

分子インプリントポリマーインターフェイスを用いた糖鎖認識トランジスタの創製 Development of Sugar Chain Targeted Molecularly Imprinted Polymer Coated-gate Field Effect Transistor for Cancer Cell Detection

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Introduction

Oligosaccharides are biomolecules that exist widely in our body, and play important roles in life activities. As there are such oligosaccharides as Sialyl Lewis, known to exist specifically on cancer cells [1], oligosaccharides could possibly be targeted for valuable-cell recognitions. Our group has been developing a molecularly imprinted polymer-coated gate field effect transistor (MIP-gate FET, shown in figure 1) for specific molecular recognition in aqueous media [2]. In this study, we have improved the MIP interface for the FET biosensor and investigated the detection selectivity of MIP-gate FET for sugar chains, especially targeted 3'-Sialyl lactose and 6'-Sialyl lactose, that are similar in structure with Sialyl Lewis, by conformational analysis, as well as comparing with the electrical signals for various sugar chains such as paromomycin and kanamycin.

Experimental

Sugar chain-template MIP gel was synthesized on Au electrode by surface initiated-activator regenerated by electron transfer-atomic transfer radical polymerization (SI-ARGET-ATRP). 4-vinylphenylboronic acid was used as a functional monomer to bind diol groups in the sugar chain, N-3-(dimethylamino) propylmethacrylamide was used to modify pH, and finally, ethyleneglycol dimethacrylate was used as a crosslinker. As a measurement, while target molecules were added to the MIP-gate FET system, the gate surface potential was measured in real-time manner by FET real-time monitoring system

Results and Discussions

First, we developed 3'-SLac-template MIP and 6'-SLac-template MIP interfaces on the FETs. Using these MIP-gate FETs, we confirmed that they could be sensed quantitatively from 10uM for each sample. Moreover, the functionalized sensors showed the selectivity to detect each target to some extent. We also found that the selectivity of MIP interface differed depending on the templated sugar chains in the MIPs, although these sugars were similar in structures. Together with the further investigation of paromomycin and kanamycin template-MIPs, we consider that the characteristics of MIPs are significantly affected by conformational structure of the sugar chain. From these results, we have obtained the strategy to design the MIP interface with selectivity on the FET biosensor, which can be applied widely in medical fields.

Reference

- [1] A. Takada et al., *Cancer Research* **53** (1993) 354-361.
- [2] S. Nishitani, T. Kajisa, and T. Sakata, *JSAP Meeting* (Mar. 2016, Oct. 2015)

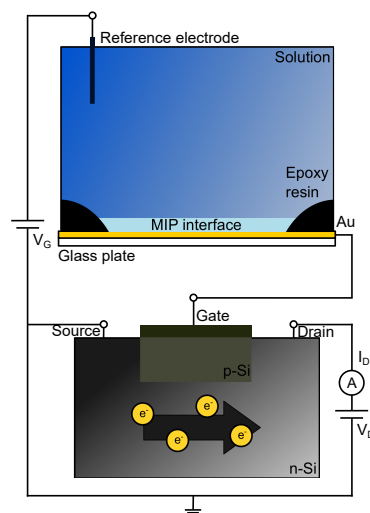


Figure 1. Conceptual structure of MIP-gate FET biosensor