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Biosensors with nanoscale controlled architecture applicable in glycomics and diagnostics

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Glycomics is a hot research field since analysis of genomic/proteomic profiles cannot be applied to study many pathological processes. Glycans (complex carbohydrates) are attached to 70% of all proteins and with high density to the surface of the cells. Analysis of protein-linked glycans is crucial for understanding of numerous physiological/pathological processes. Current state-of-the-art tool for glycan analysis is mass spectrometry (MS) combined with chromatographic/electrophoretic instrumentation. MS analysis of some glycan changes associated with cancer is quite challenging due to long analysis time, extensive sample pre-treatment/ derivatization and data interpretation is required by skilled operators. This is why advanced analytical approaches are needed for advancements in the field of glycomics and diagnostics. In this presentation we show that impedimetric biosensors constructed with interfacial layers controlled at nanoscale can detect glycans down to a single molecule level (i.e. aM level). The biosensors were extensively optimised in a way to resist non-specific interactions for analysis of complex samples i.e. serum from patients having various diseases (rheumatoid arthritis, systemic sclerosis, prostate cancer), lysates of isolated human cells (leukaemia) and even with intact leukemic cell lines and flu viruses.

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Green alternative solvents for peptide synthesis

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To date, N,N-dimethylformamide (DMF) has been considered the only solvent suitable for peptide synthesis. Here we reported the use of 2-Methyltetrahydrofuran (2-MeTHF), cyclopentylmethyl ether (CPME),) tetrahydrofuran (THF) and acetonitrile (ACN) as greener alternative solvents in peptide synthesis. The ability of these solvents to dissolve amino acid derivatives and a range of coupling reagents were evaluated as well as the swelling of polystyrene and polyethylene glycol resins. In addition, racemization and coupling efficiencies were evaluated with a model of peptide (stepwise and segment coupling). The combination between 2-MeTHF as a solvent with DIC/OxymaPure as a coupling methodology gave the lowest racemization level during stepwise synthesis and the highest purity during SPPS of pentapeptide (Aib-enkephalin pentapeptide; H-Tyr-Aib-Aib-Phe-Leu-NH2). Moreover, the use of ACN and THF in the solid-phase peptide synthesis of hindered peptides, such as Aib-enkephaline pentapeptide and Aib-ACP decapeptide, in combination with the totally polyethylene glycol ChemMatrixresin, gave a better coupling efficiency than DMF.

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