

ABSTRACT

In the present scenario of environmental awareness, the new quality requirements of textile products not only emphasize on the intrinsic functionality and long service life of the product but also a production process that is environmental friendly. Therefore research on environmental friendly colorants and antimicrobial agents based on natural products for textile application is gaining worldwide interest. Recently there has been increasing interest in using microorganisms as a source of color or antimicrobial agent since they require less labour, land, and cost effective solvents for extraction as opposed to higher plant materials. In this research work, pigment from the fungal species namely *Thermomyces* is extracted, characterized and applied onto silk, cotton and wool fabrics for imparting color and antibacterial activity. Two kinds of products namely silk suture and woollen socks are also developed and characterised. The summary of work carried out is discussed in the following sections.

The fungal pigments from the *Thermomyces* species are extracted and characterized using UV-Visible spectrometer, Chromatography and FTIR spectra. Subsequently, dyeing and antimicrobial behavior of the pigments against wool, silk and cotton fabrics are analyzed. Color strength, fastness properties and antibacterial activity of silk and wool fabrics are found to be good compared to cotton fabric. Hence, further studies are carried out with silk and wool fabrics.

For improving the coloration and antimicrobial activity of silk and wool fabrics, process conditions are optimized, Box-Behnken experimental design is formulated using three levels and three variables with pH, temperature and time as independent variables and K/S, wash, rubbing & light fastness and bacterial reduction (%) as dependent variables. The optimum concentration of the pigment is observed at 2% on weight of the fabric for both silk and wool fabrics and the optimum conditions for dyeing and antibacterial activity of silk fabrics are 60° C, 30 min at 3 pH and wool fabrics are 30° C, 60 min at 3 pH. Silk and wool fabrics are also exposed to low temperature plasma and subsequently treated with natural fungal extract *Thermomyces* and the effect of plasma treatment on coloring behavior, fastness properties and antibacterial activity are analyzed. The result showed that plasma pretreatment enhances both the wool and silk fabrics color intensity by 5%, wash fastness by 3%, rubbing fastness by 2% and antibacterial activity.

Sutures from silk filaments are also developed using a circular braiding machine. Silk sutures are treated with pigments from *Thermomyces* of different concentrations 1.5%, 2.0% and 2.5%, and its effect on the properties of silk sutures such as tenacity, knot strength, friction and antimicrobial activity are studied. The result showed that the pigment concentration in the selected range has no significant effect on friction, tenacity and knot strength of silk sutures. Antimicrobial test results showed that as the pigment concentration increases the antimicrobial activity also increases against both *E. coli* and *S.aureus* bacteria. At 2.5% concentration, a zone of inhibition of 10 mm and 14 mm are observed against *E.coli* and *S.aureus* respectively.

Socks from woollen yarns are also developed through circular knitting machine. Woollen socks are subsequently treated with pigments from *Thermomyces* and its effect on various properties such as tensile, abrasion, fastness and antimicrobial behavior are analyzed. The results showed that there is no loss in the tensile and abrasion behavior of pigment treated woollen socks but there is a significant improvement in the antimicrobial property. The pigment treated woollen socks also exhibits excellent perspiration fastness, good rubbing fastness and moderate wash fastness properties.

