World Academy of Science, Engineering and Technology
International Journal of Materials and Textile Engineering
Vol:10, No:06, 2016

Chemical Modifications of Three Underutilized Vegetable Fibres for Improved Composite Value Addition and Dye Absorption Performance

Authors : Abayomi O. Adetuyi, Jamiu M. Jabar, Samuel O. Afolabi

Abstract : Vegetable fibres are classes of fibres of low density, biodegradable and non-abrasive that are largely abundant fibre materials with specific properties and mostly found/ obtained in plants on earth surface. They are classified into three categories, depending on the part of the plant from which they are gotten from namely: fruit, Blast and Leaf fibre. Ever since four/five millennium B.C, attention has been focussing on the commonest and highly utilized cotton fibre obtained from the fruit of cotton plants (Gossypium spp), for the production of cotton fabric used in every home today. The present study, therefore, focused on the ability of three underutilized vegetable (fruit) fibres namely: coir fiber (Eleas coniferus), palm kernel fiber and empty fruit bunch fiber (Elias guinensis) through chemical modifications for better composite value addition performance to polyurethane form and dye adsorption. These fibres were sourced from their parents' plants, identified and cleansed with 2% hot detergent solution 1:100, rinsed in distilled water and oven-dried to constant weight, before been chemically modified through alkali bleaching, mercerization and acetylation. The alkali bleaching involves treating 0.5g of each fiber material with 100 mL of 2% H2O2 in 25 % NaOH solution with refluxing for 2 h. While that of mercerization and acetylation involves the use of 5% sodium hydroxide NaOH solution for 2 h and 10% acetic acid- acetic anhydride 1:1 (v/v) (CH3COOH) / (CH3CO)2O solution with conc. H2SO4 as catalyst for 1 h, respectively on the fibres. All were subsequently washed thoroughly with distilled water and oven dried at 105 0C for 1 h. These modified fibres were incorporated as composite into polyurethane form and used in dye adsorption study of indigo. The first two treatments led to fiber weight reduction, while the acidified acetic anhydride treatment gave the fibers weight increment. All the treated fibers were found to be of less hydrophilic nature, better mechanical properties, higher thermal stabilities as well as better adsorption surfaces/capacities than the untreated ones. These were confirmed by gravimetric analysis, Instron Universal Testing Machine, Thermogravimetric Analyser and the Scanning Electron Microscope (SEM) respectively. The fiber morphology of the modified fibers showed smoother surfaces than unmodified fibres.The empty fruit bunch fibre and the coconut coir fibre are better than the palm kernel fibres as reinforcers for composites or as adsorbents for waste-water treatment. Acetylation and alkaline bleaching treatment improve the potentials of the fibres more than mercerization treatment. Conclusively, vegetable fibres, especially empty fruit bunch fibre and the coconut coir fibre, which are cheap, abundant and underutilized, can replace the very costly powdered activated carbon in wastewater treatment and as reinforcer in foam.

Keywords : chemical modification, industrial application, value addition, vegetable fibre
Conference Title : ICTCME 2016 : International Conference on Textile Composites, Materials and Engineering
Conference Location : New York, United States
Conference Dates : June 06-07, 2016