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New biomaterials for the measurement of the vitamin-D-synthetic capacity of sunlight and artificial UV sources

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The present study summarizes the results of our research on Provitamin D photochemistry in various media directed on the development of reliable method for an in situ monitoring of the Vitamin-D-synthetic capacity (and 'antirachitic' UV dosimetry) of sunlight and artificial UV radiation. Such measurements are especially important given the essential role of vitamin D in maintaining health, as well as the observed pandemic of vitamin D deficiency among the world's population.

The original UV biodosimeter is based on the same photoreaction in vitro by which vitamin D is synthesized in human skin from initial Provitamin D via photo- and thermo-induced monomolecular isomerizations. The targets for UV photons in the biodosimeter are the 7-Dehydrocholesterol (Provitamin D3) molecules embedded in specially designed UV transparent and stable matrix. The dosimeter response to UV radiation is photoinduced conversion of Provitamin into Previtamin D (immediate precursor of vitamin D), and antirachitic UV biodose is determined by the amount of accumulated previtamin D. Effect of a reaction medium on the Provitamin D photochemistry was studied in polymer and hydrogel films, in micelles and in liquid crystalline matrices. Specificity of interaction of provitamin D molecules with different microenvironment affecting its photoconversions is considered.

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Ionizing radiation induced functionalization of chitosan based skin scaffolds

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The present work is part of a Coordinated Research Project from International Atomic Energy Agency (IAEA) and intends to engineer chitosan based matrices using ionizing radiation technology to simultaneously create/sterilize a skin substitute that leads to tissue regeneration. Radiation processing techniques are based on the physical interaction of radiation with matter which are capable of promoting specific chemical reactions. In particular, gamma irradiation, a clean and environmental friendly technology (there is no need of solvents, initiators, high temperatures or final purifying operations once the process leads to no chemical residues) has been successfully applied over the years in the preparation/modification of polymers. By suiting the experimental conditions like irradiation method, dose rate, irradiation atmosphere, samples' absorbed dose, reactants' concentration, etc., it is possible to functionalize polymeric based materials, tailor its properties and adequate them to different applications (mainly through polymerization, crosslinking and/or grafting reactions). Up to the moment particular attention has been given to the correlation between the different preparation conditions and the physical, chemical, structural and biological polymeric matrices' properties. Results show that all tested materials present a non-cytotoxic behaviour.

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