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Rationally Designed Random Heteropolymer Surfactants for the Encapsulation and Stabilization of Proteins in Organic Solvents BRIAN PANGANIBAN, University of California, Berkeley, BAOFU QIAO, Northwestern University, MONA OBADIA, Université Claude Bernard Lyon 1, MONICA OLVERA DE LA CRUZ, Northwestern University, ERIC DROCKENMULLER, Université Claude Bernard Lyon 1, TING XU, University of California, Berkeley — Stabilizing proteins in organic solvents can provide opportunities to overcome challenges in many areas, such as biosynthetic catalysis of hydrophobic substrates and biomimetic materials. Reverse micelles have been used to encapsulate proteins in organic solvents; however, currently-used small molecule surfactants are insufficient in both stabilizing native protein conformation and allowing for the retention of inherent protein functionality for extended periods of time. These surfactants are often quite dynamic and cannot completely suppress organic solvent penetration, resulting in protein denaturation. To address this pitfall, we report a new class of random heteropolymer surfactants that anchor to the protein surface through multiple non-covalent, complimentary interactions. These newly designed polymeric surfactants can effectively increase the retention of activity of several proteins in organic solvent in comparison to both a small molecule surfactant and an amphiphilic diblock copolymer. The modularity of this design process has the potential to be translated to a variety of proteins that can provide an enhanced platform for applications that include molecular recognition, catalysis, nanoscale assemblies, and medical therapeutics.

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