

ABSTRACT

Increasing concern over damage caused by exposure to microbes, chemicals, pesticides, UV light and pollutants in the last few years, has heightened the demand for protective garments. Clothing today is expected to be waterproof, flame resistant, self cleaning, insect repellent and antimicrobial to protect human beings from infection, UV light, chemical and biological agents, be warmer in winter and cooler in summer while at the same time being light and less bulky than current solutions. The consumers are demanding textile products with higher performances, even in the “traditional” clothing and home textiles areas as the world market of textiles is becoming highly competitive. Therefore, researchers have made many attempts to impart more functional characteristics to textile fabrics so as to get multifunctional applications.

Modal fabric is a cent percent bio-based rather than natural made from the spun reconstituted cellulose of beech trees. The reason for this is that although the fabric is made from natural raw material it undergoes chemical processing. Modal fabrics are very soft and smooth with the ability to absorb up to 50% more water than cotton. Fabric made from modal drape well and do not pile like cotton. It dyes like cotton and is color fast when washed in water. Modal fabrics resist fading, shrinking and the buildup of hard water mineral deposits even after repeated washing.

The textile fabrics used in this study were as follows;

I) Woven Fabrics: a) Modal (100%): yarn count (both warp and weft) – 27, GSM - 146, ends per inch – 84, picks per inch – 94; b) Cotton (100%): yarn count (both warp and weft) –30, GSM - 137.2, ends per inch – 94, picks per inch – 74; and c) Modal / Cotton (50 : 50) blend: yarn count both warp and weft – 30, GSM - 142.7, ends per inch – 94, picks per inch – 77.

II) Knitted Fabrics: a) Modal (100%): yarn count – 27.5, GSM 137, loop length–2.6 mm; b) Cotton (100%): yarn count – 30, GSM - 142, loop length–2.6 mm; and c) Modal / Cotton (50 : 50) blend: yarn count – 28.4, GSM 141.7, loop length–2.6 mm.

Natural dyes (kum kum, indigo, bar berry) and synthetic dyes (reactive dye (H), reactive dye (M) and sulphur dye) used were in the commercial grade.

The study was conducted on woven and knitted modal (100%), cotton (100%), and modal / cotton (50 : 50) blended fabrics. These fabrics were pretreated suitable for main treatments such as dyeing and finishing. The pretreated fabrics were subjected for natural dyeing using kum kum, bar berry and indigo and synthetic dyes such as reactive (cold and hot) and sulphur dye.

The modal (100%), cotton (100%), and modal / cotton (50 : 50) blended fabrics after dyeing using natural and synthetic dyes were undergone for various testing's. The fabrics (Modal (100%), cotton (100%) and modal / cotton (50:50) blend) were tested for physical properties such as tensile strength, drape coefficient and dyeing studies such as color strength, fastness properties (wash, light and rub) and spectroscopic study (FTIR), microscopic study (SEM), functional finishing properties such as antimicrobial, softening, UV finishing, antiodor finishing, soil release and wrinkle free.

The functional properties such as antibacterial wrinkle free, silicone softener, UV protection, antiodor and soil release properties were subjected to these fabrics. The functional finished fabrics were tested for their properties according to EN ISO 20645, AATCC 100 test to determine the antibacterial efficiency, AATCC 183 – 1999 test to determine the UV protection efficiency, organoleptic evaluation to determine the antiodor efficiency, Antipilling testing according to IS 10971-94 to determine the silicone softener efficiency, crease recovery testing to determine the wrinkle free efficiency and soil release efficiency testing according to AATCC 130 – 2000 for soil release analysis.

Modal and Modal / Cotton (50 : 50) blended woven fabrics are good in tensile strength, stiffness and crease recovery angle, whereas cotton woven fabric is good for mean drape coefficient. However among the knitted fabric cotton is good in bursting strength and mean drape coefficient.

The absorbency and wicking characters of modal fabric and modal / cotton (50 : 50) blended fabrics (woven and knitted) are good similar to that of cotton fabrics.

FTIR analysis reveals the presence of chromophore and auxochrome confirm the dye characteristics of natural dye (kum kum).

The colorimetric values of natural dyed (kum kum, indigo and barberry) and synthetic dyed (reactive (H & M), and sulphur) modal and modal /cotton (50 : 50) blended fabrics are good and with the expected value suitable for textiles and garments. This is no way inferior to that obtained on cotton fabric.

The wash fastness of dyed modal and modal / cotton (50 : 50) blended fabrics are good similar to those obtained on cotton fabric.

Similar to wash fastness the light fastness and rub fastness in dry state are good for modal, and modal / cotton (50 : 50) blended fabric dyed with kum kum, indigo, bar berry, reactive dyes (H and M) and sulphur dyes compared with those obtained on cotton fabric.

The antibacterial character of modal fabric in its original form and its blend with cotton dyed with both natural dye (kum kum, indigo and bar berry) and synthetic dye (reactive (H & M) and sulphur) is good when compared with the corresponding cotton fabric.

The mechanical and surface properties of the dyed and finished fabrics (modal, cotton and modal / cotton (50 : 50) blend) were objectively assessed by Kawabata evaluation system (KES-F).

The presence of finishing substrates of the dyed and finished fabrics (modal, cotton and modal / cotton (50 : 50) blend) were assessed by SEM analysis.

The presence of functional groups present in the dyes of the dyed and finished fabrics (modal, cotton and modal / cotton (50 : 50) blend) were assessed by FTIR analysis.

Other finishing treatments such as silicone treatments, antiodor treatments, uv treatments are good on modal, modal / cotton (50 : 50) blended fabrics similar to that of cotton fabric.

The various finished fabrics were constructed as different healthcare and protective garments. These garments were subjected to comfort evaluation and the results of which were excellent.

Hence from the overall results it could be concluded that modal fabric and modal / cotton (50 : 50) blended fabrics woven and knitted could be suitable for most of the garment purposes with excellent behaviors.