Effect of Clustering on the Fluctuation in Binding Activity of Sugar Chains to Influenza Viruses

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Abstract

Influenza is a major issue in public health. The spread of influenza A virus variants needs continuous monitoring because of the high mutation rate. Many infections in humans have been reported and this might be due to the potential of these viruses to mutate and result in a change of host from birds to humans. The surveillance of such mutations is essential, and therefore highly sensitive sensor systems are needed. We have developed a biosensor using nano-carbon materials which can detect the preferred host of the virus. The host change can be observed as a change of the bonding between the virus protein and the host sugar chain. We have developed several processes to fabricate biosensor systems. One of them is a deposition process for the binding of specific molecules on the device surface, such as those found in avian influenza viruses and human ones. For biosensors with host specificity for influenza viruses, we used sugar chains with different coordinations of terminal sialic acid and penultimate galactose, such as $\alpha$2-3 linkage of sialic acid for an avian influenza virus and $\alpha$2-6 linkage of sialic acid for a human virus. We have discussed about the dispersion of sugar chains such as sialylglycopeptide (SGP), and sialoglycopolymer and so forth. They are the candidates for detecting molecules in the biosensors for influenza viruses, and we have investigated the host specificity of them using an enzyme-linked immunosorbent assay (ELISA). Using the bovine serum albumin (BSA) localization, we have obtained the stable distribution. We have also used AFM for the observation of viruses in the binding assay. The clustering of sugar chains could also enhance and stabilize the binding activity. Figure 1 show the relative error in the fluctuation in binding activity. Comparing with single sugar chains of SGP, clusterized molecules of sialoglycopolymer and SGP-BSA show the reduction of relative errors.

Figure 1: Relative errors for biding activity of SGP, sialoglycopolymer and SGP-BSA to influenza viruses. Red bars are for human IFVs, blue (hatched) for avian ones.