ABSTRACT

This study focuses on the extraction and characterization of natural fibers from stems of *Sesbania bispinosa* (Jacq.) W.Wight, *Leptadenia pyrotechnica* (Forssk.) Decne., and *Aloe vera* L. for sustainable applications in the textile industry. The methodology used includes water retting for *Sesbania bispinosa* and *Aloe vera*, while chemical retting using NaOH, and urea for *Leptadenia pyrotechnica*. Mechanical, biochemical, and morphological properties were assessed. The average moisture content of fibers after drying in oven at 105°C for 3 hours, of *Sesbania bispinosa, Leptadenia pyrotechnica,* and *Aloe vera* was 6.78%, 6.27% and 7.69% respectively. The average water absorption was 390.3%, 1484.5% and 7.69% respectively. The average ash content was 7.7%, 8.6% and 12.8% respectively. The average %age yield was 37.21%, 13.40% and 8.86% respectively. The fiber diameter of *Sesbania bispinosa* range from 55µm to 92µm, *Leptadenia pyrotechnica* range from 20 µm to 27 µm and that of *Aloe vera* ranges from 13 µm to 22 µm. The density of the fibers was found to be 1.54 g/cm^3, 1.3 g/cm^3 and 1.1 g/cm^3 of *Sesbania bispinosa*, *Leptadenia pyrotechnica* and *Aloe vera* stem fibers respectively. The tensile strength testing showed that *Sesbania bispinosa* fibers had the highest tensile strength of 25 N, *Leptadenia pyrotechnica* fibers, with 24-25 N and *Aloe vera* fibers, with 5-6 N. *Sesbania bispinosa, Leptadenia pyrotechnica,* and *Aloe vera* fibers contain high cellulose content (89.4%, 41.5%, and 83.3% respectively). Also include hemicellulose (28.8%, 18.03%, 44.67%) and lignin (10.64%, 58.5%, 16.67%). The FTIR spectrum of these plant fibers shows peaks indicating -OH, C-H, C≡C, C=O, and C-O functional groups, showing cellulose, hemicellulose, and lignin in the fibers. XRD analysis shows the percentage crystallinity of 6.84%, 16.94% and 13.13% respectively in these plant fibers. TGA (DSC) analysis indicates that fibers of *Sesbania bispinosa* decomposes at 100-400°C, *Leptadenia pyrotechnica* at 250-450°C and *Aloe vera* at 250-400°C. The UV visible spectrum of ethanolic extract of fibers of *Sesbania bispinosa* shows a maximum absorbance at 282.2 nm, *Leptadenia pyrotechnica* at 221.2 nm while *Aloe vera* at 201.1 nm indicating strong UV light absorption. SEM analysis of these fibers at different magnifications of (1.01KX, 501X, 250X and 92X) shows morphology of nodes, ridges on the rough surface. Antimicrobial test demonstrated that these fibers had strong antibacterial effects against *Escherichia coli*, *Bacillus licheniformis*, and *Staphylococcus aureus*. The results of this study indicate that these fibers have potential to use for textile purposes.