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Poly (L-Lysine)-Coated Liquid Crystal Droplets for Sensitive Detection of DNA and Its Applications in Controlled Release of Drug Molecules

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Abstract : Interactions between DNA and adsorbed Poly (L-lysine) (PLL) on liquid crystal (LC) droplets were investigated using polarizing optical microcopy (POM) and epi-fluorescence microscopy. Earlier, we demonstrated that adsorption of PLL to the LC/aqueous interface resulted in homeotropic orientation of the LC and thus exhibited a radial configuration of the LC confined within the droplets. Subsequent adsorption of DNA (single stranded DNA/double stranded DNA) at PLL coated LC droplets was found to trigger a LC reorientation within the droplets leading to pre-radial/bipolar configuration of those droplets. To our surprise, subsequent exposure of complementary ssDNA (c-ssDNA) to ssDNA/ adsorbed PLL modified LC droplets did not cause the LC reorientation. This is likely due to the formation of polyplexes (DNA-PLL complex) as confirmed by fluorescence microscopy and atomic force microscopy. In addition, dsDNA adsorbed PLL droplets have been found to be effectively used to displace (controlled release) propidium iodide (a model drug) encapsulated within dsDNA over time. These observations suggest the potential for a label free droplet based LC detection system that can respond to DNA and may provide a simple method to develop DNA-based drug nano-carriers.

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