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Biomolecular interaction analysis based on a tetraether lipid matrix

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Introduction

Tetraether lipids (TEL) are the main compound of membranes of archaea. The extremophile microorganisms underwent an enormous adaption to extreme conditions in their natural environment concerning temperature, pH and high salt concentrations. We developed biosensor chips on glass slides for Reflectometric Interference Spectroscopy (RIfS) using tetraether lipids as an immobilization matrix to be able to capture molecules such as anti-GST and anti-CRP antibodies or streptavidin. Tetraether lipids promise improved conditions for biomolecular interaction studies concerning stability and handling while shielding the sensor surface from non-specific protein binding.

Methods

Reflectometric Interference Spectroscopy (RIfS) is a specific and robust method for biomolecular interaction analysis. It operates with glass transducers that have a 10 nm Ta_2O_5 interference layer with a 300 nm SiO_2 coating upon which coupling chemistry can be realized. The apparent optical thickness (n x d) of a thin layer is determined by measuring the interference of white light which is directed vertically onto the multiple-layer system where the partial beams are reflected at each phase boundary and refracted. Any change in optical thickness causes a shift in the resulting interference pattern such that monitoring this change over time allows the study of the binding behaviour of the target molecules to be observed.

Results

Ligands like Streptavidin, an anti-GST and an anti-CRP antibody could successfully be attached to the TEL-matrix. In biomolecular interaction studies with the corresponding analytes sensitivity in a nano-molar range could be observed. Due to an efficient blocking method applying a BSA solution highly specific binding events were measured. Furthermore, the sensor surfaces were stable and regenerable so that strategies could be developed to make the sensor reusable.

Conclusion

A versatile sensor platform for RIfS could be established applying evolutionary optimized tetraether lipids. Three highly specific and sensitive affinity tags could be developed with great potential for further chip modifications e.g. His-tag/Ni^{2+}-nitriloacetic acid.

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