Sensors and Materials, Vol. 23, No. 2 (2011) 135–146
MYU Tokyo

S & M 0833

Label-Free Detection of Oligosaccharide-Lectin Interaction Using Plasmonic Optical Device for Glycomics Application

Tatsuro Endo[1,2,*], Sayoko Matsuda[3], Takakiyo Obara[3], Yasushi Chuma[3], Makoto Ogata[3], Yasuko Yanagida[1,2], Takeshi Hatsuzawa[1,2] and Taichi Usui[3]

[1]Department of Mechano-Micro Engineering,
Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology,
4259 Nagatsuta-cho, Midori-ku, Yokohama 226-8502, Japan
[2]Precision and Intelligence Laboratory, Tokyo Institute of Technology,
4259 Nagatsuta-cho, Midori-ku, Yokohama 226-8503, Japan
[3]Department of Applied Biological Chemistry, Faculty of Agriculture, Shizuoka University,
Ohya 836, Suruga ward, Shizuoka 422-8529, Japan

(Received March 2, 2010; accepted June 1, 2010)

Key words: plasmonics, localized surface plasmon resonance (LSPR), oligosaccharide, lectin, glycomics

In this paper, we describe the fabrication and characterization of a localized surface plasmon resonance (LSPR)-based plasmonic optical device for the label-free detection of oligosaccharide-lectin interaction using a core-shell-structured nanoparticle-layer substrate. The oligosaccharide performs a crucial function for life phenomena such as cell growth, differentiation, and canceration. To understand these functions of living organisms in terms of oligosaccharides, a more simplified, cost-effective, and label-free analysis device has been desired. To achieve this, we aimed to develop a novel device for the detection of oligosaccharide-lectin interactions using an LSPR-based plasmonic optical device. For the detection of oligosaccharide-lectin interactions, the divalent *N*-acetyllactosamine (LacNAc) glycoside carrying a disulfide group was obtained using chemoenzymatic synthesis. Additionally, the divalent glycoside was immobilized onto the plasmonic optical device surface. Then, the changes in optical characteristics with the LacNAc glycoside-wheat germ agglutinin (WGA) interactions were determined. As a result, the LSPR-based plasmonic optical device could be used to detect oligosaccharide-lectin interactions. Furthermore, the LacNAc moiety, which was obtained using chemoenzymatic synthesis, was specifically recognized by WGA molecules. This plasmonic optical device was more simplified, requiring smaller sample volumes than those required by conventional analytical systems such as surface plasmon resonance (SPR) and a quartz crystal microbalance (QCM). Thus, the plasmonic optical device has potential for use in cost-effective, highly simplified, and highly sensitive test kits for future glycomics applications.

*Corresponding author: e-mail: endo.t.ab@m.titech.ac.jp