CHAPTER V

CONCLUSIONS AND SUGGESTION

Charged derivatives of chitosan, *N*-sulfofurfuryl chitosan (SFC) and *N*-[(2-hydroxyl-3-trimethylammonium)propyl]chitosan chloride (HTACC), were successfully prepared by reductive alkylation using FFSA as reagent and ring opening of GTMAC by amino groups of chitosan, respectively. ^{1}H NMR and FTIR analyses were used to verify the chemical structures of the charged derivatives. QCM analysis suggested that multilayer has been formed by alternate layer-by-layer adsorption of 3 pairs of polyelectrolytes : chitosan-PSS, PAH-SFC and HTACC-PAA. The assembly process of chitosan-PSS (at pH 4) and HTACC-PAA (at pH 7) was mainly driven by electrostatic attraction, whereas the one of PAH-SFC (at pH 8) was influenced by both electrostatic attraction and hydrogen bonding. However, the presence of characteristic functional groups of polyelectrolyte in the multilayer films could not be verified by ATR-IR analysis because the overall thicknesses of tested multilayer films were possibly thinner than the sampling depth of the technique. Water contact angle data confirmed that the multilayer film deposited on plasma-treated poly(ethylene terephthalate) (treated PET) substrates was stratified.

Bioactivity of deposited multilayer film on treated PET substrate was tested against four proteins (albumin, fibrinogen, γ-globulin and lysozyme) having distinctive size and charge. Albumin and fibrinogen, as negatively charged proteins, showed the alternate response to positively and negatively charged multilayer films. To a certain extent, adsorption of lysozyme, a positively charged protein, corresponded with the charge characteristic of the multilayer film for the systems of PAH-SFC and HTACC-PAA. The enzymatic activity of lysozyme towards chitosan is believed to be responsible for the absence of odd-event trend in chitosan-PSS system. Because pI of γ-globulin (6.5) is very close to experimental pH (7.4), it may not be strongly charged. Thus, the

electrostatic interaction may not be a major driving force for adsorption. This led to the unusual trend of γ-globulin adsorption for all multilayer systems.

In vitro cellular responses and antibacterial activity of the multilayer films assembled from charged derivatives of chitosan are subjects of future investigation in order to test the feasibility of using these charged polymers in the field of biomaterials and biomedical applications.