ENERGY MIGRATION DYNAMICS OF FLUORESCENT PROTEIN LAYERS ADSORBED ON CHEMICALLY MODIFIED GOLD SURFACES

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AUGUST 2013

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A thesis submitted in fulfilment of the
requirements for the award of
Doctor of Science (Chemistry)

Graduate School of Science
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AUGUST 2013

Dedicated to My Love Ahmad Termimi, my son Ken Hamza
My beloved father Hj Mohd Yusoff bin Hussin,
My beloved Mother Hjh Wan Bidah binti Wan Sulaiman,
family and friends.

ACKNOWLEDGEMENT

I would like to express my most grateful thanks to my supervisor Professor Hiroshi Fukumura for believing in me in doing this research. I am also truly thankful and amazed with his patience, endless efforts in guiding and imparting his wide knowledge to me. He is such an optimistic person and believes in my capabilities. Doing this research and writing this thesis under his supervision and guidance was a remarkable accomplishment for me. Thanks to the ever constant advice and support from my supervisor.

Many thanks also to my co-supervisors Associate Professor Izabela I. Rzeźnicka, Associate Professor Shinji Kajimoto, Professor Kazuhiro Sogawa and Associate Professor Noriko Nishizawa Horimoto. Without their coaching and guidance, it will not be an easy job in accomplishing my goals. My deepest thanks to Associate Professor Izabela I. Rzeźnicka for the moral support, sharing all her knowledge about STM and proteins and also has given me strength to complete this study.

To all my lab mates, especially Fujita-san, thank you so much for everything. Is has been a joy working with all of you. Special thanks to Hirotaka Hoshi who has guided me with biological study. These thanks also go to other professors, associate professors and other staffs who has involved in this study either direct or indirectly.

To my ever dearest husband, Ahmad Termimi Ab Ghani. I am very thankful to have you all the way through. I really appreciate all the sacrifices, unconditional support, comforting me at most of the times. To my son Ken Hamza, thank you so much for being a wonderful son and cheer me up during bad times with your cheeky acts.

Lastly, I would like to acknowledge my wonderful parents Mohd Yusoff and Wan Bidah, siblings, relatives and friends whose patience, love and support enabled me to complete this research.

ABSTRACT

Research involving protein adsorption at an interface has extended into many areas since protein adsorption may induce denaturation or structural changes. Knowing the nature of adsorbed protein is interesting in the area such as biomaterials and pharmacology. In this study, a fluorescent protein (FP) has been chosen as a model to understand protein behaviour when adsorbed on a surface. Citrine from yellow fluorescent protein (YFP) variants has been chosen among other variants. Several works related with fluorescence dynamics such as lifetime and anisotropy decay of fluorescent protein in solution have been reported. However, so far there has been no report upon fluorescent dynamics of dried protein film.Two methods were used which involved scanning tunneling microscopy (STM) to study protein's morphology on surfaces as well as time correlated single photon counting (TCSPC) for understanding fluorescence dynamics. Citrine was dried on hydrophilically and hydrophobically modified gold surfaces by drop cast protein solution on the freshly modified surfaces. The drop cast solution formed a "ring-like" pattern having a concentrated and visible rim. Citrine films were observed with an STM under ambient condition and after that followed by TCSPC measurement. Interestingly, from the fluorescence spectra and lifetime of adsorbed layers, citrine molecules seems to remain intact at the adsorbed surface. From STM images, citrine molecules adsorbed more uniformly packed crystal-like protein layers on hydrophilic surface. While on hydrophobic surface, citrine molecules were more randomly adsorbed forming some aggregates on non homogenous layers. The comparison on both surfaces together with corresponding anisotropy decays can be seen from STM images and anisotropy decay curve. Furthermore, time-resolved anisotropy clearly has shown the tendency of fast and randomized layers on hydrophobic surface to compare with on hydrophilic surface.