低温等离子体改性 PHBV 表面的研究

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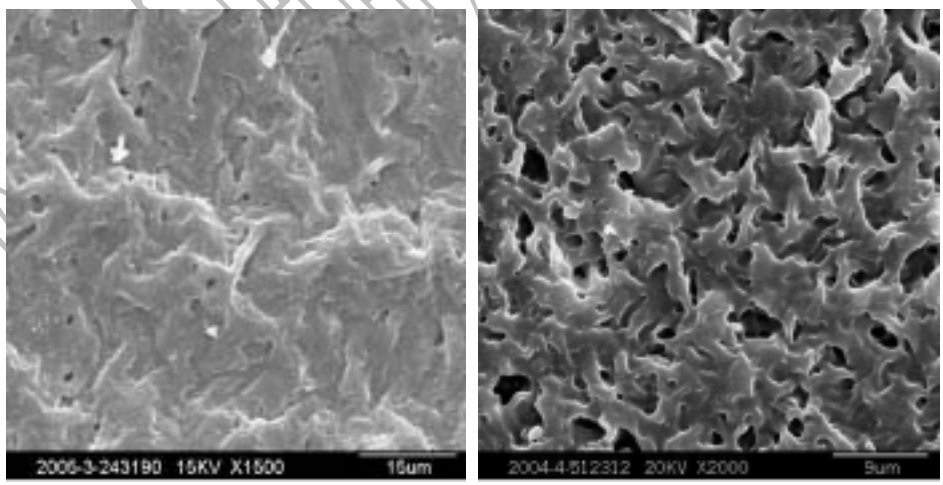
关键词：PHBV，表面改性，低温等离子体

本研究分别以 O_2、NH_3 和 SO_2 三种气体的低温等离子体[1]对 PHBV 表面进行处理，处理时间分别为 5 min、10 min、20 min 和 30 min。处理之后，立即使用多种分析手段对材料表面物理与化学性质的变化进行表征，以评价其改性效果。扫描电镜（SEM）照片显示经过低温等离子体处理之后，PHBV 表面的多孔结构变得更加明显，表面粗糙度也得到了较大的提高。静态水接触角数据表明，PHBV 表面在经过低温等离子体处理之后，亲水性得到了明显的改善，并且每种气体的等离子体都有一个最佳处理时间，使材料表面的水接触角达到一个最小值。X-光电子能谱（XPS）分析表明，经低温等离子体处理之后的 PHBV 表面引入了多种极性基团。O_2 等离子体可将 C=O 和 C-OH 引入到 PHBV 材料的表面[2]，NH_3 等离子体可将 C-NH_2 和 C=NH 等基团引入到 PHBV 材料的表面[3]，而 PHBV 膜在被 SO_2 等离子体辐照之后，表面可接上 C-SH 和 C-SO_3H 等极性基团，其中 C-SO_3H 可大大提高 PHBV 材料的抗凝血性。在材料表面进行狗主动脉内皮细胞的培养，结果显示经过等离子体改性之后，细胞在材料表面上的黏附能力得到了较大程度的提高。



(a) (b)

Fig. 1 SEM images of PHBV surfaces: (a) untreated; (b) NH_3 treated for 10 min

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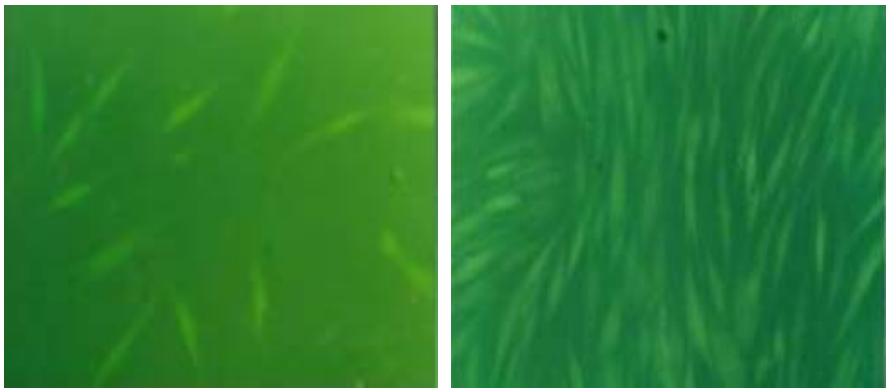

(a) (b)

Fig. 2 Morphology of cell-adhesion on PHBV surfaces: (a) untreated; (b) NH_3 treated for 10 min.

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Study on surface modification of PHBV using a low-powered gas plasma

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PHBV films were treated by a low-powered gas plasma using O_2, NH_3 and SO_2 as treatment gases with different treatment time of 5 min, 10 min, 20 min and 30 min. The changes of the physical and chemical characteristics of the biopolymer surface were studied in this work. Surface morphology was evaluated by scanning electron microscopy (SEM) which showed improved roughness of the surface after plasma treatment. The wettability of the surface was examined by static water contact angle measurements (SCA) which presented that there was a decrease of static water contact angle in all plasma treatments compared to the untreated surface. X-ray photoelectron spectroscopy (XPS) indicated some polar functional groups such as hydroxyl, amino and sulfonic groups were successfully introduced to the PHBV surface following plasma treatment. After cell culture on the virgin and modified PHBV films, we can see that the cell-adhesion has been greatly improved through plasma treatment.

Keywords: PHBV; Surface Modification; Gas Plasma.