

SYNTHESES AND EVALUATION  
OF ANTIOXIDANTS  
BASED ON  
MANNICH REACTION  
IN NATURAL RUBBER COMPOUNDS  
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A B S T R A C T

The polymers are exposed in their commercial applications to agencies such as light, oxygen, ozone high energy radiation, mechanical stress, moisture, atmospheric pollutants of industrial origin and various combinations of these. Synthetic materials of increasing chemical complexity have been synthesised in a continuing search for materials which are more resistant to the many degradative agencies.

Commercially available hindered phenols such as 2,6 di-tert butyl phenol and cardanol and secondary amines such as dimethylamine, piperidine and morpholine were used for the synthesis of antioxidants. The Mannich reaction was used and the compounds were successfully synthesised with satisfactory yields. The Mannich bases thus formed by the Mannich reaction were reacted with carbon disulphide to form the corresponding dithiocarbamates. These were also obtained in satisfactory

yields. The Mannich bases and dithiocarbamates of meta cresol were also prepared using the above amines.

The structures of the synthesised compounds were confirmed by using the instrumental techniques such as infrared, nuclear magnetic resonance and mass spectroscopy.

The cure characteristics of the vulcanisates with the synthesised compounds were determined using a Monsanto Rheometer. It is evident from the results that they exert a beneficial effect on the cure. Accelerated ageing tests viz. oxygen absorption, tensile strength and continuous stress relaxation were carried out to evaluate the ageing behaviour. The compounds synthesised based on cardanol compounds i.e. N (8,11 penta deca dienyl) hydroxy benzyl dimethylamine and N(8,11 penta deca dienyl) hydroxy benzyl dimethylamine dithiocarbamate were found to be quite efficient as antioxidants compared to the conventional antioxidants. It is also seen that dithiocarbamates perform the function of antioxidants and accelerators whereas the Mannich bases function mainly as antioxidants.

The physical properties of the vulcanisates with the synthesised compounds, were also determined. The initial tensile strength values of these vulcanisates are comparable with the vulcanisates containing conventional antioxidants. The initial MOD values at 100% and 300% elongation, of the vulcanisates with the synthesised compounds were better than the vulcanisates with the conventional antioxidants.

The derivatives of cardanol showed satisfactory antioxidant effects. The source of cardanol which is the cahsew nut shell liquid is available as a commercial product in Sri Lanka. Therefore, it seems that there is potential for the industrial implementation for the syntheses of the derivatives of cardanol.