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.

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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.

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