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Functional Properties and Ecotoxicity of Bionanocomposites Based on PHBV/PLA Blend under Electron Beam Irradiation

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Aseptic food packaging material is therefore essential to preserve food quality over time. For biodegradable packaging, these materials have to be sterilized or decontaminated prior to use to protect against possible microbial contamination. Since our knowledge about polyhydroxyalcanoates (PHA) for food packaging is rather limited, the challenge is to produce biodegradable primary packaging materials which remain stable without affecting mechanical and barrier properties as well as not resulting in toxicological side-effects during both storage and usage. Therefore, the present article reports some experimental data on the oxidative degradation under e-Beam irradiation of neat poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), neat polylactide (PLA) and PHBV/PLA blend (50/50 w/w) with and without organo-modified montmorillonite, i.e. Cloisite 30B (C30B) (3 wt %) at absorbed doses of 1 and 10 kGy. The changes in the chemical structure, the molecular weight, the thermal, mechanical and barrier properties as well as the morphology were evaluated. The data showed that e-Beam irradiation of PHBV/PLA blend leads to oxidation reactions involving ester groups in both neat PLA and neat PHBV resulting in the formation of hydroperoxides groups. The presence of C30B in the polymer blend has no influence on the nature of the degradation process. However, the good dispersion of C30B nanoparticles provides more stability to the molar mass and the thermal, mechanical and barrier properties of PHBV/PLA blend. At absorbed dose of 10 kGy, the irradiated samples are completely safe. Though there were drastic changes in the chemical structure of the blends, there was no resulting toxicity as measured using the luminescent bacteria-based bioassay (Microtox).

Country/Organization invited to participate

Algeria

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