

## CHAPTER 6

### Conclusions and Suggestions

There is an increasing trend in the biomedical field to tailor the functions onto the biomaterials surface. PLA is one biodegradable polymer that is widely used in the biomedical fields. The plasma treatment is an effective way to incorporate the various functions onto the polymer surface without affecting bulk properties. In this study, PLA surface characteristics were investigated using plasma technique for understanding behaviors and preferential adsorption of different proteins on the plasma treated PLA surface.

The  $\text{NH}_3$ -plasma and  $\text{SiO}_x$  treated with  $\text{O}_2$ -plasma investigated the films surface wettability. HSA and Fib were adsorbed less on the  $\text{NH}_3$ -treated PLA but more on the untreated PLA. The  $\text{NH}_3$ -plasma treatment raised the surface hydrophilicity of the PLA films due to the polar groups such as amines or amides. Hence, the protein adsorbed with the weak bond of hydrophilic interaction. This study argues that polarity influences the protein adsorption. The surface wettability of the  $\text{SiO}_x$  films increased in the OH bond that is responsible for the enhancement of the wettability due to hydrogen replacement and incorporation into the oxide films to contribute to the polar surface. The OH functional group on the surface will interact with the amine group of the protein with the hydrogen bonding. BSA protein was more adsorbed on the hydrophilic  $\text{SiO}_x$  films treated by  $\text{O}_2$ -plasma, resulting in less cell attachment but cell-type-dependent cell proliferation, increased for the L929 mouse fibroblast cells but almost no changes for the MC3T3-E1 mouse pre-osteoblast cells. These results can be summarized to Table 6.1. The table shown the surface properties after plasma modification, proteins adsorption test and cell culture, these results were compared with the pure PLA.

The hydrophilic surface of PLA, using plasma treatment, would benefit to cell adhesion and enhance cell attachment since albumin was loosely bound on the surface and could thus be replaced by larger cell attachment proteins such as fibronectin and collagen which are the components of the extracellular matrix.

Table 6.1 The film surface modification with the protein adsorption and cell culture.

Film Condition	Surface Properties			Protein Adsorption					Cell Culture		
	Hydrophobic	Polar Component	Functional	HSA	HFib	BSA	MC3T3-E1	L929	MC3T3-E1	L929	Proliferation
Ar plasma	☺	☺	C-H, OH	☺	☺	-	-	-	-	-	-
NH <sub>3</sub> plasma	☺	☺	C=N, C-NH	☺☺	☺☺	-	-	-	-	-	-
NH <sub>3</sub> +Ar plasma	☺☺	☺☺	C=O-NH, NH <sub>3</sub> <sup>+</sup>	☺☺	☺☺	-	-	-	-	-	-
SiO <sub>x</sub> film	☺	☺	Si-O	-	-	☺☺☺	☺☺	☺☺	☺	☺	☺
SiO <sub>x</sub> + O <sub>2</sub> film	☺☺☺	☺☺☺	Si-OH	-	-	☺☺	☺	☺	☺☺	☺☺	☺☺

☺ No changed

☺ Slight

☺☺ Fair

☺☺☺ Fluent