第77回応用物理学会秋季学術講演会 講演予稿集 (2016 朱鷺メッセ (新潟県新潟市))

新規アレルギー診断に向けたヒスタミン分子鋳型ポリマーを有するFETバイオセンサの創製

Development of Histamine-template Molecularly Imprinted Polymer-based Field Effect Transistor for a Novel Allergy Test

東大工[1]，（株）PROVIGATE[1]，広島大[3] ○杨 皓月[1]，西谷 象一[1]，加治佐 平[2]，柳瀬 雄輝[3]，坂田 利弥[1]

Univ. of Tokyo[1], PROVIGATE Inc.[2], Hiroshima Univ.[3], ○Haoyue Yang[1], Shoichi Nishitani[2], Taira Kajisa[2], Yuki Yanase[3], Toshiya Sakata[1]

E-mail: sakata@biofet.t.u-tokyo.ac.jp

Introduction

Allergy is a kind of closest disease in the world, which is widely infected and induced by various allergen sources. Our group previously reported the monitoring of type I cell allergic reaction by ion-sensitive field effect transistor (IS-FET), and consequently considered the histamine as one of the main signal sources secreted from allergy reaction [1]. Then, to detect histamine specifically by FET, we chemically modified the gate sensing surface of the FET device by histamine-template molecularly imprinted polymer (MIP-gate FET). In this study, we report the improved MIP-gate FET showed the highly selective detection of histamine against similarly structured molecule, nicotinamide.

Methods

Extended-gate Au electrode was modified by MIP through UV bulk polymerization. To improve the selectivity of histamine-template MIP, we used 2-(trifluoromethyl) acrylic acid (TFMAA) as functional monomer to strongly interact with histamine in the pre-polymer solution. The use of TFMAA was previously reported by the T. Takeuchi group as an improved reagent for amino-carboxylic interaction [2]. We used N, N'-methylenebisacrylamide (MBAA) as cross-linker, which strategically makes MIP hydrophilic and hopefully avoid the adhesion of proteins, which are considered to be main competent for the allergy detection. As a measurement, a change in the gate surface potential was monitored by FET real-time monitoring system when histamine or the competent was added to the solution. The pH was controlled around 7.4 by phosphate buffered saline (PBS).

Result and future plan

First, the gate surface potential of MIP-gate FET was monitored when histamine and nicotinamide were separately added to the solution. As a result, although both histamine and nicotinamide were quantitatively detected as a negative shift of surface potential, the absolute value of the potential shift was significantly larger for histamine addition. Thus, the selectivity for detection of histamine was enhanced by MIP. For the next step, we will apply the sensor for specific cell allergic detection.

References

[1] H. Y. Yang, T. Kajisa, Y. Yanase and T. Sakata, *JSAP Meeting* (Oct. 2015).

[2] J. Matsui, O. Doblhoff-Dier, and T. Takeuchi, *Analytica Chimica Acta*, **343** (1997) 1-4.