

Selective Surface Modification via Oligoethyleneoxide Derivatives

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INTRODUCTION: As a flexible method of forming thin and well-defined organic films on a variety of solid surfaces, self-assembly molecules (SAM's) have attracted increased attention in recent years.¹ The use of alkyl phosphorous acids opens a novel route to build molecular thin films on inorganic metal oxide surfaces.² Especially, substrate materials showing distinct Brønsted-amphoteric properties, like Ti/TiO₂ or Al/Al₂O₃ seem well-suited for this surface modification procedure. By use of a structured solid surface containing TiO₂ and SiO₂, this kind of molecule will selectively adsorb on TiO₂. When the molecule additionally contains a terminal oligoethylene glycol unit, the adsorbed layers avoid unspecific protein adsorption on the substrate.³ By further functionalisation of the oligoethylene glycol, specific surface reactions are possible with biomolecules. For these purposes tailor-made ω-functionalised oligo(ethyleneglycol)alkylphosphates have been synthesised.

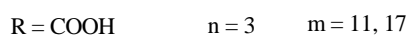
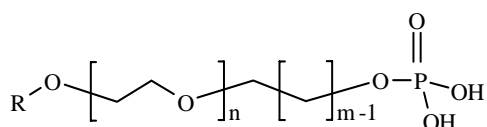


Fig. 1: Structure of the ω-functionalised alkane phosphates

METHODS: Specific synthetic pathways have been developed for the synthesis of these novel molecules. The composition and structure were proved by elemental analysis, IR- and NMR spectroscopy.

For the adsorption freshly cleaned substrates (Al/Al₂O₃, Ti/TiO₂) are immersed in a 1 mmol aqueous solution of the molecules. The change of surface properties is determined by contact angle measurements. Orientation of the molecules is studied by angle-dependent XPS. Kinetics of the adsorption process can be followed by SPR.

RESULTS: The synthesis of these ω-functionalised oligo(ethyleneglycol)alkylphosphoric acid esters requires a multi step procedure. The advantage of

such kind of molecules is their defined structure and chain length. We synthesised molecules with different chain length and functional groups to investigate their variable behaviour during adsorption and surface reactions. Dynamic contact angle measurements revealed that the surface is homogeneously covered by the monolayers. Compared to the bare substrate contact angle hysteresis strongly decreases indicating smooth surfaces. XPS showed that film quality seriously depended on surface roughness.

DISCUSSION & CONCLUSIONS: Defined bifunctional compounds have been designed and synthesised for surface modification of oxide surfaces to avoid unspecific protein adsorption as well as to improve binding of special proteins. We could prove that monomolecular layers of these compounds were formed on Al₂O₃ and TiO₂ surfaces. The behaviour of these films in the presence of proteins will be tested by means of SPR, XPS or QCM. Because the compounds own defined structures and sizes, variation of these properties will influence the interaction with the proteins.

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