CHAPTER V
CONCLUSION

Polyelectrolyte multilayer thin films from poly(diallyldimethylammonium chloride) and Scarlet G dye were successfully coated on nylon multifilament by Layer-by-Layer technique at pH 11 which is a non-dyeable condition. Parameters controlling the growth of PEM on nylon multifilament were studied. It was found that the deposition of the PEM was complete and constant even with deposition time as short as 15 seconds. The increasing of salt concentration up to 0.5 M increased the growth of PEM but excess salt concentration induced precipitation of Scarlet G dye. PDADMAC concentration influenced the growth of PEM more strongly than the dye concentration did. The increase in PDADMAC concentration up to 1 mM increased the growth of PEM. The growth of PEM was decreased when PDADMAC concentration was more than 1 mM due to partially stripping of PEM into PDADMAC solution, while the increasing of Scarlet G dye concentration increased the growth of PEM steadily. Dye loading and dye release behavior were studied before coating PEM on dyed silk multifilament. It was found that the increasing exhaustion time increased the adsorption of dye on silk. The adsorption of dye on silk did not depended on the speed of spinner. The increasing salt concentration up to the optimum concentration in Scarlet G dye solution increased the efficiency of adsorption of dye. After this optimum concentration, the efficiency of dye loading was decreased because of dye precipitation. The increase of pH of dye solution decreased the efficiency of dye loading.

As for dye release behavior, it was found that the increase in the length of dyed silk increased the amount of dye release found in the soaping solution, conforming to a linear relationship. The kinetics of dye release were studied and found that 80% of dye were released within the first fives minutes and constant after that. The pH of soaping solution influenced the amount of dye release. The increasing pH decreased the amount of ammonium groups which, in turn, induced dye release.

Finally, PEM were coated on dyed silk multifilament in order to improve color fastness to washing. PEM from PDADMAC/PSS-co-MA and PDADMAC/PSS were constructed on dyed silk. The efficiency to protect dye release from silk during washing process was compared. The pH of soaping solution influenced the potential

of PEM to protect dye release since pH controlled charge density and swelling of PEM. Thickness of PEM from PDADMAC/PSS-co-MA did not affect the efficiency to protect dye release while the increasing thickness of PEM from PDADMAC/PSS decreased dye release from silk in linear relationship. PEM from PDADMAC/PSS, which top layer was PSS, had the highest efficiency to protect dye release. It was found that it can protect dye from being released at 47% comparing to the release of dye from conventional dyed silk (no PEM).

The main contribution of this research is that PEM was successfully coated on textile fiber substrates at ambient temperature by the Layer-by-Layer technique. An application of this PEM coated on textiles was illustrated in this thesis. It could be used to improve color fastness to washing of dyed silk multifilament. Several more applications can be developed through this innovation. However, few comments must be pointed out as follows.

Polyelectrolyte multilayer thin films coated on multifilament in this research were assumed to be in nano-scale. PEM on multifilament substrate was difficult to be prepared and characterized because of the limitation in the size and shape of multifilament substrate and the fragileness of the film. In this research, PEM were characterized quantitatively using spectrophotometric technique. Other techniques may be used to characterize PEM, possibly with a higher cost.

The automatic dipping machine could only prepare small sample (length of multifilament 4 meters) because the robotic platform was designed for beakers of 100 ml. in size. The other way which may be used to prepare PEM on larger surface area, could be using a spray [28]. Joseph B. Schlenoff et al. studied sprayed polyelectrolyte multilayer between PSS and PDADMAC and found that a highly uniform thin film was rapidly obtained over a large area. The morphology uniformity and chemical; composition of sprayed multilayers as well as the selective membrane properties are found to be virtually the same as those prepared by dip-immersion.

Part of this work was already published in a research journal [29] and 2 more parts will be submitted to others journals.