Effect of Manganese on Radiation Vulcanization of Natural Rubber

Wasikur Rahman[ab*], Jahangir Alam[a] & Maksudur Rahman Khan[b]

[a] Department of Chemical Engineering, Jessore University of Science and Technology, Jessore, Bangladesh

[b] Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Kuantan, Malaysia

ABSTRACT

Manganese was added as a promoter to investigate physico-mechanical properties of radiation-vulcanized natural rubber latex (RVNRL) films. RVNRL films were prepared by the addition of Mn with the concentration range 0–30 ppm to natural rubber latex and irradiated with various radiation doses (0–20 kGy). Tensile strength, tear strength, and cross-linking density of the irradiated rubber films increased with increasing the concentration of Mn ions as well as radiation doses. In contrast, elongation at break, permanent set, and swelling ratio of the films were decreased under the same conditions. The concentration of Mn ions and radiation doses were optimized and found to be 20 ppm and 12 kGy, respectively. The maximum tensile and tear strengths of irradiated rubber films were observed as 29.12 MPa and 44.78 N/mm, respectively at the optimum conditions. The mechanical properties of the films increased markedly with the addition of Mn until they attained the highest values of 33.88 MPa and 54.77 N/mm, respectively. These enhancements, which reached approximately 20% at the most favorable conditions, can be explained by the effect of transition metals in view of Fajan's rules regarding the covalent character of ionic bonds and suggest that the higher the difference in charges between cation and anion, the higher the ability to form distortion or polarization of ions.

KEYWORDS: Irradiation, Manganese, Natural rubber, Tensile properties, Vulcanization

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