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Distinct Polymeric Based Materials Prepared/Functionalized by Gamma Irradiation for Biomedical Applications and Roman Mosaics Preservation

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Polymeric based materials are being successfully prepared/modified or functionalized by ionizing radiation processing techniques targeting an increasing number of specific applications in different areas. We have been particularly focused in two reactional systems:
1) Chitosan based copolymeric biocompatible and biodegradable matrices to be used as skin scaffolds for tissue regeneration processes and,
2) PDMS-Silica ormosils (organically modified silicates) hybrid materials for medical applications (bioactive component for bone substitution/reparation /consolidation for orthopedic and dental surgeries) and for the consolidation of ancient Roman mosaics (additive with biocide activity for the composite materials used in ancient mosaics panels conservation processes).

Regarding chitosan based copolymeric biocompatible and biodegradable matrices, a methodology involving freeze-dry of (co)polymeric solutions followed by gamma irradiation from a Co-60 source was tested. In order to compare the performance of matrices concerning cell-matrices interaction, the effect of matrices content in poly(vinyl alcohol) and gelatin was evaluated in terms of matrices'structural properties and cellular viability. Results evidence that for the same radiation dose matrices'composition can be used to tailor the matrices' surface in terms of porosity/roughness. Moreover, in vitro tests revealed that cells adhered and proliferated in all irradiated matrices.

Concerning the preparation of hybrid materials by gamma irradiation we have been investigating the system PDMS-TEOS-PrZr (polydimethylsiloxane, tetraethylorthosilicate and zirconium propoxide, respectively) in different conditions. Materials are prepared by direct energy deposition on a mixture of PDMS silanol terminated (33 wt% fixed content), TEOS and a minor content of PrZr that varied from 1 to 5 wt%, in a closed system under nitrogen atmosphere, using gamma radiation from a Co-60 source. The samples, dried in air at room temperature, are bulk, flexible, transparent and nanostructured. Depending on the polymer Mw and on the amount of PrZr it is possible to tailor the size and distribution of the oxide regions as so the hybrid porosity. Results obtained evidence, although relatively low, their natural bioactivity and biocide activity. The introduction of new components in the hybrid formulation to improve these properties seems to be effective, without compromising their natural affinity and compatibility with the materials to which they are intended to "work together". Preliminary results shows good perspectives for their intended use.

Country/Organization invited to participate

Portugal

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