A Comparative Study on Degradability of NBR and NR Latex Gloves

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Natural rubber (NR) and Nitrile rubber (NBR) gloves are two main types of latex gloves used in the personal protective equipment market. In the face of an abrupt increase in the demand and usage of these gloves due to the present Covid-19 pandemic, degradation of these gloves after usage may create an environmental threat. Therefore, a study was conducted to compare the degradable behavior of these products. Both glove types were treated under thermal and hydrothermal, and UV radiation environments. Untreated samples were used as the control. Under thermal, hydrothermal and photo-oxidative treatments, an increase of the swelling index of untreated NR gloves (65.2%) increased by 38.23%, 14.69% and 7.17%, respectively while NBR gloves showed a percentage swelling index increment of 14.52%, 15.56% and 12.12% with compered to the percentage of the swelling index of the untreated sample (28.77%) in the same order of treatments. The average tensile strength of NR was decreased from 16.89 to 15.67, 11.19, and 15.63 MPa while for NBR it decreased from 28.06 to 24.35, 23.93 and 20.56 MPa after the thermal, hydrothermal and UV exposure, respectively. Hydrothermally treated NR gloves showed new peaks suspected as hydroxyl groups and carbon-carbon triple bonds. Spectra of thermally and hydrothermally treated NBR showed identical loss of the peak responsible for the cyanide group. TGA analysis showed that the initial decomposition temperature of NR has reduced from 365.42 ˚C to 364.95 ˚C, 360.63 ˚C and 365.27 ˚C, respectively after the thermal, hydrothermal and UV treatments. NBR gloves also showed the same trend except for hydrothermal treatment where an increase in initial decomposition temperature was recorded. Overall, hydrothermal treatment was the best degradation method for NR gloves among candidates while exposure to UV radiation exhibited the highest degradation potential for NBR gloves. It was also found that removal of cyanide group when NBR gloves were subjected to hydrothermal degradation.

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