

Differently Charged PEG-Conjugated Catechol Derivatives

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INTRODUCTION: Highly controlled physicochemical surface properties are key factors in the development and optimization of new biomaterials and devices for different fields of applications such as dentistry, surgery and for manufacture of devices that have regular contact with moisture. In recent works L-3,4-dihydroxyphenylalanine (DOPA), a catechol which is believed to be the key molecule in mussel adhesive proteins (MAPs), was attached to monomethoxy-terminated poly(ethylene glycol) (mPEG) for the purpose of rendering surfaces protein resistant. It is being a non-proteinogenic amino acid which carries a negative charge at physiological pH. As at these conditions most metal oxide surfaces are negatively charged as well, electrostatic repulsion effects could impede adsorption processes and decrease the stability of adsorbed molecules. Dalsin et al. [1] observed a multivalency effect by studying peptides containing up to three DOPA residues conjugated to mPEG. We would like to present new single-side derivatives of DOPA connected to PEG and investigate the effect of the molecular charge. Therefore, a neutral, a negatively and a positively charged catecholic derivatives were synthesized and adsorbed on metal oxide surfaces [2].

METHODS: The molecules were investigated in terms of adsorption behavior and subsequent resistance against serum adsorption, using variable angle spectroscopic ellipsometry (VASE), optical waveguide lightmode spectroscopy (OWLS) and X-ray photoelectron spectroscopy (XPS). For polymer adsorption standard conditions were defined as follows: 1 mg/ml resp. 0,1 mg/ml of polymer dissolved in cloud-point buffer, adsorption at 50°C for 4 hours. Adsorptions were done on TiO₂ coated silicon wafers for VASE and XPS experiments and on TiO₂ coated waveguides for OWLS measurements.

RESULTS: Our preliminary results demonstrate that the charge of PEG derivatives has a major influence on polymer adsorption and stability. In order to confirm these observations further results, including long term stability study will be presented.

DISCUSSION & CONCLUSIONS: VASE and OWLS experiments revealed that neutral

and positive charged mPEG-DOPA derivatives show an enhanced adsorption on TiO₂ and lead to a superior protein resistant behavior compared to negative charged mPEG-DOPA₁ used in related work by Dalsin et al. [1].

REFERENCES: ¹ J.L Dalsin, et al (2005) *Langmuir* **21**: 640-646. ² D. Wackerlin (2005) *Biomimetic Surface Modifications with Differently Charged PEG-conjugated Catechol Derivatives*.