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Quasi-Static Behavior of Palm-Based Elastomeric Polyurethane: For Strengthening Application of Structures under Impulsive Loadings

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Abstract: In recent years, attention has been focused on elastomeric polymers as a potential retrofitting material considering their capability in contributing towards the impact resistance of various structural elements. A comprehensive understanding of the behavior and the morphology of this material are essential to propose an effective and feasible alternative to existing structural strengthening and retrofitting materials. This article presents the findings obtained from a series of experimental investigations to characterize the physical, mechanical, chemical and thermal behavior of eight types of palm-based polyurethane (PU) elastomers, which were synthesized from the reaction between palm kernel oil-based monoester polyol (PKO-p) and 4,4-diphenylmethane diisocyanate (MDI) with polyethylene glycol (PEG) as the plasticizer via pre-polymerization. Fourier transform infrared (FT-IR) spectroscopy analysis was conducted to examine the functional groups in PU systems. Mechanical and physical behavior was studied with focus on elongation, stresses, modulus, energy absorption and dissipation, and load dispersion capacities by conducting hardness, tensile, flexural, Izod impact, and differential scanning calorimetry tests. Experimental results suggest that the palm-based PU has positive effects as a strengthening and retrofitting material against dynamic impulsive loadings both in terms of energy absorption and dissipation, and load dispersion. In addition, among all PUs with different plasticizer contents, PU2 to PU8 (which contain 2% to 8% (*w*/*w*) PEG with respect to PKO-p content) show the best correlation with mechanical response under quasi-static conditions focusing on energy absorption and dissipation and load dispersion characteristics.

Keywords: palm-based polyurethane; elastomer; impulsive loadings; quasi-static; retrofitting; trengthening

1. Introduction

In recent years, substantial efforts by various researchers have been assessed to identify novel and cost-effective solutions, and their feasibility to minimize damage to buildings and infrastructures caused by terrorist activities and accidental explosions [1–7]. The use of elastomeric polymers to