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Identification of carbonyl species of weathered LDPE films by curve fitting and derivative analysis of IR spectra

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Polyethylene exposure to UV radiation leads to oxidation of the original molecular structure. However, the initial polymerization conditions affect the nature and type of chromophoric structures that are able to develop during the photo-degradation processes that the macromolecular structure of plastic films undergo when exposed outdoors. We describe the examination of the weathering degradation of LDPE (low density polyethylene - locally produced B24/2 and imported LDPE 2100T), supplied by two different manufacturers and processed into films for greenhouse coverings, over several months in a sub-Saharan region of Algeria. The three IR regions most affected by weathering degradation are 800-1100 cm^{-1} , 1680-1800 cm^{-1} and 3300-3600 cm^{-1} . The IR spectral region most affected by the aging process is the carbonyl region. Oxidation reactions are very complex and result in a variety of products. A more precise identification of all of the carbonyl species remains very difficult because the corresponding signals often overlap. Only by separating their corresponding signals can an exhaustive identification of all of the components be made. Curve fitting combined with derivative spectroscopy revealed that the composite carbonyl band encompasses more than 10 different oxidation products. The most significant among these in terms of absorbance are carboxylic acids, ketones, aldehydes and esters. The oxidation kinetics with respect to the type of LDPE film shows that B24/2 LDPE undergoes less oxidization than LDPE 2100 T. Calculating the concentrations of different carbonyl species compared to their respective absorbances indicates that the aldehydes are the predominant component of the final compound, rather than the carboxylic acids.

Biography

Wassima Yagoubi has completed her PhD from Laghouat University, Algeria. She worked as physics teacher at high school (1988-1995), Algiers, Algeria. She is working as Assistant Professor in Department of Physics, University of Laghouat since 1995 and at ENS of Laghouat (2015), Laghouat, Algeria.

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