

## **ABSTRACT**

Among the vast categories of medical textile products, hospital textiles such as bed linens, uniforms and mattresses are expected to fulfill hygienic and comfort properties such as breathability, moisture management property, thermal conductivity, wettability, wickability and antimicrobial activity. The commercially available hospital textiles, made of fibers like cotton, polyester and their blends, have moisture absorbency and heat transportation properties which are not sufficient to transmit the body heat and fluids, leading to a moist laden atmosphere on the skin which is conducive for the growth of microorganisms like bacteria, fungus and virus. Similarly, the mattresses provided in the hospitals are made of hard polyurethane foam, covered with water proof coated fabrics, over which single layered cotton bedspread is used, which makes the patient highly uncomfortable due to the heat generated and strain produced on the contact areas.

The functional requirements of hospital textiles have led to the innovative use of a variety of natural and manmade fibers with enhanced comfort and hygienic properties in the development of new products for medical textiles. This research work is an attempt towards developing hospital textiles using the new generation comfort fibers and their blends.

From the survey carried out in ten hospitals in and around Coimbatore, it was observed that hospital bed linens suffer from higher friction and lower air and water vapour permeability. Similarly the existing

hospital mattress exerts pressure to the level of more than 33 mmHg on certain parts of the body like head, hip, seat and heel which causes frictional festers with unbearable pain on the contact areas.

Through this research work single and multilayered hospital textiles were developed using fibers like lyocell, micro lyocell, polyester, micro polyester, bamboo, bamboo charcoal and their blends. Lyocell, a regenerated cellulosic fiber is used as the major component for constructing hospital textiles, because of its good breathability, moisture absorption, smooth fiber surface, low wet cling tendency by maintaining dry and cool micro climate on the skin.

To produce single layered hospital textiles, lyocell/polyester and micro lyocell/micro polyester blended yarns were produced with two blend ratios such as 70:30 and 85:15 and from each blended yarn, three different fabrics were produced with plain, 2/2 twill and 1/3 twill weave structures. Since polyester-rich fabric lags in comfort characteristics and are not suitable for hospital textile applications, the proportion of polyester in the blend was limited to 30%.

After scouring and desizing, the fabric samples were analyzed for their comfort and moisture management properties. Among the lyocell/polyester blended fabrics, the lyocell rich fabrics show an improvement in comfort properties and addition of polyester improves the moisture management properties.

Similarly as the proportion of micro polyester increases in the micro polyester/micro lyocell blended fabrics, the strength, elongation, air permeability and drying rate of the fabric increases.

Union fabrics were produced from bamboo/lyocell, bamboo:cotton/lyocell and bamboo charcoal/lyocell fiber combinations by varying the lyocell yarn proportion in warp and weft ways. From the analysis of comfort properties, it was observed that, combining lyocell with bamboo yarns has proved to be advantageous in improving the strength and enhancing the comfort properties of the resultant fabrics. Presence of lyocell content in the fabric increases the strength, air permeability and moisture management properties of the fabrics.

Similarly the positive attributes of the three skin friendly fibers like cotton, lyocell and bamboo were found to be more suitable for medical textile applications. The bamboo charcoal and lyocell blended union fabrics also possess higher microbial resistance and comfort characteristics required for hospital textiles.

In an attempt to develop multi layered structures for hospital textiles, tri-layer knitted and woven fabrics were developed which has a combination of two fabric layers compounded by a binding yarn. The multi layered fabrics have better comfort and moisture management properties.

A pressure relieving mattress with an air circulation device was also developed to reduce the heat generation and point pressure exerted on contact areas of the body. A comparison of the interface pressure measurement

of the conventional mattress and pressure relieving mattress developed recorded a pressure reduction of 30% to 60% due to the highly soft nature of the hollow fiber filled part of the mattress which deforms to fit to the shape of the body, thereby increasing the area of contact between the body and the mattress leading to pressure distribution to more area.

A wireless communication device was developed which could be integrated into the apparel worn by the patient or to the hospital bed linen, through which the mobility impaired patient could communicate to people within five kilometers. This wireless communication device has a woven antenna fixed onto the clothing which acts as a receiver and transmitter of audio signals.

The single and multi layered hospital textiles developed has improved comfort and hygienic properties than the existing hospital textiles. The pressure relieving mattress developed reduces the strain on the patients to great extent.