Amino Acid-Functionalized Polyelectrolyte Films as Bioactive Surfaces for Cell Adhesion

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Surfaces were prepared with polyelectrolyte derivatives of poly(styrene-alt-maleic anhydride)
(PSMA) functionalized with amino acids of different hydropathy indices, with the aim of evaluating
the effect of the chemical functionality of polyelectrolytes on SH-SY5Y neuroblastoma cell adhesion.
Functionalizing PSMA derivatives with I-glutamine, I-methionine, and I-tyrosine yielded PSMA-GIn,
PSMA-Met, and PSMA-Tyr polyelectrolytes, respectively. We first studied the adsorption behavior of
PSMA functionalized with amino acids on silicon wafer surfaces modified with
3-aminopropyltriethoxysilane at pH 4.0 and 7.0 and at low and high ionic strengths. The highest rate
of polyelectrolyte adsorption was at pH 4.0 and high ionic strength and was higher with the

glutamine and tyrosine films. The advance contact angles (?A) of the polyelectrolyte surfaces

showed a moderate effect of ionic strength and pH on polyelectrolyte film wettability, with PSMA-Tyr

being slightly more hydrophobic. Atomic force microscopy images of the polyelectrolyte surfaces

showed two types of morphology: the well-defined globular nanostructure of PSMA-Met and PSMA-Tyr and densely packed nanofibrous-like structure of PSMA-Gln. The highest level of ionic strength caused a slight decrease in the size of the nanostructure that formed the surface domains, which was reflected in the degree of surface roughness. Cell adhesion assays with the polyelectrolyte film showed that SH-SY5Y neuroblastoma cells cultured on PSMA-Met present a well-extended morphology characterized by a stellate shape, with five or more actin-rich thin processes, whereas SH-SY5Y cells that were seeded on PSMA-Gln and PSMA-Tyr have a round morphology, with fewer and shorter processes. These results indicate that it is possible to modulate the surface characteristics of polyelectrolyte films based on their chemical functionality and environmental parameters such as pH and ionic strength in order to evaluate their effect on cell adhesion. Thus, surfaces prepared from polyelectrolytes functionalized with amino acids are an attractive and simple platform for cell adhesion, which can be used in developing biomaterials with modulated surface properties. © 2019 American Chemical Society.

amino acid

cell adhesion

functionalization

polyelectrolytes

SH-SY5Y neuroblastoma

Amino acids

Atomic force microscopy

Cell adhesion

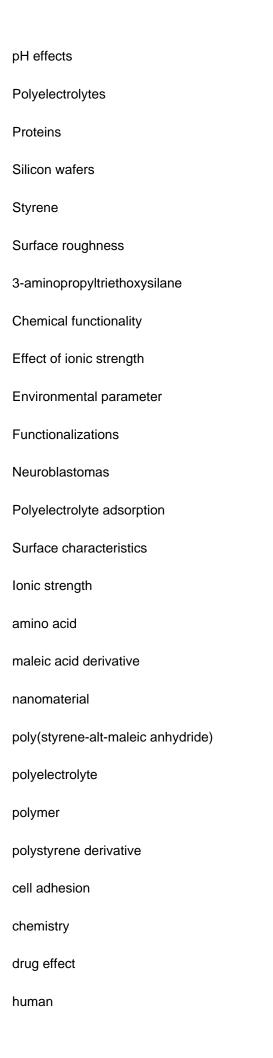
Cells

Crystal atomic structure

Film preparation

Morphology

Nanostructures



infrared spectroscopy
рН
scanning electron microscopy
surface property
tumor cell line
ultrastructure
wettability
Amino Acids
Cell Adhesion
Cell Line, Tumor
Humans
Hydrogen-Ion Concentration
Maleates
Microscopy, Electron, Scanning
Nanostructures
Polyelectrolytes
Polymers
Polystyrenes
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Surface Properties
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