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FIBRONECTIN ADSORPTION ON MODIFIED POLY(l-LACTIDE) SURFACE AFTER AMMONIA PLASMA TREATMENT

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INTRODUCTION: Gas plasma treatment is extensively used for chemical modification of biomterials[1,2]. In this work, in order to improve the hydrophilicity and surface roughness, ammonia was used as non-polymerizing gase to create reactive sites on the surface of PLLA, such as amine groups. Protein adsorption, depending on the surface property of biomaterials, may influence the biological activities in relation to cell culture *in vitro* and implanted *in vivo*. Therefore, investigation of protein adsorption on the surface of biomaterials is a critical evaluation to elucidate the cell adhesion in vitro and in vivo[3]. Fibronectin, an important extracellular matrix protein[4], was used as a model in this study.

METHODS: PLLA films were fabricated by solution casting method and subsequently their surfaces were treated by ammonia plasma on a Plasma Graft Polymerizer (VTC-FSN-200, Japan, 13.56 MHz) with different powers. The surface chemical composition of the plasma-treated PLLA films was investigated by X-ray photoelectron spectroscopy (XPS). The contact angles of the samples to water were measured to evaluate their hydrophilicity. The surface morphology and roughness of ammonia plasma-treated PLLA films were observed by Atomic force microscopy (AFM). Fibronectin adsorption was studied by ^{125}I-labelled method.

RESULTS: The increased N-functional groups on the treated samples, for example, amino ($-NH_2$) and imino($-CH=NH$), were reflected in the XPS data. Along with the increase of treated power, the hydrophilicity, measured by contact angles, and the roughness, presented with a Ra, were both evidently increased (showed in table 1).

Table 1. Effect of ammonia plasma treatment power on water contact angles and average roughness of PLLA

Sample	θ (°)	Ra(nm)
Before treatment	83.2±1.6	22.32±1.24
50w, 2 min	58.3±2.2	31.35±2.34
100w, 2 min	32.4±1.8	37.50±2.71
150w, 2 min	21.7±0.9	47.26±5.3

The surface morphology of ammonia plasma-treated samples was observed by AFM (showed in Fig 1). It could be seen that the surface morphology depended on the treating power. From the results of fibronectin adsorption test, ammonia plasma-treatment is an effective means to adjust the adsorption kinetics and isothermal adsorption of fibronectin.

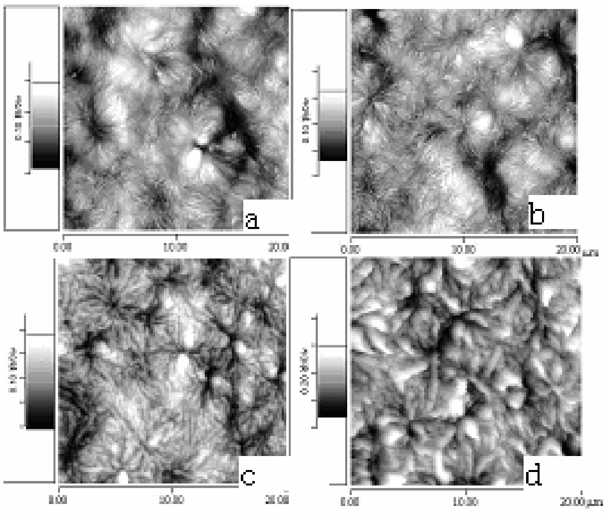

Fig. 1: The morphology of PLLA samples. a: before treatment; b: 50w, 2min; c:100w, 2min; d:150w, 2min.

DISCUSSION & CONCLUSION: The surface properties of ammonia plasma-treated PLLA films were characterized by a series of surface analysis techniques. The hydrophilicity, surface chemistry and surface roughness could all influence the fibronectin adsorption on the surface of treated PLLA films. Furthermore, it could also ultimately affect the biological events of cell, such as adhesion, proliferation and differentiation.[5]

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