233f Bioactive Surfaces Based on Aldehyde-Containing Reactive Polymer Coatings

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The design of surfaces that are biologically active offers a new dimension to the development of advanced materials. The exploration of such surfaces has enabled the creation of biologically relevant micro-environments for studying cell-cell communication, cell adhesion, pathogen-cell interactions, providing routes for tissue engineering, patterning of proteins, DNA and saccharides. However, a versatile immobilization platform is essential for the successful fabrication of biologically active surfaces. The biomolecules should be stable on the surface and the immobilization chemistry should preserve the orientation, conformation, and accessibility of the ligands on the surface. Moreover, the reaction chemistry should have fast reaction kinetics and the linkage should be stable. Our approach to the preparation of biologically active surfaces relies on reactive polymer coatings, which have functional groups for covalent-binding of ligands. Herein, we report the synthesis and characterization of poly[4-formyl-p-xylylene-co-p-xylylene], which is a new member of the family of reactive coatings. The chemical composition of this polymer was confirmed using X-ray photoelectron spectroscopy (XPS) and infrared spectroscopy (IR). We further demonstrated the polymer's usefulness as a reactive coating by immobilizing proteins and oligosaccharides onto the surface, taking advantage of the condensation reaction between a hydrazide moieties and the carbonyl group. Surface patterns were fabricatied via microcontact printing of hydrazide ligands onto the surface of the reactive coating. This method establishes an attractive approach to the immobilization of biomolecules, because it benefits from the rapid kinetics of this reaction and the relative inactivity of both the hydrazide and carbonyl functionalities towards other biomolecules or biological functionalities, such as amines, acids and thiols. Thus, aldehyde-containing reactive coatings establish a promising platform for surface engineering via covalent binding of biomolecules.