Recycling Polymer Waste from Flooring Materials and Electrical Wire Sheathing

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Abstract:

A systematic, scientific approach was undertaken to optimise processing and product quality in response to persistent challenges in recycling heterogeneous polyvinyl chloride (PVC) waste streams derived from flooring materials and electrical wire sheathings. Feedstock materials were individually characterized using Fourier Transform Infrared Spectroscopy (FTIR) and Thermogravimetric Analysis (TGA) coupled with Gas Chromatography-Mass Spectrometry (GC-MS). Preliminary results confirmed the predominant presence of PVC with trace amounts of plasticisers and stabilisers, as evidenced by distinct carbonyl peaks (1700–1750 cm^{-1}). TGA of flooring-derived PVC revealed a two-stage degradation profile, with a 50% mass loss near 250 °C and an additional 30% reduction between 350–400 °C, leaving a residual mass of 10–20% and releasing hydrogen chloride. In contrast, electrical wire sheathings exhibited degradation near 300 °C, losing almost 80% of mass under a controlled heating regime (N_2 to 700 °C, then air up to 900 °C). Injection-moulded specimens were prepared for further mechanical evaluation, including planned tensile testing, DSC, and hardness assessments. Moreover, strategies for dust mitigation during grinding were explored. Additionally, systematic feedstock pre-assessment and optimisation of mixing ratios were performed to minimise equipment wear and improve safety. A comprehensive datasheet was compiled to guide recycling operations and serve as a reference for future process enhancements.

Keywords:

Polyvinyl Chloride, Recycling, Plasticisers, Stabilisers, Feedstock, Injection Moulding.