EURADH 2021
13th European Adhesion Conference
11-14 October 2021

BIOAD / Bioadhesion

● Design and investigation of proteins inspired by natural adhesive matrices

A. Benabdi, C. Vendrely, C. Picot
Cy Cergy Paris Univ., Cergy (FR)

Abstract content

Design and investigation of proteins inspired by natural adhesive matrices Amel Benabdi[1], Andrey Zaytsev[1], Naïma Ahmed Omar[1], RémyAgniel[1], Marianne Weidenhaupt[2], Franz Bruckert[2], Olivier Gallet[1], Cédric R. Picot[1], Charlotte Vendrely[1,2] Sessile organisms can adhere to diverse surfaces underwater. Among them, barnacles secrete an adhesive matrix, named cement, composed of proteins which are able to self-assemble into fibers to successfully achieve the adhesion under immersed environments [1]. The self-assembly of proteins is thought to be responsible of the adhesion mechanism. The proteins forming the adhesive matrix of the barnacle *Megabalanus rosa* have been previously identified, sequenced and named Mrcp [2]. Mrcp19k sequence are particularly rich in repetitions [3]. In our study, we designed by genetic engineering two recombinant proteins of different lengths according to the repeated part of Mrcp19k protein in order to mimic a natural cement protein of *Megabalanus rosa*. We investigated the self-assembly of these recombinant proteins in different conditions (pH, salt, contact surfaces). Our results show that they are able to form fibers at acidic pH on hydrophobic and hydrophilic surfaces. The nanoscale morphology and the secondary structure of the recombinant proteins under soluble and assembled states have been characterized by atomic force microscopy and circular dichroism. And we show that, depending on the conditions, proteins are able to self-assemble into different kind of fibers rich in β-sheet structures. In addition, using surface plasmon resonance, we show that the recombinant proteins adsorbs on a hydrophobic surface. The self-assembly behavior of the recombinant proteins suggests a specific role of the natural protein in barnacle adhesive matrix formation.

References

[1] Kamino K. Mar Biotechnol. 2008 Mar-Apr; 10(2):111-21. [2] Kamino K. Biofouling. 2013; 29(6):735-49. [3] Urushida Y, et al. FEBS J. 2007 Aug; 274(16):4336-46.