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## Study on the antibacterial and anticancerous properties of herbal finished textile fibers for the development of sanitary napkins

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### Abstract

Natural herbs used by the women during their menopause time in the olden days was selected and investigated for its antibacterial activity after finishing onto cotton fibres. The study was aimed to understand the antibacterial and anticancerous properties of the herbal extract finished fibres; so that the fibres shall be used for the development of sanitary napkins. Cotton fibres was procured along with medically significant herb (Turmeric). The herbal extraction was carried out using a standard Soxhlet extraction method. The extracts was finished onto the fibres as herbal composites using a standard dyeing procedure. The mordant sodium chloride was added to impart permanent colour to the fibres. The surface change in the fibres if any was also determined under Scanning electron microscope. As expected for the antibacterial potential of the selected herbs in the study, the antibacterial activity of the herbal composite finished fibres were analyzed using standard EN ISO 20645 test method.

**Keywords:** Sanitary napkin, cotton, viscose, medicinal herbs

### Introduction

Menstruation is a monthly occurrence that requires access to appropriate materials and facilities, without which, females suffer from poor menstrual hygiene which restricts their movement and self-confidence. Good menstrual hygiene is crucial for the health and dignity of girls and women. Sanitary napkin is an absorbent item worn by a woman while she is menstruating. The key property requirements of hygiene products are to absorb and retain menstrual fluid discharge which is a complex viscous mixture of water, salts and cells; barrier performance for containment and absorption without leakage, comfort and breathability, wicking and wetting behaviour, mechanical properties, sterilization stability, antimicrobial properties without skin irritant tendencies which are achieved by suitable raw material choices and design considerations (Jassal, 2011) <sup>[1]</sup>. Menstruation is a process in which woman discharge blood and other material from the lining of the uterus at an interval of about 28 to 35 days from puberty until menopause. It causes serious problems to the women if not managed properly. This menstrual discharge can be absorbed by some absorbent material. The functional requirement of a feminine hygiene product is to absorb and retain the menstrual fluid so that back tracking of fluid does not happen and at the same time it should be odor free. Commercially available menstrual hygiene pads are made up of material which may seem innocuous but they are laced with dioxins, petrochemicals, artificial fragrances etc. These chemicals come in contact with sensitive skin tissue, can cause skin irritation. Cellulosic chlorine bleached pulp; rayon which is used to increase absorbency of pad contains dioxin leads to cervical cancer irregular growth in reproductive organs. In the context of menstrual hygiene some kind of protection is necessary for every girl during menstruation. It is realized that there is a strong need for a hygienic product for menstrual protection worldwide. The micro-organisms easily grow on surface where fabric is in the direct contact with body. In this sense sanitary napkin is prone to microbial infestation. *Staphylococcus aureus* is a leading cause of human infections and can survive best at human body temperature (37 °C). It may cause a variety of diseases including impetigo, cellulitis, food poisoning, toxic shock syndrome, necrotizing pneumonia, endocarditis, and sepsis (Voyich *et al*, 2005) <sup>[4]</sup>. To avoid infections and diseases caused by these micro-organisms textile material, specially the sanitary napkin, need to have some antibacterial activity. The turmeric extract (*Curcuma longa*) gel extracted antimicrobial finish is herbal, eco friendly, non irritant, and suitable for textiles.

It has been found very effective against the growth of micro-organisms that is bacteria and fungi, as it does not support the growth of these micro-organisms. So there is a need to develop techniques to impart antimicrobial agents to the textile substrates, which do not alter the textile properties. There are many natural products which show antimicrobial properties. The main objective of this study was to evaluate the antimicrobial properties of turmeric against *E. coli*.

#### Procurement of cotton fibers and herbs

The absorbent cotton fibre was obtained from local market of Kanpur. Herbal powders of turmeric were also obtained from organic store of Kanpur. Whole research work was done during the month of August 2019 to October 2019.

#### Extraction of herbal oil and coating of cotton fibers

About 100 g of curcuma longa were extracted with 250 ml of ethanol using soxhelt operator. The extract was stored at RT for further use. The extract was then coated on the cotton fibers and evaluated for antibacterial activity.

**Antibacterial activity:** Antibacterial activity of herbal coated cotton fiber was evaluated against *E. coli*. In this process the pre measured size 2 cm of the test cotton fiber was tested against *E. coli* plated on the surface of Muller-Hinton agar plate, previously seeded with an overnight culture of test organism and incubated at 37°C for 24 to 48 hours. Antibacterial activity was measured as the diameter of the zone of inhibition.

#### Wicking properties of fibers

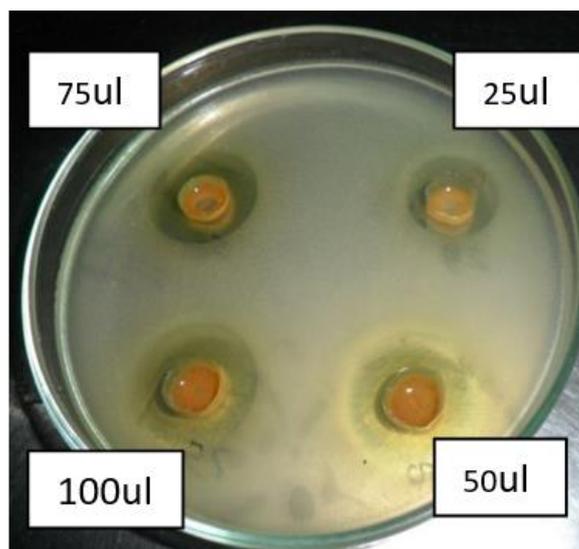
Vertical Wicking of Textiles, is used to measure "the ability of vertically aligned fabric specimens to transport liquid along and/or through them. This property is important to measure fabrics ability to remove liquid from contact body. The wicking properties were analyzed for control fiber and test fiber by placing the sample in a standard atmosphere of 22c under 65% relative humidity for 24 hours. 1.5 to 10 cm sized samples were mounted on the glass slides and kept immersed in a reservoir containing artificial blood. The wicking height of the advancing liquid front as a function of time was recorded by visual observation after 5 minutes. Using a standard ruler scale, the color of artificial blood absorbed on the fiber surface was measured for each sample and the values were recorded.

#### Result and Discussion

Plants produce a wide variety of natural chemical compounds which have different biological functions which have different defense mechanisms (Joshi *et al* 2009) [3]. Healing properties of some herbal plants have been using since ancient times and in present time these properties have been evaluated for various products. Although there are many plant derived compounds which have antimicrobial properties but their use for textile industry depends upon durability allergic reactions, antimicrobial potential, shelf life etc. Hence in the present work turmeric was chosen for the coating of sanitary napkins, as it is a treasure of beneficial compounds. Turmeric has been found very effective as antiseptic antimicrobial etc. Sanitary products treated with natural herbal extracts help in regarding the spread of infection, decrease inflammation, reduce the vaginal infection, remove the unpleasant odour, provide comfort to the wearer (Shanmugasundarama and Gowda, 2010) [2]. There are very few studies, wherein efforts have

been made to exploit these ecofriendly bioactive natural products for textile application in a systematic way. So a need was perceived to impart antibacterial herbal finishes to the sanitary napkins as no related work has been reported in this sector. During the application of these extracts to the textile substrate, there may be the blocking of the active functional groups which are responsible for the antimicrobial activity, which may result in the loss of physical and other performance properties such as air permeability, stiffness of the treated textiles (Joshi *et al.*, 2009) [3].

There are many factors which are responsible for the antimicrobial activity of curcuma. Curcumin is the compound which is responsible for the antimicrobial action. The inhibitory zones indicate the antimicrobial potential of the herbal extracts. The antimicrobial activity of the turmeric (*Curcuma longa*) extract was determined against *E. coli* by well diffusion method. The results obtained in the evaluation of the antibacterial activity of extract of the selected plant against *E. coli* are shown in figure. Four different concentrations *viz.* 25, 50, 75 and 100ul were used, 100ul concentration showed better zone of inhibition in comparison to the all tested concentrations. Thus, from this study it is clear that this extract can be used for the finishing of cotton and viscous fiber furnishing. There are many reports which clearly indicate that turmeric can be used as antimicrobial control.



**Fig 1:** Antimicrobial action of Turmeric extract on *E. coli*

The wicking properties were evaluated by time for wetting. During the analysis it was observed that both treated and non-treated textile fibers showed the same wicking properties. This clearly indicates that existing herbal dye concentration did not inhibit the wicking capacity of the finished fibers. The herbal dye treated cotton fiber has the same level of blood absorbency as the non-treated fibers.

#### Conclusion

In the present work we selected *Curcuma longa* extract for the finishing of textile fibers based on its antimicrobial property. The selected herb is commonly used in food preparations and is very effective in antiseptic and antimicrobial agent. The selected were used on textile fibers and their antimicrobial activity was checked. Results of antimicrobial and wicking properties clearly declare it as ecofriendly and secure sanitary napkin for use. The developing ease of this sanitary napkin is also very convenient.

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