Title : Reverse Engineering, Characterization and Testing of Unknown Polymer Sample

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ABSTRACT

The objective of this research is to study the reverse engineering process for analyzing an unknown polymer sample, focusing on the identification and separation of its main polymer components and various additives. The visual inspection was performed to examine and record the external characteristics of the sample, and a burning test was conducted to study its combustion behavior. Several analytical instruments were used in this study, including a thermogravimetric analyzer for examining thermal degradation behavior and residue content, a differential scanning calorimeter for determining melting points and crystallinity, and a Fourier transform infrared spectrometer for identifying chemical functional groups in polymers. In addition, an ash content test using a chamber furnace was performed to determine the amount of inorganic residue. The analysis results revealed that the sample consisted of a blend of several polymers, primarily ethylene-vinyl acetate, high-density polyethylene, polypropylene, and acrylonitrile-butadiene-styrene, which together accounted for 84.12 wt%. In addition, the sample contained additives, including 13.87 wt% of calcium carbonate and 1.45 wt% of carbon black. From the preliminary calculations, the overall composition of the sample could be effectively determined. These findings demonstrate that the reverse engineering approach is a reliable method for separating and identifying the components of unknown polymer samples. Moreover, this analytical approach can be applied in quality control, product development, and material formulation research.

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