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Physical insights into self-assembly of enzymatic protein particles using Small-Angle X-ray Scattering (SAXS)

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Assembled protein particles are emerging as advanced protein biomaterials with significant impact in areas of vaccine development, biocatalysis, drug delivery and biosensing. To date, assembled protein particles primarily serve as scaffold to tether functional entities for various applications. Since they lack inherent functional properties, subsequent functionalisation of protein particles is essential. In this work, we present a simple approach using self-assembling peptides to form particles of protein of interest in the presence of stimuli.[1] We demonstrate this by a model protein-peptide module using enzyme bovine carbonic anhydrase (BCA) fused with self-assembling peptide (P114) via GS-linker and expressed in E. coli. The BCA-P114 self-assembles into particles in response to two different stimuli i.e., pH and magnesium ions. Through dynamic light scattering we showed that BCA-P114 particles form spontaneously, and particle size can be controlled with the extent of stimuli.[2] Using SAXS (SAXS/WAXS beamline at the Australian Synchrotron), we studied the self-assembly kinetics and the timescales of BCA-P114 particle formation using magnesium ions as stimuli. The SAXS analysis of particle formation kinetics exhibited the particle formation to occurs within 10 secs of exposure to magnesium ions. Furthermore, the structure and function of BCA-P114 particle were confirmed by transmission electron microscopy and enzyme assay respectively. Our self-assembling strategy provides a platform for the spontaneous formation and customisation of particles of desired functional protein.[3] This platform technology will open-up new opportunities to adapt functional proteins into particles for use as advanced biomaterial.

Level of Expertise

Early Career <5 Years

Presenter Gender

Woman

Pronouns

Which facility did you use for your research

Australian Synchrotron

Students Only - Are you interested in AINSE student funding

No

Do you wish to take part in the Student Poster Slam

No

Condition of submission

Yes

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