Title:	Surfactin-Laden Aqueous–Liquid Crystal Interface Enabled Identification of Secondary Structure of Proteins
Authors:	Verma, I. (/jspui/browse?type=author&value=Verma%2C+I.) Valsala, Selvakumar S.L. (/jspui/browse?type=author&value=Valsala%2C+Selvakumar+S.L.) Pal, S.K. (/jspui/browse?type=author&value=Pal%2C+S.K.)
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Abstract:	The development of stimuli-responsive biomimetic systems to understand interactions between proteins and surfaces is of an increasingly important scientific interest due to its potential applications in diagnostics and fundamental biological research. In this study, we report a simple and label-free method utilizing interfacial properties of liquid crystals (LCs), mediated by self-assembly of a naturally occurring cyclic lipopeptide, surfactin (SFN). We demonstrated that SFN molecules promote the homeotropic alignment of LC at the LC–aqueous interface giving rise to dark optical appearances under cross polars. The ordering transition of LC is mainly caused by the lateral hydrophobic interactions between hydrocarbon chains of SFN and LC molecules at the interface. Interestingly, the optical state of LC changed to bright when protein (five proteins studied herein) molecules were in the vicinity of the interface thereby, allowing label-free imaging of protein adsorption at those interfaces. It was further realized that the shapes of bright spatial patterns at the SFN-laden interface, which are formed in the presence of proteins, are directly associated with the native secondary conformations of proteins, i.e., elongated/fibrillar (β-sheet-rich) and globular domains (α-helix-rich). Thus, the designed LC system can also be applied to detect amyloidogenic proteins, mainly involved in neurological disorders. In addition, the LC-based method presents additional advantages over existing spectroscopic/biological techniques such as simple optical readout, high sensitivity (nanomolar concentration regime), and easy sample preparation. We believe that the SFN-decorated LC-based interfaces will open a new avenue to detect other subtle biomolecular interactions at LC–aqueous interfaces.
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