Recycling of Rubber Waste from Latex Products industries

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Abstract

This research investigates the recycling potential of two types of waste rubber generated during condom production: waste of pre-vulcanized natural rubber latex (WPVNR) and rejected condoms. First, a novel coating material is developed using blends of natural rubber (NR) latex and commercial acrylic emulsion. Blending pre-vulcanized natural rubber latex (PVNR) with WPVNR in the NR latex base creates a sustainable material for painting and coating applications. Increasing the acrylic emulsion proportion reduces the viscosity of the mixture, enhancing adhesion, drying, and application of the coating. Film properties are evaluated through mechanical testing, water, acid, and alkali swelling resistance, revealing optimum performance at 30%wt acrylic emulsion. The practical application demonstrates its ease of use and rapid drying. Second, conductive rubber nanocomposites are successfully fabricated by incorporating multi-walled carbon nanotubes (MWCNTs) into recycled condom waste. Three devulcanization processes: physical, thermomechanical, and thermochemical are evaluated, yielding three recycled rubbers with varying cross-link densities. The dense network domains within the recycled rubber regulate CNT dispersion in the nanocomposites, promoting the formation of segregated networks. Concurrently, the CNTs effectively entangle and connect at low filler concentrations. This research demonstrates the efficient recycling of both WPVNR and rejected condom waste into valuable materials with potential applications in coatings and conductive composites. This study also provides sustainable and upcycling approaches to managing rubber waste while minimizing environmental impact.

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References

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