The study focuses on the preparation of elastomeric compounds based on natural rubber (NR) and a filler – cellulose (CEL) at various temperatures ranging from 95 °C, 110 °C and 140 °C. The influence of mixing temperature and filler content on the mechanical properties of the elastomeric blends was examined. The prepared blends were analysed for hardness, tensile strength, and elongation at break before and after thermo-oxidative ageing (TOA).

Based on the results, it is evident that the mixing temperature during the first stage has a significant influence on the mechanical properties of elastomeric compounds containing a cellulose filler (NR/CEL), both before and after thermo-oxidative aging. Before thermo-oxidative aging, the influence of mixing temperature was most pronounced at higher filler content (55 phr), where the compound mixed at 95 °C exhibited the highest hardness. Higher mixing temperatures (110 °C and 140 °C) led to a decrease in hardness, likely due to intensified matrix chain scission, resulting in a reduction of molecular chain length. The most notable impact of mixing temperature on tensile strength was observed in compounds with 27.6 phr of filler, with the maximum tensile strength recorded at a mixing temperature of 110°C. Both the filler content and the mixing temperature had also an influence on elongation at break. The highest elongation was achieved by the compound prepared at 110 °C with 27.6 phr of cellulose filler.

Thermo-oxidative aging (TOA) significantly affected all elastomeric compounds. In formulations with lower filler content (27.6 phr), hardness values decreased post-aging compared with same compounds before TOA. The decreasing hardness values can be attributed to degradation of the polymer matrix. Tensile strength values increased with rising mixing temperatures, regardless of the filler content. Elongation at break generally declined following TOA, with the most substantial reduction observed in the compound containing 27.6 phr of cellulose mixed at 110 °C.

Based on the findings obtained, it can be concluded that the optimal filler content (cellulose) in a natural rubber-based compound is 27.6 phr. The most suitable mixing temperature during the first stage of NR/CEL compounds preparation appears to be 110 °C.