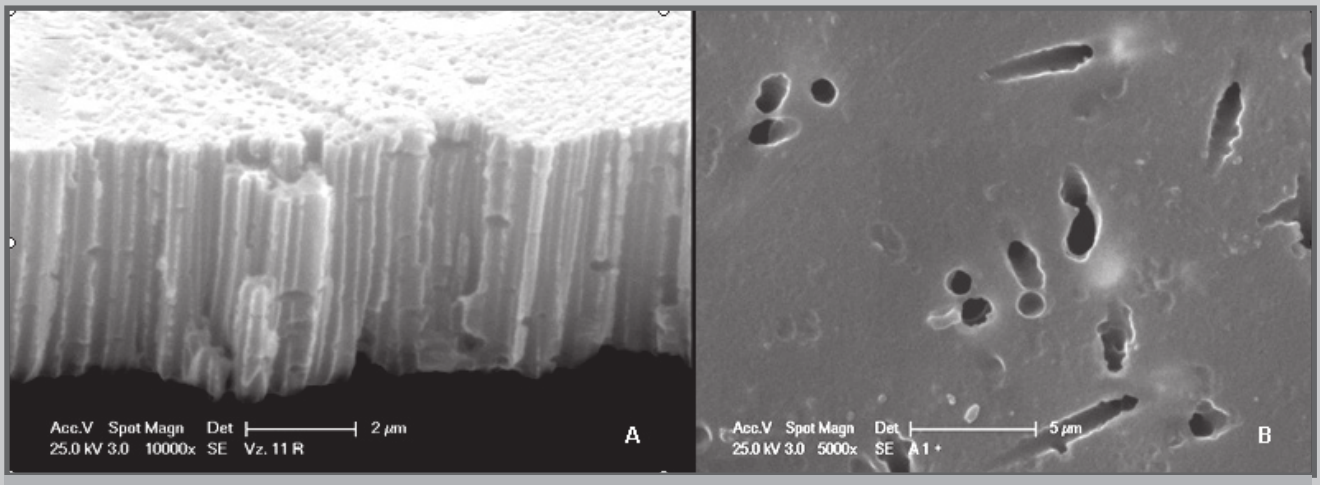

FIG.1. PET foils irradiated by Cu-ions (A) and fission fragments (B) viewed by scanning electron microscopy

membranes could serve as synthetic analogues of internal elastic lamina separating vascular smooth muscle cells and endothelial cells in a newly constructed bioartificial vascular wall.

[Engineering of Biomaterials, 99-101,(2010),108-109]

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FULLERENE-TITANIUM (C_{60}/Ti) COMPOSITES CAUSE NO DNA DAMAGE RESPONSE IN HUMAN OSTEOBLAST-LIKE MG 63 CELLS

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Abstract

Fullerenes (C60) and fullerene-based composites are considered as promising substrates for biological cell colonization. It might be mainly due to their nanostructure, resembling the nanoarchitecture of the natural extracellular matrix. Thin films of binary C_{60}/Ti composites with various concentrations of Ti ranging from 25% (i.e., 25 Ti atoms and 75 C_{60} molecules) to 70% were deposited on microscopic glass coverslips in micro-patterned form through a metallic mask, and were tested for their potential use in bone tissue engineering. It is known that fullerenes and their derivatives can cause cytotoxic injury, cell death or inhibition of cell growth. These effects are based mainly on the reactivity of fullerenes, which may weaken with time due to the oxidization and polymerization of fullerenes in an air atmosphere. We therefore tested the dependence between the age of C_{60}/Ti composites (i.e., from one week to one year) and the level of DNA damage of human osteoblast-like MG 63 cells in cultures on these materials. The DNA damage was analyzed by immunofluorescence staining of markers of DNA damage response, such as phosphorylation of histone H2AX and focal recruitment of p53-binding protein. As positive control to markers of DNA damage response was used 7 days long treatment with 2,5 mM Thymidine. We also monitored the proliferation and

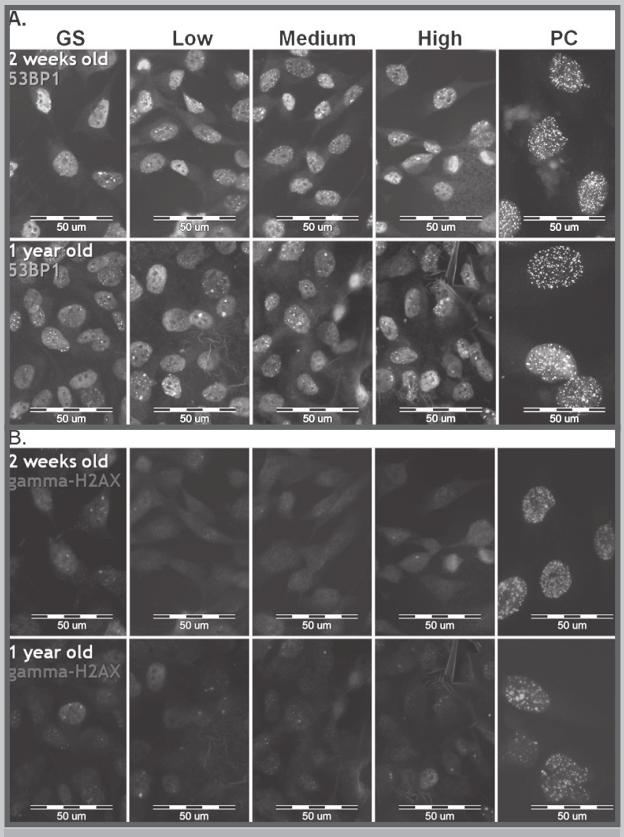

FIG.1. Immunofluorescence staining of markers of DNA damage response: 53BP1 (A) and gamma-H2AX (B) in human osteoblast-like MG 63 cells on 2 weeks old and 1 year old fullerenes with various concentrations of Ti (Low, Medium and High). GS–control microscopic glass coverslips, PC–positive control to markers of DNA damage response, 7 days long treatment with 2.5 mM Thymidine

morphological changes of the cells.

After 7 days of cultivation, we observe no cytotoxic morphological changes, such as enlarged cells or cytosolic vacuole formation, which are signs of cell senescence, and no increased induction of cell death. In addition, there was no increased level of DNA damage response on the C_{60}/Ti composites (FIG.1). We also found no significant differences in cell population densities and no increased level of DNA damage among various Ti concentrations (FIG.1). Moreover, there was no effect of the age of the C_{60}/Ti composites on the cell population densities or on the DNA damage response (FIG.1). These results suggest that fullerenes in combination with Ti do not cause cytotoxic injury and this material could be used in bone tissue engineering.

[Engineering of Biomaterials, 99-101,(2010),109-110]

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BIOCOMPATIBILITY OF HYBRID FIBROUS MATERIALS BASING ON POLY-L/DL-LACTIDE

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Abstract

Hybrid biomaterials due to their unique structure may become an alternative for many popular composite and nanocomposite materials. Multilevel modification of their matrix manifesting itself in the presence of particles of different sizes i.e., micrometric, submicrometric and nanometric together with the variety of shapes of a modyfing phase (nanometric fibres, submicron particles, coated nanoparticles) and its different chemical character make the hybrid materials similar to natural tissue. Bone tissue structure is particulary close to this model in which collagen fibres and hydroxyapatite particles and nanoparticles have not only different form but first of all they play different role in the tissue which depends on their chemical nature. In the biomedical engineering syntetic hybride biomaterials are usually produced using resorbable and degradable polymer matrices and inorganic fillers (ceramic bioactive particles; HAp, TCP, SiO_2) or organic filers (collagen, polysaccharides e.g. alginate fibres). The main function of the modyfing phase is inprovement of the polymer matrix leading to bioactive, stronger material showing high biofunctionality.

Production of hybrid materials is based mainly on experimental works, which is related to the presence in their matrix few phases with different properties which may interact. Hybrid materials do not follow the rule of mixtures thus it is difficult to predict behaviour of a material in which co-exis different chemical and phisical phases. In the work hybrid composite foils were produced in which modyfing phase consisted in; nanocomposite calcium alginate fibres modyfied with ceramic nanoparticles; HAp (CAH fibres), TCP (CAT fibres), SiO_2 (CAS fibres) and MMT (CAM fibres). Short fibres were subjected to additional size reduction in vibration ball mill resultiong in submicron and nanometric phases. Size of the particels after grinding was determined by screening analysis and DLS method (for particels smaller than 500 nm). It was observed than the population of short fibres consist in three fractions i.e.; micrometric (~2µm, 50 wt.%), submicrometric (500–800 nm, 40 wt.%) and nanometric (below 500 nm, 10 wt.%). The fibres and products of their grinding were homogenised in P(L/DL)LA polymer solution (poly-L/DL-lactide, Purarorb 80, Purac Germany). A hybride material in the form of thin foils containing 2 wt.% of a modyfing phase were subjected to durability tests consisting in incubation in distilled water (30 days/37C). Monitoring of the medium pH and conductivity did not show changes related to harmful products of their decomposition. Osteoblast-like cells from MG-63 line contacted with the surface of the materials showed high viability (MMT test) comparable with the reference material (TCPS). High degree of adherence of the cells to the materal surface (CV test) testifies of potential abilities of the material stimulating proliferation of bone tissue cells. The highes rate of dynamic growth (increase of the cells number after 7 days of incubation) was observed for the material which was modified with CAS fibres and products of their grinding. The performed investigations have a preliminary character. Their results testify for potential osteoconductive or osteoinductive abilities of hybride materials basing on P(L/DL)LA and alginate nanocomposite fibres.

[Engineering of Biomaterials, 100-101, (2010), 110]

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