Small angle neutron scattering study of globular proteins confined in porous carbons

Balázs Nagy, Ajna Tóth, Irina Savina, Sergey Mikhalovsky, Lyuba Mikhalovska, Isabelle Grillo, Erik Geissler, Krisztina László

School of Engineering

Abstract

This article reports measurements of the concentration distribution of two model proteins adsorbed from aqueous solution by two different high surface area carbons, using small angle neutron and X-ray scattering (SANS and SAXS). The proteins investigated were bovine serum albumin (67 kDa), and bovine pancreatic trypsin inhibitor (BPTI), also known under the name aprotinin (6.5 kDa). The two carbon substrates were C1, an open structured carbon aerogel derived from a resorcinol-formaldehyde polymer aerogel, and C2, a commercial nanoporous carbon from MAST Carbon (UK). Although both C1 and C2 possess a high proportion of pores that are either closed or inaccessible to low temperature nitrogen vapour, the size distribution of the accessible pores is broad enough to accommodate BSA molecules. In C1, which is hydrophobic, the BSA molecules migrate individually into pores that are compatible with their size, whereas BPTI forms clusters having the same size as BSA. With C2, the hydrophilic internal surface limits the adsorption efficiency. The strong adhesion of proteins to hydrophilic surfaces prevents diffusion of either molecule into the micro- and nanopores. In this sample both BSA and BPTI form large clusters. These observations have relevance to biomedical applications, such as haemoperfusion or as a medium for protein storage.

Original language	English
Pages (from-to)	142-151
Number of pages	10
Journal	Carbon
Volume	106
State	Published - Sep 1 2016

Nagy, B., Tóth, A., Savina, I., Mikhalovsky, S., Mikhalovska, L., Grillo, I., ... László, K. (2016). Small angle neutron scattering study of globular proteins confined in porous carbons. *Carbon*, *106*, 142-151. DOI: 10.1016/j.carbon.2016.04.081