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Marine Biodiversity and Ecosystems

Mussel Protein-Based Biomaterial Design: Overcoming the Yield Challenge of Mussel Adhesive Proteins

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Venue: Auditorium, 1st Floor,
Interdisciplinary Research Building
跨領域科技研究大樓1樓演講廳
Host: Dr. Benny K. K. Chan 陳國勤研究員

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Abstract

Mussel foot proteins (MFPs) hold immense potential for various applications, but their low natural production yield poses a significant challenge. Advanced recombinant techniques can improve production efficiency but often lack the essential mussel adhesion chemical signature, 3,4-Dihydroxyphenylalanine (DOPA). To address this limitation, we employed amino acid labeling and mass spectrometry techniques to identify the configuration of mussel foot proteins adsorbed on a solid substrate, focusing on the labeling profiles of modified lysine (Lys) and arginine (Arg). Our findings detail the binding sequence between the mussel adhesive and a solid surface, analyzed using a quartz crystal microbalance (QCM). This study can potentially benefit the development of accurate and efficient mussel protein-inspired sequences for designing wet adhesive polymers for specific surfaces.

Additionally, we synthesized MFP nanoparticles through spray-drying and assessed their adhesion on surfaces with varying hydrophobicity. Nanoparticle-based adhesives offer enhanced adhesion on solid surfaces and can further increase adhesive ability due to the enhanced cohesion when metal ions play a role.

These results provide insights into the molecular-level binding mechanism of MFP adhesives, offering a solution to the low production yield challenge and potential for enhancing bioadhesive materials.