

Experimental report

11/02/2025

Proposal: 9-13-1059

Council: 10/2022

Title: Characterisation of the effects of osmotic stresses on the structure of hepatitis B virus (HBV) capsids using SANS with contrast variation

Research area: Soft condensed matter

This proposal is a new proposal

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Samples: partially-deuterated polyethylene glycol (dPEG)
hepatitis B virus (HBV) capsids

Instrument	Requested days	Allocated days	From	To
D22	1	1	26/05/2023	27/05/2023

Abstract:

Packaging and release of genetic material is one of the most crucial steps in hepatitis B virus (HBV) replication cycle. In particular it is pivotal to understand how the capsid enclosing genetic material assembles and disassembles during this process. To access these information conventional methods (e.g. mass spectrometry or electron microscopy) fails since it is not possible to introduce the required osmotic stresses to initiate disassembly. Here we propose a method based on the small-angle neutron scattering and contrast variation we recently introduced to study the elastic moduli of soft colloids with dimensions of few hundreds of nanometers [J. E. Houston et al. Science Advances 8: eabn6129 (2022)]. Using partially-deuterated PEG contrast matched in pure D₂O, we plan to directly measure the form factors of viral capsid under different exerted osmotic stresses. Furthermore, we want to explore the effects of different osmotic stress on the fully assembled viral capsid and its intermediate states. Our approach will open up for studies of self-assembly pathway without necessity of performing time-resolved measurements.

Report on experiment 9-13-1059

The experiment aimed to investigate the structural properties of ferritin under osmotic stress. The data collected without applying external pressure were fitted using the core-shell model in SasView, Fig. 1. While the fit quality is not ideal and shows signs of sample aggregation, the overall parameters are consistent with the expected dimensions of the ferritin structure. Further analysis or experiments will be required to improve the fit and assess the impact of osmotic stress on ferritin. The data are currently part of a manuscript we are working on and we plan further experiments to test different condition of osmotic stress to see how they affect the structure of the ferritin.

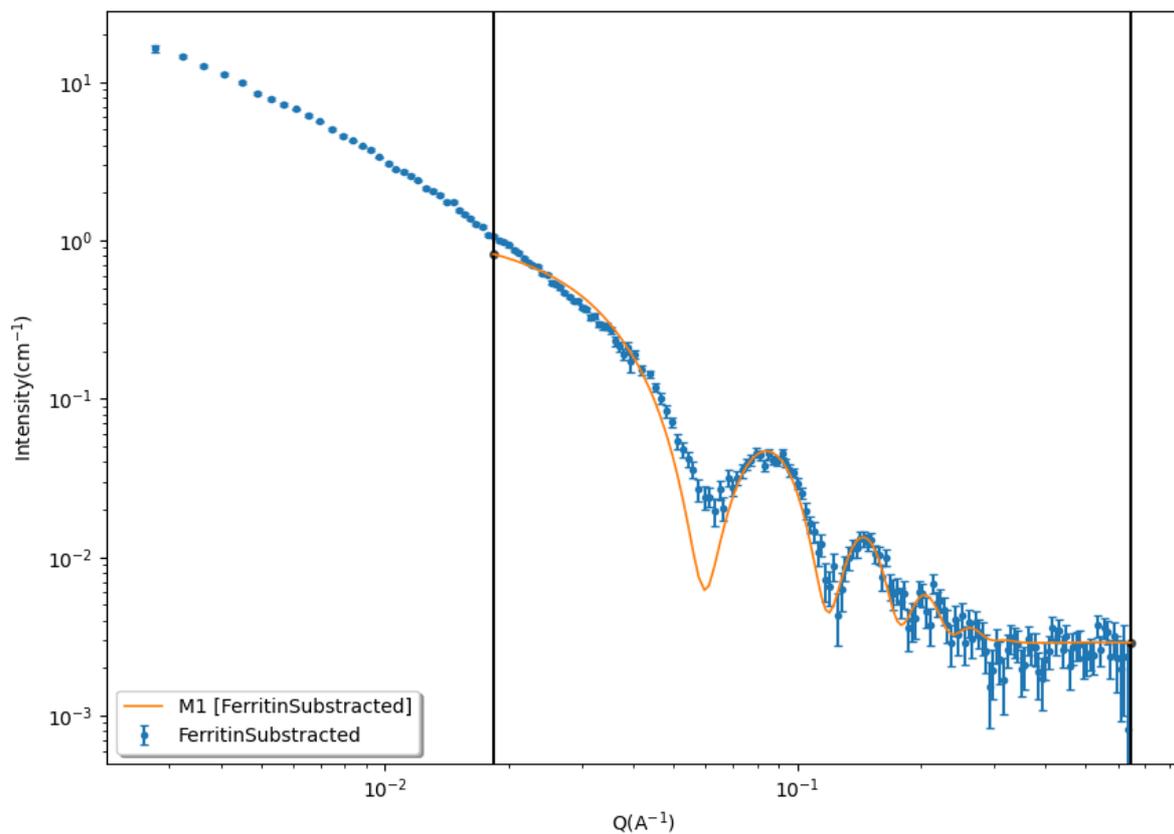


Fig. 1 Form factor of ferritin capsid assembled under an osmotic pressure of 10kPa exerted by partially deuterated PEG contrast matched in pure D₂O.