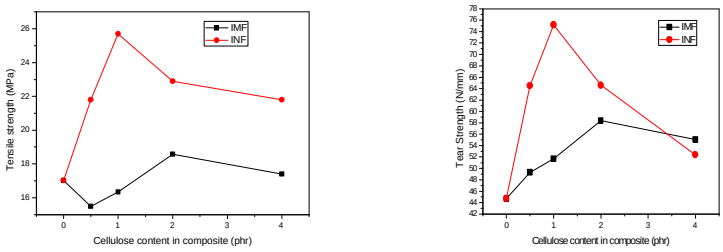
DEVELOPMENT OF POLYMER BIO NANOCOMPOSITES USING NANOCELLULOSE OBTAINED FROM ISORA FIBRES

Lovely Mathew P[a*], Sabu Thomas[b], Jithin Joy[a]

[a]Department of Chemistry, Newman College, Thodupuzha, Kerala, India
[b]Centre for Nano science and Nano Technology, M.G.University, Kottayam, Kerala.
*Corresponding author; lovely.mathew@gmail.com

ABSTRACT

Natural fibre reinforced polymer composites have raised great interests among material scientists and engineers in recent years due to the need for developing an environmentally friendly material. In this work, Isora nano cellulose (INC) was prepared from a novel fiber, Isora by an eco-friendly biological method. Isora is cellulose rich fiber separated from the bark of Helicteres isora plant by retting process. Phanerochaete Chrysosporium is selected as suitable organism for biological delignification due to its high lignin degrading efficiency. After the treatment of fibre by the enzyme produced from the organism by solid state fermentation process, the size of fiber reduced to micro level. Cellulose micro fibrils [IMC] so obtained are subjected to bleaching followed by acid hydrolysis and homogenization to obtain the fibril in the nano level [INC]. The obtained nano cellulosic fibres are characterized by TEM, AFM and FESEM, WAXRD. Rubber micro and nanocomposites are prepared using IMC/INC via a two-step process involving (a) master-batch preparation of IMC/INC in NR latex and (b) two-roll mill mixing of the master batch with solid Natural rubber and vulcanizing agents followed by subsequent curing. Significant improvement in mechanical properties of the composites is observed at relatively low filler loadings. Addition of IMC/INC increases the tensile strength and modulus values accompanied by a moderate decrease in elongation at break. Abrasion resistance, compression set and hardness are also enhanced due to the IMC/INC loadings in NR. Thermal ageing for 2 days at 70^0c, increase the tensile properties of the composites due to post curing on ageing. Composites with 2phr IMC and 1 phr INC respectively show maximum mechanical properties. Nanocomposites show enhancement in tensile properties than micro composites at comparatively still lower filler loadings The nano composite with 1 phr INC shows an increase in tensile properties to an extent of 51% and tear strength of 68 %.. SEM analysis of the tensile fractured surfaces of the composites revealed better interfacial adhesion between the rubber and the reinforcement at comparatively low filler loadings.



(a) (b)

Figure 1(a)Variation of tensile strength and (b) tear strength with filler loadings

Key words
Isora, Delignification, Phanerochaete chrysosporium, nanocellulose, Natural rubber, nanocomposites.

Acknowledgement
The Investigators are grateful to Kerala State Council for Science Technology and Environment for giving the financial support for completing the work.

References:

1. Jacob, M.; Varughese, K. T.; Thomas, S. *Biomacromolecules* **2005**, 6, 2969.
2. Jacob, M.; Varughese, K. T.; Thomas, S. *J ApplPolymSci* **2006**, 102, 416.
3.. Grunert, M.; Winter, W. T. *J Polym Environ* **2002**, 10, 1.
4. Oksman, K.; Mathew, A. P.; Bondeson, D.; Kvien, I. *Compos SciTechnol* **2006**, 66,,2776.