Small Angle X-ray Scattering and Fluorescence Spectroscopy of Lanthanide Binding Peptide Complexes

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Lanthanide binding peptides are of great interest as structural probes in biological systems as they combine the luminescent properties of lanthanide ions with the biological selectivity of peptide scaffolds [1]. Peptides that demonstrate selective binding of lanthanides may also be of interest for separations [2]. However, in order to design peptides that effectively and selectively bind lanthanides it is necessary to better understand the complexation process. Therefore a simple model system of three diastereomers of tetraglutamic acid was chosen for investigation. In order to harness the luminescent properties of the lanthanide ions for investigation of the peptide-lanthanide complexation process, 1,8-naphthalimide was attached to these peptides as a sensitizing antenna [3].

Luminescence titrations with europium (Eu) in HEPES buffer and water were performed and showed that the three diastereotopic tetrapeptides demonstrated different binding behaviours. Also, in some cases, complex formation was dependent on the media in which the reaction was performed. Small-angle x-ray scattering (SAXS) of these peptide:Eu complexes at the Australian Synchrotron showed that the kinetics of complex formation was very fast and that at ~0.1mg/mL concentrations large aggregates were formed that were subject to radiation damage. Decreasing the concentration tenfold allowed SAXS data to be collected for the 1:1 peptide:Eu complex for all three tetrapeptides. This result shows the importance of synchrotron radiation for measurement of dilute samples as this data could not have been collected without the high flux of the synchrotron SAXS instrument.

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