

LIQUID ISOPRENE RUBBER AS A SAFE PROCESSING AID IN NATURAL RUBBER COMPOUNDS

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In order to overcome the emission of carcinogenic 'polycyclic aromatic hydrocarbon' from aromatic oils, which are restricted in European countries since 2010, various efforts have been made to replace the aromatic oil in rubber-based compounds either fully or partially. Liquid isoprene rubber (LIR) was used as a reactive plasticizer in natural rubber (NR) compound at different loadings (2, 4, 6 and 8 phr) and its effect on viscosity, curing characteristics and physico-mechanical properties. The results were compared with those of the control compound containing conventional aromatic oil as plasticizer. The minimum torque for the control compound was 0.33 dNm and that for LIR based compounds ranged between 0.16 and 0.56 dNm. The LIR based compounds exhibited a slightly higher Mooney viscosity but offered the same scorch safety. The results support the utility of LIR as a promising alternative as revealed by the comparable rheological and physico-mechanical properties that are attained with the usage of appropriate quantity of LIR, unlike the other alternatives of the previous investigations that usually showed a difference in the properties.

Key words: Aromatic oil, Liquid rubber, Reactive plasticizer, Safe processing oil

INTRODUCTION

While designing a rubber compound for any intended application, the four major parameters to be considered are (i) physico-mechanical properties, (ii) ease of processing, (iii) cost and (iv) the regulations. The performances can be tuned by appropriately selecting suitable rubber, compounding ingredients such as filler, plasticizer, curatives *etc.* and the process conditions including temperature, pressure and duration. The impact of these ingredients, under the given processing and service conditions, on the ecosystem are also important.

Among the compounding ingredients, it is well known that, process oils such as aromatic, naphthenic and paraffinic oils, are widely used to improve the processability of various natural and synthetic rubber compounds based on their compatibility. Traditionally, they are used as extender oils due to its low price. Among them, the aromatic oil [distillate aromatic extracts (DAE)] is the single largest oil used in rubber compounds. However, in 1994, a report by the Swedish National Chemicals Inspectorate showed that polycyclic aromatic hydrocarbon (PAH), which is one