Immobilization of Glycans on Silicon Substrates for Diagnostic Microarrays

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Biochemical methods that enable rapid and early diagnosis are critical to disease and patient management. Of unequivocal importance to addressing these issues is the study of interactions between glycans expressed on cell surface and glycan-binding proteins. Microarrays are formed by printing separated glycans on selected areas of a substrate. This enables quick and high-throughput diagnosis. However, current array analysis is limited to the use of expensive analytical methods such as Surface Plasmon Resonance, or fluorescence-based detection methods which do not allow real-time measurement. In this work, Precision Ellipsometry (PREL) was used to study the immobilization of glycans onto silicon substrates and examine whether they retain their functionality. This was developed in three phases. First, aminosilane and glutaraldehyde was used as the anchor between the silicon substrate and the amine-linked glycans. Second, to ensure atmospheric stability of the anchor layer, glutaraldehyde was functionalized with streptavidin through imination. This enabled successful adsorption of biotin-linked glycans. In the course of study, the serendipitous adsorption of the conjugate of thiolsilane and maleimide-PEG-succinimidyl ester pointed to a third and simpler method. As such, this anchor layer was used to absorb amine-linked glycans, obtaining uniform glycan spatial-density that is optimized for microarrays. Overall, three methods were developed to immobilize glycans. For the first time, single-step attachment of an anchor layer on silicon was achieved. This more facile and efficient approach to fabricating glycan microarrays enables PREL to be used as a diagnostic kit that is as sensitive as current methods but at least 100 times cheaper.

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