
ABSTRACT

Natural rubber (NR) is a versatile material having vast applications in day to day life starting from baby feeding nipples, footwear, clothing, gaskets & seals, pipes, conveyors and transmission belts, shock absorbers and isolators, tyres and much more. With the growth of population in the world and rise in industrialization on one hand and increasing per capita consumption of rubber throughout the universe on the other hand, the need of natural rubber has been much higher than its supply. The development of petroleum-based synthetic rubber has eased out the situation to some extent but could not restrict the price fluctuation and meet the specific requirements. The tropical requirement of NR trees has limited its area for plantation throughout the world. Under the circumstances, the search for a natural rubber source which can also be grown in climates other than tropical regimes will be of a potential alternative of the NR. It is answered by none other than Guayule natural rubber (GNR). It is also known as Mexican rubber, primarily grown in the arid region of Mexico and Arizona, USA.

In the present work, GNR is extensively analyzed in different forms and compared with NR in respective conditions. The different physical and chemical properties of GNR have been determined and found comparable with that of NR. GNR chemically modified with phosphorylated cardanol prepolymer by grafting (PCP-g-GNR) has been proved to be a multifunctional additive. The PCP-g-GNR used as an additive not only improves the rolling resistance and wet-skid resistance properties but also reduces the requirements of the processing oil. The use of the PCP-g-GNR can lead us to achieve the green tyre and cost effectiveness with ease of processing. Moreover, the abrasion resistance of NR and GNR based formulations improves significantly with the addition of PCP-g-GNR. The property variations of GNR with the different fillers such as carbon black (HAF), nano silica, precipitated silica and nano fly ash has been discussed in detail. This thesis also reports an easy and interesting devulcanization process followed by comparing the physicochemical properties of GNR and NR revulcanizates at similar conditions. Therefore, GNR presents itself as an alternate to NR which can be modified, blended and devulcanized for its easy and early adoption by the rubber industry.

Keywords: Guayule natural rubber, phosphorylated cardanol prepolymer grafted GNR, multifunctional additive, devulcanization, revulcanizate, alternate natural rubber source.
