Abstract No: 181 ***Natural Sciences***

DEVELOPMENT OF BIODEGRADABLE POLYMER COMPOSITE FOR GLOVE MATERIAL BASED ON NATURAL RUBBER AND SCREW-PINE LEAVE PARTICLES

H.G.T.H. Jayatunga*

Department of Chemistry, Faculty of Science, University of Kelaniya, Sri Lanka
**thanujayatunga@gmail.com*

Natural rubber (NR) glove industry attracts a vast area of natural rubber-based industries in Sri Lanka. In the production of NR gloves a considerable waste materials are produced causing disposal problems which in turn resulting in environmental issues. As a solution to these environmental issues, a natural rubber composite was developed which possessing enhanced biodegradability of NR latex gloves. In this study, the natural rubber latex (60% w/w) was blended with Screw-pine leaf particles. Screw-pine leaves were dried, ground and sieved to obtain particle sizes less than 180 µm. Natural rubber latex solution was then prepared by adding all the compounding ingredients such as, zinc oxide, zinc diethyldithiocarbamate, zinc mercaptobenzothiozole, diphenylguanidien, sulphur, rolax and a dispersing agent. Screw-pine particles were added to the final dispersion to obtain 0.5%, 1.0%, 1.5% w/w of filled polymer composites. Then, the latex films were cured at 120 °C for 3 min and 50 s. The biodegradability of both filled and unfilled samples were checked by the soil burial method. Weight-loss was used as the parameter to check the biodegradability. The water absorption capacity was measured by soaking above mentioned samples in water. Tensile and tear strengths were measured for both filled and unfilled samples. The fourier transform infrared spectroscopy (FTIR) and thermogravimetric analysis (TGA) were done for samples with the maximum mechanical properties, screw-pine filled sample (0.5% w/w) and for unfilled sample.

The biodegradability has increased with increasing screw-pine particle concentration. Screw-pine mainly contains cellulose (≈50%) and also hemi-cellulose, lignin, starch *etc*. Microorganisms use these plant fibers in their metabolic pathways. This fact was used to enhance the biodegradability of natural rubber composite since Screw-pine particles can be degraded by microorganisms. Degradation is not only done by microorganisms but also *via* physical methods such as by UV irradiation and by heating. The tensile strength and tear strength have decreased with increasing filler concentration. These changs could be due to changes in structural properties of the polymer and also due topoor physical interactions between screw-pine particles and polyisoprene. In the FTIR spectrum if 0.5% screw-pine filled sample, two new peaks (1494.71 cm^{-1}, 1402.72 cm^{-1}) are identified. These two additional peaks give evidence for the presences of new interactions in the filled sample. According to the TGA, onset temperature of thermal degradation of unfilled polymer sample and 0.5 % screw-pine filled polymer sample are 280 °C and 273 °C, respectively. Hence, the unfilled sample is thermally more stable than that of the 0.5% screw-pine filled polymer sample. The purpose of this research is to enhance the biodegradability of natural rubber while retaining higher mechanical properties. 0.5% w/w screw-pine particle filling gives highest biodegradability to natural rubber.

Financial assistance given by the University of Kelaniya is acknowledged.