Hydration shells exchange charge with their protein

Hydration shells exchange charge with their protein

Investigation of the interaction between a protein and its hydration shells is an experimental and theoretical challenge. Here, we used ultrasonic pressure waves in aqueous solutions of a protein to explore the conformational states of the protein and its interaction with its hydration shells. In our experiments, the amplitude of an ultrasonic pressure wave is gradually increased (0–20 atm) while we simultaneously measure the Raman spectra from the hydrated protein (β-lactoglobulin and lysozyme). We detected two types of spectral changes: first, up to 70% increase in the intensity of the fluorescence background of the Raman spectrum with a typical relaxation time of 30–45 min. Second, we detect changes in the vibrational Raman spectra. To clarify these results we conducted similar experiments with aqueous solutions of amino acids and ethanol. These experiments led us to conclude that, without the presence of an ultrasonic pressure, a protein and its hydration shells are in thermodynamic and charge equilibrium, i.e. a protein and its hydration shells exchange charges. The ultrasonic wave disrupts these equilibria which are regained within 30–45 min after the ultrasonic pressure is shut off.

General information
State: Published
Organisations: Department of Physics, Nano-Microstructures in Materials, Materials Research Division, Risø National Laboratory for Sustainable Energy, Biophysics and Fluids, Aquaporin A/S
Contributors: Abitan, H., Lindgård, P., Nielsen, B. G., Larsen, M., Bohr, H.
Pages: 365102
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Journal of Physics: Condensed Matter
Volume: 22
Issue number: 36
ISSN (Print): 0953-8984
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.37 SJR 0.875 SNIP 0.921
Web of Science (2017): Impact factor 2.617
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.89 SJR 1.553 SNIP 0.91
Web of Science (2016): Impact factor 2.678
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.65 SJR 1.043 SNIP 0.889
Web of Science (2015): Impact factor 2.209
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.99 SJR 1.284 SNIP 0.987
Web of Science (2014): Impact factor 2.346
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.11 SJR 1.326 SNIP 1.022
Web of Science (2013): Impact factor 2.223
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.33 SJR 1.688 SNIP 1.168
Web of Science (2012): Impact factor 2.355
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1