Novel screening protocol for wet chemical surface functionalization

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INTRODUCTION: The arising diversity of biomaterials requires custom-made surfaces that offer application-specific properties. Often surface modification is used to ease an assimilation of the bulk material in different environments and prevent degradation[1]. To ensure an adequate surface modification, a firm surface chemistry is needed, which is stable enough to withstand changing conditions over the whole time period. The present work aims on the development of novel binding motifs on the basis of natural adhesives, which shows the extraordinary ability to strongly attach onto various materials[2,3]. The potential adhesion of differently functionalized amino acids should be tested under various conditions and surfaces. The high number of experiments requires a novel screening protocol for effective and simultaneous testing. Therefore a multi-well array was designed and verified with a fluorescence-based read out.

METHODS: The verification of the multi-well array is done by the adsorption of poly (L-lysine)-*grafted*-poly (ethylene glycol) solutions (PLL-*g*-PEG) in HEPES II buffer. The adsorption is then analyzed by microspot ellipsometry (Sentech SE8500, 350-920nm, spot size; <1mm) and/or by the fluorescence microscope (Zeiss Axioscope 2plus).

RESULTS: The designed multi-well array is able to perform simultaneously eighty adsorption experiments, each with a volume of 20µL (Fig. 1). The functionality of the array was tested on glass slides and coated/uncoated silicon wafer, whereas PLL-*g*-PEG served as an adhesion model, to coat and protect the surface. The quality of this adsorption was then verified with a secondary incubation of FITC-fibrinogen, on top of the PLL-g-PEG layer, followed by measuring the fluorescence intensity (Fig. 2). It shows an increasing FITC-fibrinogen adsorption with decreasing PLL-*g*-PEG layer thickness.

Fig. 1: Multi-well array for parallel-adsorption on various surfaces

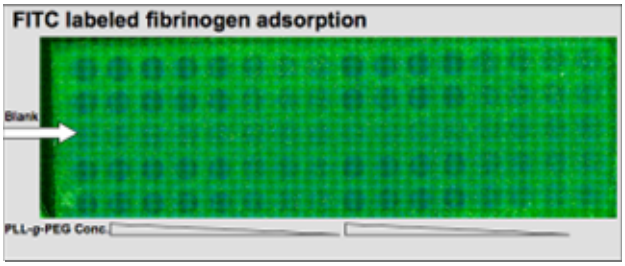

Fig. 2: Fluorescence microscope picture of the multi-well array (SiO_2-surface) after incubation with differently concentrated PLL-g-PEG and FITC labeled fibrinogen solutions.

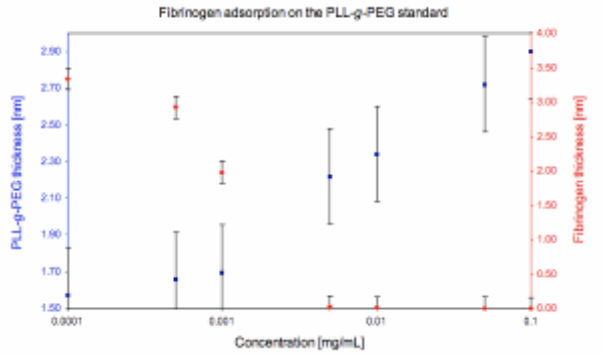

Fig. 3: Measurement of the PLL-g-PEG layer thickness versus the FITC-fibrinogen layer on silicon oxide by microspot ellipsometry

Furthermore the adsorption studies were also confirmed by µspot ellipsometry (Fig. 3).

DISCUSSION & CONCLUSIONS: The fluorescence measurements offer a very fast, semi-quantitative verification of the adsorption properties of different molecules. In addition this data can always be investigated more precisely by µspot ellipsometry, as a secondary method. In the near future new potential adhesive molecules should be linked onto PLL-*g*-PEG and investigated by using the multi-well array.

REFERENCES:

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