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A NEW ANALYTICAL APPROACH TO CHARACTERIZE THE EFFECT OF γ-RAY STERILISATION ON WOOD

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Abstract

Irradiation with γ rays is widely used in the sterilization of a large variety of products and materials in the field of medical supplies, pharmaceuticals, cosmetics, food industry and cultural heritage. It is also applied on wood materials, with the purpose of improving their shelf-life, by lowering the microbial charge and hence the microbial-related deterioration rate. A fundamental issue when applying γ rays is the preservation of the chemico-physical as well as of the structural and mechanical properties of the materials irradiated, since a significant change of properties may jeopardize the use of the materials for the purpose intended. To this end, in this paper we analyzed the chemico-physical properties of four different types of wood used for the construction of musical instruments namely fir, maple, poplar and durmast oak under increasing doses of γ rays. In detail, the effect of incremental radiation doses was evaluated by comparing the results obtained by acoustic tests with those providing information at molecular level, i.e., cyclic voltammetry, linear square voltammetry and infrared spectroscopy. Moreover, in this work the glucose released as a result of the degradation of wood cellulose and hemicellulose, has been analyzed for the first time, with an innovative tool, based on the use of a Gellan gel. The integrated approach presented here, based on both traditional and innovative techniques has proven to be highly efficient in providing a complete picture of wood behavior following γ-ray irradiation, at both the macroscopic and the molecular level.

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