

ABSTRACT

In drug delivery system (DDS), polyelectrolyte complex (PEC), which is formed by electrostatic interaction between oppositely charged polymers, has been increased the attention to researchers since the past decades; especially polyelectrolyte multilayer (PEM). This system is widely used in many applications, including in drug delivery, wound healing, membrane filtration and other biomedical applications. In this study, layer by layer assembly (LBL) was used in film fabrication process to produce thin films with order structures. Both chitosan and pectin had been selected as raw materials to form PEC multilayered thin films. Chitosan acted as a drug container since the mixture of pectin and calcium chloride were used to improve the mechanical characteristic of film as a coated layer. Due to excellence properties of curcumin in healing application, it was favored to use as drug model in releasing study. This study aimed to characterize the effect of layer by layer assembly on the physical characteristics and drug released behavior of thin film. To analyze the physical characteristics of film, swelling behavior, degradation rates, microscopic images, BET surface area analysis, contact angle, mechanical strength and FTIR spectra were measured. In addition, the pH environmental changes described the differentiation of drug releasing behavior from film by defining the drug release concentration. Based on the results of this study, higher number of layer films provided lower ratio of swelling about 87.96%/day and lower degradation rate 18.18%/week. In addition, in term of improving its mechanical properties, the increasing number of layer film improved its surface roughness, reduced of pore size, and decreased its hydrophilicity characteristics. The interaction of amino groups of chitosan and carboxyl group of pectin were verified by spectrum of FTIR. The drug release concentrations were increased by time until reaching the steady state, defined with UV-Vis spectrophotometer. In drug releasing study, the drugs were released faster in basic medium comparing to PBS and acidic condition, respectively. The thin thickness of multilayer film rendered the high concentration of curcumin releasing in a short period of time; meanwhile, low concentration of releasing with longer period of releasing was demonstrated in high thickness film. Among the three medium, the favorable for releasing study medium was in acidic medium. The drug release concentrations were 0.02445 mg/ml, 0.01143mg/ml and 0.00499mg/ml in single layer of chitosan, 3layers and 7layers drug loading multilayers films, respectively. Additionally, based on simulation modeling results, the effective diffusivity coefficient of films is 2.8053×10^{-7} (cm²/sec) in 3layers and 2.4582×10^{-7} (cm²/sec) in 7layers film. In conclusion, both mechanical characteristics and drug released behavior of thin film were precisely influenced by the number of layers as well as the LBL assembly used; therefore, it is potentially used as drug carrier in drug delivery system.

Keywords: Polyelectrolyte complex (PEC), layer by layer, chitosan, pectin, drug delivery system (DDS)