Flanking lysine controls the balance between surface adhesion and cohesion in underwater adhesion system of marine mussel

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Dopa has been considered as the key molecule in underwater adhesion. In spite of intensive studies, we still have a little understanding about how mussel controls the balance between surface adhesion and cohesion which is critical feature for successful adhesion. In this work, we focused on lysine (Lys) which has acquired less attention compared to Dopa. We designed peptides inspired by mussel adhesive protein (MAP) to investigate how Lys affects underwater adhesion with respect to the distance between Dopa and Lys. Nano-scale surface adhesion and cohesion forces were measured using surface forces apparatus (SFA) with the designed peptides, and NMR analysis were performed to explain its phenomenon. We also redesigned two biased proteins from MAP and biosynthesized in bacterial expression system. Sequentially, same nanomechanic measurements were performed to confirm our findings from the peptide study. We expect this study could explain how nature assigns the roles of Dopa in underwater adhesion of marine mussel, and could also give insights in designing biomaterials exploit catechols for underwater adhesion.