

SILANES AND SURFACE ACTIVATION WITH ACTIVE $-NH_2$ GROUPS FOR APPLICATIONS IN BIOSCIENCES

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In the last decade, there has been increasing interest in describing and understanding the exact mechanism(s) involved in surface silanisation, i.e. surface activation on flat [1] and particulate surfaces [2]. Organosilanes are based on the chemical structure $X-(CH_2)_m-SiR_n(OR')_{3-n}$ which can function as coupling agents and are widely used to mediate the introduction of a functional group to an inorganic or organic surface.

Organosilanes react with surface $-OH$ groups (silanol: in the case of silica surfaces) under appropriate conditions (i.e. solvent, reaction time and temperature) to leave the surface covered with a layer of functional groups which can then be used in grafting ligands.

Research to date, has involved establishing the methods and approaches necessary to produce amine functionalised surfaces using silica-magnetite nanoparticles as substrates. Commercially available organosilanes particularly aminopropyl triethoxysilane (APTS), aminopropyl diethoxymethylsilane (APDS) and aminopropyl monoethoxydimethylsilane (APMS) have been used in these experiments. A colorimetric assay has been used and standardized for surface $-NH_2$ density measurement as well as CHN combustion analysis. Initial results indicate that APDS works best in generating $-NH_2$ activated surfaces (up to 8.5 amine molecules/nm²) whilst APMS was poorest in this respect (0.1 amine molecules/nm²). Amine modified silica-magnetite nanoparticles were further used for surface functionalisation to aldehyde for subsequent surface oligonucleotide grafting and hybrid capture of its complimentary fluorescently labelled sequence.

References:

- [1] J. H. Moon, J. W. Shin, S. Y. Kim and J. W. Park, *Langmuir* **12** (1996), 4621-4624
[2] I. J. Bruce, J. Taylor, M. Todd, M. J. Davies, E. Borioni, C. Sangregorio and T. Sen, *Journal of Magnetism and Magnetic Materials* **284** (2004), 145-160.

Figures:

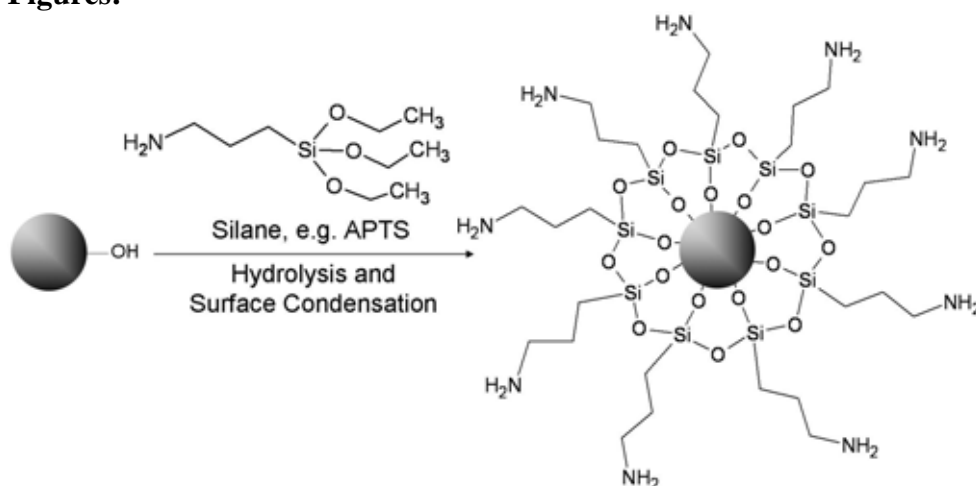


Figure 1: Silanisation of silica-magnetite nanoparticles.

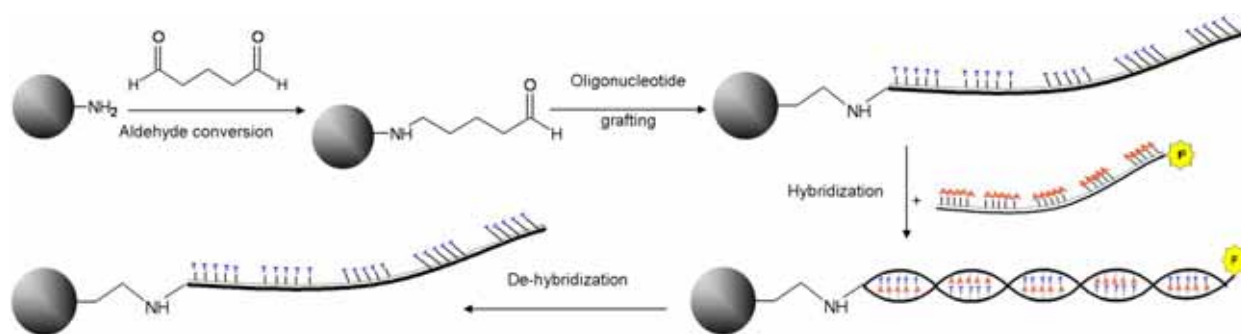


Figure 2: Surface amine to aldehyde conversion with glutaraldehyde, oligonucleotide grafting and hybrid capture of a complimentary fluorescently labelled oligonucleotide.