

## ABSTRACT

The increase in technologies has witnessed a number of advances in the textile industries, especially for medical and hygienic uses. Chemical treatment of cotton cellulose to alter physical properties of the fibers without changing their fibrous form is a common practice in the textile industry to achieve the desired finishing effects. Cotton is considered as the king of the textile fibers based on its overall properties suitable for the end use products. To enhance the functional properties of the cotton fabrics, it is essential to treat them with the suitable chemicals without reducing the needed aspects of the materials. Hence, in this research work, it was decided to treat the cotton fabrics with suitable chemicals so as to receive the functional characteristics. 100% woven and knitted cotton fabrics were selected and treated with i) sodium hydroxide of 15% (owm), ii) morpholine 40% (w/v), and iii) cellulase enzyme 4% (owm) concentrations respectively. These treated fabrics were then subjected with chitosan of 2% (owm) concentration followed by natural (25 gpl) and synthetic (2% owm) dyeing. The treated and finished fabrics were then tested suitably for the necessary aspects.

The physical properties of treated cotton (woven and knitted) fabrics (sodium hydroxide treated, morpholine treated, cellulase treated and untreated) dyed with annatto, onion, pomegranate, indigo, myrobalan, barberry, reactive dye, and sulphur dyes are good and are within the tolerance limit. The drop absorbency of cotton these treated fabrics dyed with annatto, onion, pomegranate, indigo, myrobalan, barberry, reactive dye, and sulphur dyes is good. The cotton fabrics after treatment with the chemicals (sodium hydroxide, morpholine, and cellulase enzyme) when applied with chitosan followed by dyeing, the overall absorbency is increased considerably particularly in the sodium hydroxide treated one.

The sodium hydroxide treated fabric shows maximum water retaining behaviour followed by the morpholine treatment and cellulase enzyme treatment. The cotton fabrics treated with sodium hydroxide, morpholine, and cellulase enzyme when undergo the application of chitosan followed by the dyeing, there is a steady increase in the water retention in all the dyed fabrics, however the sodium hydroxide treated fabrics show an edge over all the other materials. The sodium hydroxide treatment influences more on the wicking behaviour followed by morpholine treatment and cellulase treatment. The difference in the wicking behaviour of the dyed cotton fabric is only marginal. The cotton fabrics treated with different chemicals when applied with chitosan followed by the dyeing, there is an increase in the wicking behavior comparatively in all the dyed fabrics, however the sodium hydroxide treated fabrics show an considerable increase over all the other materials. The chemical treated cotton fabrics applied with chitosan and dyed with annatto, onion, pomegranate, indigo, myrobalan, barberry, reactive dye and sulphur dyes give good values of water vapor permeability. Similar trend is also available for air permeability behavior of the cotton.

The K/S value of chitosan applied sodium hydroxide treated cotton fabric is maximum when compared with morpholine treated, cellulase treated and untreated cotton fabrics. Among the dyes applied on the cotton fabric, there is only a marginal difference in the K/S values; however reactive dye shows the maximum K/S values. The sodium hydroxide treated and dyed chitosan applied cotton fabric (woven and knitted) shows improved wash and light fastness compared to the corresponding morpholine treated, cellulase treated and untreated cotton fabrics. The rubbing fastness in dry state is extremely good than that of wet state. The reactive dyes show marginal high value of rubbing fastness than other dyes (annatto, onion, pomegranate, indigo, myrobalan, barberry, and sulphur dye) applied on woven and knitted chitosan applied cotton fabrics in the dry state. The stain resistance of

synthetic dyes is more compared to those of natural dyes applied on both woven and knitted chitosan applied chemical treated cotton fabrics.

The smoothness is observed more on the chitosan applied and dyed sodium hydroxide treated cotton fabric followed by morpholine treated, enzyme treated and untreated cotton fabrics. The stiffness of the fabrics is reduced due to the sodium hydroxide treatment, morpholine treatment and enzyme treatment followed by chitosan treatment and dyeing. The fullness is maximum on the sodium hydroxide treated cotton fabrics followed by morpholine treated, enzyme treated and untreated fabrics. In general, the primary hand value is maximum for the sodium hydroxide treated fabrics followed by morpholine treated, enzyme treated and untreated / dyed and chitosan applied & dyed woven and knitted cotton fabrics. The chemical treatments reduce the bending lengths on the cotton fabrics; and sodium hydroxide treatment tops the list in this reduction followed by morpholine and enzyme treatments. The crease recovery both in warp and weft directions of dyed and chitosan applied and dyed cotton fabric treated with sodium hydroxide is minimum compared to morpholine treated, enzyme treated and untreated cotton fabrics.

All the chemical treated dyed woven and knitted chitosan applied cotton fabrics showed a higher zone of inhibition against staphylococcus aureus when compared to escherichia coli. In general, the sodium hydroxide treated chitosan applied cotton fabric shows a higher zone of inhibition (both by staphylococcus aureus and escherichia coli) followed by morpholine treated, cellulase treated and untreated cotton fabrics.

The maximum UPF value is given by the sodium hydroxide treated (dyed only and chitosan applied & dyed) and UV finished cotton fabrics followed by morpholine treated, and cellulose enzyme treated one. There is a very good UV protection category as revealed by UPF rating for the dyed and

finished cotton fabrics. The anti odour behaviour of dyed woven and knitted chemical treated cotton fabrics is very good as assessed by subjective evaluation technique.

The SEM images and FTIR spectra show the effect of sodium hydroxide treatment, morpholine treatment and cellulase enzyme treatment and chitosan application on the woven and knitted cotton fabrics. The chitosan applied and dyed sodium hydroxide treated cotton fabric gives good appearance in the SEM image and FTIR spectra followed by morpholine treated and enzyme treated.