

Physicochemical and Micromechanical Investigation of A Nanocopper Impregnated Fibre Reinforced Nanocomposite

Md. Najmul Kabir Chowdhury^a, Ahmad Fauzi Ismail^a, Maksudur Rahman Khan^b, Mohammad Dalour Hossen Beg^b, Mohd Hafiz Dzarfan Othman^a, Rasoul Jamshidi Gohari^{ac} and Ali Moslehyani^{ad}

^aAdvanced Membrane Technology Research Center, University Technology Malaysia, 81310 Johor Bahru, Malaysia

^bFaculty of Chemical & Natural Resources Engineering, University Malaysia Pahang, 26300 Gambang, Kuantan, Malaysia

^cDepartment of Chemical Engineering, Islamic Azad University, Bardsir Branch, Bardsir, Iran

^dDepartment of Chemical and Biological Engineering, University of Ottawa, 161 Louis Pasteur St., Ottawa, Canada

ABSTRACT

This paper outlines the synthesis of a novel sustainable nanocomposite and the investigation of its physicochemical and mechanical properties using micromechanical models. As a novel approach, palm oil fibres were treated with freshly prepared nanocopper sols to make them strong and sustainable. Nanocopper particle impregnated strong and durable fibres were used to develop a fibre reinforced unsaturated polyester resin nanocomposite. The composite behavior was investigated systematically by using Fourier transform infrared spectroscopy, X-ray diffraction, scanning electron microscopy, thermogravimetric analysis, differential scanning calorimetry, *etc.* Among all of the composites tested, the nanocopper particle impregnated strong and durable fibre (30%) reinforced unsaturated polyester resin composite was demonstrated to have the highest mechanical strength. The change of weight gain follows typical Fickian diffusion behavior. To predict the strength of the nanocomposite, standard micromechanical models were analyzed and the trends were seen as mixed success. The observed properties of the developed nanocomposites indicate that they can be considered for indoor to outdoor applications.

DOI: 10.1039/C5RA19021E