

## **ABSTRACT**

Textiles are considered to be an integral part of human life, since they are associated with the human body round the clock. Owing to the 360° usage of textiles, it is obvious that people will expect functional characteristics such as comfort, healthcare and hygiene properties in clothing. The outcome of any activity is decided by the comfort level of the human body and mind. A sound mind and a sound body will result in sound output. Due to various physical activities, the heat and the sweat generated in the body moistures the clothing and when the clothes are saturated with the mismatch of rate of sweating and rate of absorption and evaporation, the wearer becomes tired due to the condensation of sweat. One of the most important types of comfort in clothing is thermo physiological comfort which regulates the body temperature through effective moisture and temperature management. Hence, clothing should mainly provide the thermo physiological comfort for a smooth and efficient working.

The healthcare characteristics are also expected much in clothing to protect the human being from the adverse effects of outside environment resulting in infections and various diseases. The bacterial and viral infection is a common phenomenon in human's life causing number of diseases from fever to major malfunctioning of important body parts. Depletion of the ozone layer over Antarctica is to be noted as an alarm which is going to cause dangerous health hazards like skin cancer to human beings due to the penetration of UV rays from the sun directly reaching earth. These points are to be addressed by giving special attention for the sake of the well-being of the future generation.

Hence, this research work aims at specifically identifying new approaches with the aid of technological advancements. This work focuses on investigating the above mentioned characteristics through developing natural based treatments such as herbal finishes and charcoal applications with a specific attention on comfort and hygiene properties as their effects. Researches have already been carried out and continued with neem and bermuda grass finishes on textiles for their antimicrobial and other medicinal properties; however, specific focus on comfort related characteristics is very much limited which is to be explored. In spite of the convincing properties of the synthetic fabrics, they are not much preferred because of their hydrophobic nature and poor moisture management leading to less comfort to the wearer.

Hence, in the first part of this research work, an attempt has been made to explore the possibilities of using the natural medicinal herbs for imparting the thermo physiological comfort properties on textile materials for the first time. Two herbs i.e. the well known neem and a novel, less explored herb, the bermuda grass, have been chosen and subjected to extraction for the preparation of finishing solution. The finishes were applied on 100% Polyester and 50/50 Polyester/Acrylic blended synthetic fabrics. The finished fabrics were tested for thermo physiological comfort properties such as wetting, wicking, water vapour permeability, air permeability and thermal conductivity. It has been found that the treatment has resulted in the improvement in most of these properties with significant increase in moisture properties, little reduction in thermal conductivity and a slight compromise decrease in air permeability. Washing studies have revealed good durability of these finishes on the fabrics. The results have been comparatively discussed between the fabrics treated with the two different herbs.

The use of bamboo charcoal fibres, yarns and fabrics has assumed importance in recent times since they exhibit excellent functional properties like anti-bacterial, de-odouring, far infra-red rays absorption and emission, wicking, healthcare, moisture absorption, water vapour permeability, etc. It is to be noted that the availability of bamboo charcoal fibres, yarns and fabrics are limited and that too from a few parts of the world. Moreover, the manufacture of bamboo charcoal fibres involves the addition of charcoal powder in the polymer of certain synthetic fibres which is a complicated process for spinning fibres and yarns. The particle will interfere with the dynamics of fluid flow and so the spinnability would be affected. Additionally, if these particles are included in the dope, it would require more quantity to exhibit certain level of performance compared to those applied on the surface or near surface applications i.e. in the case of finishing method. Another concerning factor is the cost which is very high when compared with the regular fibres, yarns and fabrics.

In the second part of this work, the thermo physiological comfort properties were investigated on textile substrates through application of charcoal particles. Two different materials have been chosen for the purpose, i.e. the less explored for comfort properties, bamboo and novel neem for charcoal preparation. The charcoals from the selected materials were prepared under specified temperature and the particles were obtained at submicron level by top-down method. The charcoal micro particles were characterized for particles size and distribution through particle analyzer. The average particles size was found to be in the submicron range i.e. 350 nm – 400 nm. The charcoal particles were applied on to 100% cotton, 100% polyester and 65/35 P/C blended woven fabrics. The treated fabrics were tested for thermo physiological comfort properties such as wetting, wicking, water vapour permeability, air permeability and thermal resistance. It has been found that the treatment has resulted in the improvement in most of these properties with

significant increase in moisture properties, improvement in thermal conductivity due to a reduction in thermal resistance with a slight compromise decrease in air permeability. SEM and FTIR of the treated and untreated fabrics reveal the presence of the particles.

Additionally, the charcoal treated fabrics were also subjected to hygiene tests such as antibacterial and UV protection (UV Protection Factor, UPF) and have been found that the treated fabrics have developed antibacterial and UV protection properties. Washing studies have revealed good durability of the charcoal treated fabrics. The results of the study have been comparatively discussed between the fabrics treated with two different charcoal particles.