Eco-Advancements in Elastomers: Bio-Based Rubbers, Polyurethane Foams, and TPVs

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Abstract

The rapid evolution of elastomer technology has ushered in a new era of sustainable materials with profound implications for industries reliant on flexible, durable, and eco-friendly solutions. This presentation explores the recent eco-advancements in three key elastomeric categories: Bio-based rubber, Polyurethane foams, and Thermoplastic vulcanizates (TPVs).

Bio-based rubbers represent a paradigm shift towards renewable resources, utilizing raw materials derived from plants and biomass to manufacture elastomers. This eco-friendly approach mitigates reliance on finite petrochemical sources and reduces carbon footprint, contributing to a more sustainable and circular economy. We studied the synthesis and characterization of solid/liquid polymers, exploring the transformative potential of farnesene, dibutyl itaconate, and styrene through emulsion and Diels-Alder reactions, focusing on their application in innovative rubber compounds.

Polyurethane foam, used in many applications such as automotive sound absorption parts, has undergone a transformative green conversion. Our research propels the evolution of bio-based polyurethane foams by preparing bio-polyols derived from bio-waste. Bio-polyol synthesis from spent coffee grounds takes center stage in our endeavors, promising comparable performance to traditional counterparts and a substantial reduction in environmental impact. The properties of the foams were investigated.

In the realm of thermoplastic elastomers, the focus has shifted towards TPVs–a particular class of materials that combine the flexibility of elastomers with the processability of thermoplastics. The processing and fabrication of bio-based plastic and rubber materials for diverse applications can achieve enhanced sustainability. Our study involves processing and characterizing bio-plastic-based TPVs to propel these materials to innovation.

Thus, these eco-advanced elastomers not only address the growing demand for greener alternatives but also force the elastomer industry towards a circular economy.

Keywords: Bio-based elastomer, Liquid rubber, Eco-polyol, Spent coffee grounds, Bio-based thermoplastic vulcanizates

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