Interaction study of peptide-PAMAM as potential bio-nanogate for detecting anti-hepatitis B surface antigen

ABSTRACT

Bio-nanogate involves synthesized or natural molecules as a 'gate' towards bioreceptors and responds upon the presence of targeted analytes in nanoscale dimension. Development of bio-nanogate improves analyte selectivity and signal response across various types of biosensors. The versatility of PAMAM dendrimers to form conjugates with guest molecules, such as proteins can be utilized in forming a bio-nanogate. PAMAM interaction with peptide bioreceptor for antibody detection is of interest in this study. This study investigated the interaction of synthesized immunogenic 'a' determinant (aD) region of hepatitis B virus surface antigen (HBsAg) with PAMAM G4 and anti-HBsAg antibody, as a potential bio-nanogate for anti-HBsAg detection. The aD peptide fused with maltose binding protein (MBP), was confirmed with Western blotting. Nano-Differential Scanning Fluorimetry (nano-DSF) study revealed that the interaction of MBP-aD with anti-HBsAg indicated a higher thermal stability as compared to its interaction with PAMAM G4. Electrochemical impedance spectroscopy showed that a higher binding constant of MBP-aD interaction with anti-HBsAg (0.92 μM-1) was observed at maximum saturation, as compared with PAMAM G4 (0.07 μM-1). Thermodynamic parameters demonstrated that MBP-aD interacted with anti-HBsAg and PAMAM G4, through van der Waals and hydrogen bonding. These analyses suggest that the weak interaction of MBP-aD and PAMAM G4 may form a potential bio-nanogate. It is hypothesized that the presence of anti-HBsAg has a higher affinity towards MBP-aD which may displace PAMAM G4 in the anti-HBsAg detection system. This interaction study is crucial as an initial platform of using peptide-PAMAM as a bio-nanogate in an antibody detection system.

Keyword: Bio-nanogate; Peptide-PAMAM; MBP-aD; PAMAM G4; Anti-HBsAg