Fig 3. TEM micrographs of the uranyl acetate stained PFS loaded capsids during the CV experiment. Grids were prepared by quickly dipping the grid into the solution containing the PFS polyanions A) PFS loaded capsids before oxidation and reduction cycle B) PFS loaded capsids after first oxidation. C) PFS loaded capsids after first oxidation and reduction.