BONE MORPHOGENETIC PROTEIN-2 ADSORPTION ON PHOTOACTIVE POLYMERIC SUBSTRATES

MAGDALENA WYTRWAL-SARNA[1]*, AGATA POMORSKA[2], MAŁGORZATA SEKULA-STRYJEWSKA[3], KATARZYNA GAJOS[4], KAMIL AWSIUK[4], MICHAL SARNA[5], EWA ZUBA-SURMA[3,5], KRZYSZTOF SZCZUBIAŁKA[6]

[1] ACADEMIC CENTER FOR MATERIALS AND NANOTECHNOLOGY, AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY, POLAND
[2] JERZY HABER INSTITUTE OF CATALYSIS AND SURFACE CHEMISTRY PAS, POLISH ACADEMY OF SCIENCES, POLAND
[3] MALOPOLSKA CENTER OF BIOTECHNOLOGY, JAGIELLONIAN UNIVERSITY, POLAND
[4] FACULTY OF PHYSICS, ASTRONOMY AND APPLIED COMPUTER SCIENCE, JAGIELLONIAN UNIVERSITY, POLAND
[5] FACULTY OF BIOCHEMISTRY, BIOPHYSICS AND BIOTECHNOLOGY, JAGIELLONIAN UNIVERSITY, POLAND
[6] FACULTY OF CHEMISTRY, JAGIELLONIAN UNIVERSITY, POLAND
*E-MAIL: WYTRWAL@AGH.EDU.PL

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Introduction

Incorporation of growth factors into the scaffold biomaterial can improve osteogenesis and angiogenesis. A number of bone-derived growth factors have been isolated and characterized from bone matrix, such as bone morphogenetic proteins (BMPs), which display mitogenic, differentiating, and osteolytic activities, allowing these molecules to act as potential determinants of local bone formation [1]. The main aim of this study was the effective covalent and electrostatic immobilization of BMP-2 onto polymeric multilayers (PEM).

Materials and Methods

Polymeric multilayers were composed from diazoresin (DR) and chondroitin sulphate (CHON). After adsorption, growth factors are immobilized onto PEM surfaces by electrostatic or covalent photochemical crosslinking [2]. Quartz crystal microbalance (QCM) was used to analyze the kinetics of structural and mass changes of BMP-2 adsorption on polymeric substrates. Atomic force microscopy (AFM) was used to verify morphology of the substrates. X-ray photoelectron spectrometer was used to analyze functional groups, exposed to bulk (angle resolved-XPS). Secondary-ion mass spectrometry (Tof-SIMS) gave us the information about protein spatial adsorption onto PEM multilayers.

Results and Discussion

The effective protein adsorption was confirmed by QCM. This technique gives an insight into the reaction kinetics as well as multilayers structure modification during adsorption. Much more BMPs were adsorbed on non-crosslinked multilayers. From the dissipate energy it was observed that the substrates became more stiff. AFM data showed that the proteins are efficiently deposited on the surface of the polymers. XPS measurements confirmed that all deposited polymeric layers penetrate each other. Hydroxyl and ester functional groups are exposed to the surfaces.

Conclusions

The result showed that the polymeric multilayers are effectively photocrosslinked. BMP-2 adsorb effectively on the PEM independently of the terminal layer and non-crosslinked and crosslinked layers. PEM films are the versatile substrate for proteins immobilization. Those research will determine the possibility of future usage of such PEM with BMPs as active coatings of implants or scaffolds enabling the proliferation and differentiation of stem cells.

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References

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