

CHAPTER 4 : CONCLUSION

4.1 Findings

The incorporation of PEG showed shorter cure time and scorch time and faster cure rate for compounds with and without Si-69. This indicates that PEG could fill up the roughness of the silica surface and prevent adsorption of accelerator at the grooves of the silica surface.

Viscosity of the compounds had increased with the addition of PEG. The compounds without Si-69 showed higher viscosity compared to the compounds with Si-69. This is due to the plasticizing effect contributed by Si-69 which is not observed with the use of PEG.

Tensile strength did not show any improvement with the addition of low level of PEG in the presence of Si-69. A reduction at higher levels of PEG was observed instead. In the absence of Si-69, tensile strength is slightly better with addition of 0.5 pphr PEG. However, reduction of tensile strength was observed at higher level of PEG. Upon ageing, no improvement was shown in tensile stress-strain properties with addition of PEG.

The addition of PEG appears to improve the tear strength of compounds with Si-69 to levels better than that of the compounds without Si-69.

The incorporation of PEG had resulted in lower storage modulus, E' for the compounds with Si-69 but increases slightly for the compounds without Si-69.

The addition of PEG had resulted in inferior cut growth resistance especially for the compounds with Si-69.

A summary of the effect of incorporation of PEG on compound properties are as tabulated in Table 26. From statistical analysis, some properties had demonstrated a general linear trend with addition of PEG. The properties with r^2 greater than 0.80 are shown in Table 27.

	With 1 pphr Si-69	Without Si-69
Cure time	Shorter	Shorter
Scorch time	Shorter	Shorter
Cure rate	Faster	Faster
Mooney viscosity	Increases	Increases
Crosslink density	Reduces	Increases for 0.5 pphr but reduces at higher levels
Tensile strength	Reduces at higher levels	Increases for 0.5 pphr but reduces at higher levels
Elongation at break	Similar	Similar
M300	Increases for 0.5 pphr but reduces at higher levels	Reduces
Hardness	Similar	Slightly inferior
Resilience	Similar	Slightly better
Tear strength	Improves	Similar
Heat build-up	Similar	Similar
Tan δ	Similar	Similar
Storage modulus, E'	Decreases	Increases slightly
Cut growth resistance	Inferior	Increases slightly for all levels of PEG except at 5 pphr
Abrasion resistance	Slightly better	Slightly better

Table 26 : Summary of effect of PEG incorporation on compound properties

With 1 pphr Si-69	Without Si-69
Δ (Torque)	Cure rate
Heat build-up	Δ (Torque)
Tear strength	M300

Table 27 : Summary of properties with r^2 greater than 0.80

4.2 Suggestions for Further Work

4.2.1 Use of PEG in other types of rubber compound formulation.

4.2.2 Use of PEG in other types of cure system.