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Green Approach to Develop Antimicrobial Fabric using *Garcinia zeylanica* and Tea Waste Extract

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Abstract

Recently, there is an upsurging interest in textile industry towards production of antimicrobial fabrics due to their potential for reducing the transmission of infections. These products are of greater interest in sportswear industry and medical/healthcare industry due to the high moisture content that aggravate the microbial growth in sportswear and high exposure to pathogenic microorganisms in hospital settings. Fabric provides a hospitable growth surface to microorganisms resulting in irritation of the skin, development of body odor and finally deterioration of the fabric. The main objective of this study was to develop an antimicrobial fabric using a natural origin in a sustainable manner. Natural antimicrobial agents are important in terms of their bio-compatibility, eco-friendliness and low or zero toxicity to human body. *Garcinia zeylanica* which is an endemic plant to Sri Lanka and tea dust are two natural resources that can be easily found in the country. Aqueous and ethanolic crude extracts of these were characterised using UV-Vis spectra and, FTIR spectroscopic techniquesa and Total Phenolic content studies. Aqueous and ethanolic extracts of *G. zeylanica* showed inhibition of 120.5 mm and 140.5 mm against *Escherichia coli* respectively and inhibitions of 140.5 mm and 170.5 mm against *Staphylococcus aureus* respectively. Aqueous and ethanolic extracts of tea dust showed inhibition of 100.5 mm and 130.5 mm against *S. aureus* respectively. Optimisation of the dyeing pH and temperature were carried out and on cotton, nylon and polyester fabric in order to compare the effect of dyeing on natural fibers vs synthetic fibers. Using aqueous and ethanolic solutions of concentration of 5% by weight of the solvent the pre-mordanted fabric (by ferrous sulphate) were dyed, under the optimised conditions. The antimicrobial activity of aqueous and ethanolic extracts of *G. zeylanica* and tea dust were investigated using well-diffusion assay whereas the antimicrobial activity of dyed fabric were investigated via disc-diffusion assay. Aqueous and ethanolic extracts of *G. zeylanica* and tea dust showed pronounced inhibition against *S. aureus* and *E. coli* while no antifungal activity was observed against *Candida albicans*. Polyester fabric dyed from ethanolic extract of *G. zeylanica* and tea dust showed inhibition of 90.5 mm and 120.5 mm against *S. aureus* respectively, when a discs of 6 mm were used. Hence, it can be concluded *G. zeylanica* and tea dust can be used to give fabric an antimicrobial finish naturally.

Keywords: Green approach, *Garcinia zeylanica*, Tea waste, Antimicrobial, Fabric, Ferrous sulphate, *Staphylococcus aureus*, *Escherichia coli*