# RUBBER RECYCLING: COMPATIBILIZATION OD WASTE TIRE RUBBER AND POLY(ETHYLENE-CO-VINYL ACETATE) BLENDS USING LIQUID RUBBER AND ELECTRON BEAM IRRADIATION.

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Accumulation of rubber waste is a pressing global issue. Tires are complex bulky rubber composite which has received global recycling attention. At the end of life, tires are collected, shredded, segregated, ground and down-sized into rubber recyclates, more commonly know as waste tire rubber. These waste tire rubber, having undergone a lifetime on the road and downsizing processes, has poor properties and is not favoured in high-end applications. Many researchers have attempted to blend waste tire rubber with plastic to produce thermoplastic elastomer. However, one of the most prominent drawbacks of these thermoplastic elastomers was the poor interfacial adhesion which results in poor mechanical properties.

In this study, the above-mentioned problem was addressed by blending 50 wt% of reclaimed waste tire rubber (WTR) with 50 wt% of poly(ethylene-*co*-vinyl acetate) (EVA) which was compatibilized using liquid styrene-butadiene rubber (LR). Compatibilized blends were prepared using an internal mixer. The blends were later subjected to electron beam irradiation with doses ranging from 50 to 200 kGy. While compatibilization on its own did not distinctly enhance the properties of the blends, the irradiation remarkably enhances mechanical, thermal and dynamic mechanical properties of the blend by at least 2 folds compared to un-irradiated blends.

FIG 1 shows the schematic representation of RTR/EVA blend compatibilization by LR. RTR phase is encapsulated by LR, efficiently decreasing the interfacial tension. This improves the dispersion of RTR in EVA matrix. Similar observation was also reported in GTR/LDPE blends compatibilized by elastomers [1]. Furthermore, the free chains of LR can co-mingle with both free devulcanized chains of RTR and EVA matrix, improving the interfacial adhesion. Upon irradiation, both EVA and RTR can be adhered together through formation of crosslinks between these co-mingling chains.

FIG 2 illustrate the storage modulus of the control blend (50RTR) and 3 wt% LR compatibilized blends (50RTR/3LR) before and after irradiation. All the blends, before and after irradiation clearly displayed glass, transition and rubbery characteristics in the storage modulus curve. Storage modulus was highest in the glassy region and rapidly decreases from transition region and displayed a plateau rubbery curve. Before irradiation, LR compatibilized blend showed decrease in the storage modulus in glass and transition region compared to 50RTR blend. This is expected due to plasticizing effect of LR. However, irradiation tremendously improved the storage modulus throughout the temperature range. This is due to increase in the elasticity of the blend with efficient crosslink formation in LR.

## REFERENCES

[1] FORMELA, K., KOROL, J. & SAEB, M. R. Interfacially modified LDPE/GTR composites with non-polar elastomers: From microstructure to macro-behavior. Polymer Testing, 42 (2015) 89-98

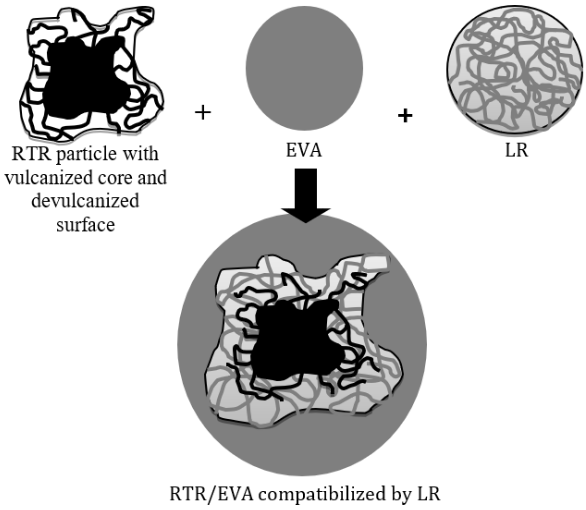


*FIG 1 Schematic representation of RTR/EVA blend compatibilization by LR*

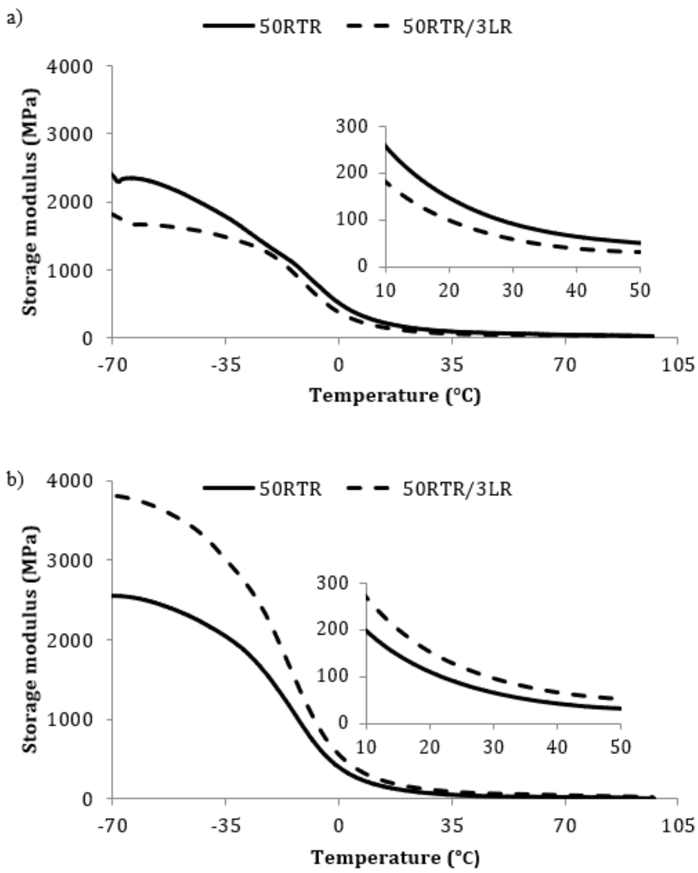


*FIG 2 Storage modulus of 50RTR and 50RTR/3LR a) before and b) after irradiation*