Effects of hydrolytic and Oxidizing Agents on the Properties of Low Density Polyethylene/ Halloysite Nanocomposites for Biomedical Applications

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ABSTRACT

Low density polyethylene (LDPE) nanocomposites reinforced with natural halloysite nanotubes (HNTs) were synthesized and evaluated as a prospective material for biomedical applications via in vitro biostability studies in this work. A twin-screw extruder machine was used to fabricate the examined LDPE & LDPE/HNTs nanocomposites (NCs), followed by in vitro treatment of the prepared NCs via immersion in oxidizing & hydrolytic chemicals for four weeks at 37°C. The materials' in vitro mechanical characteristics were evaluated under these harsh conditions. The analysis showed that the LDPE with 3 wt% HNTs exhibited the best nanofiller dispersion characteristics. This NC also presented smoother surface degradation characteristics compared to the plain LDPE and other LDPE NCs. Furthermore, as compared to plain LDPE, the LDPE NCs showed enhanced mechanical capabilities, and these qualities were less impacted by the in vitro conditions. The introduction of 3 wt% HNTs into the LDPE gave the best in vitro mechanical characteristics. Furthermore, the existence of a better-scattered nanotube structure was thought to offer a more sinuous pathway for the propagation of H2O and the oxidants, thereby reducing their penetration across the matrix chains. Hence, the kinetics of disintegration inside the LDPE molecular chains were slower, resulting in improved biostability.