

Development of antimicrobial cotton fabric by application of Chitosan, Methylene Blue and Rose Bengal

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Abstract: Textiles have long been recognized as media that favor the growth of micro-organisms. Natural fibers are particularly problematic in this respect; in the case of cotton, carbohydrates can act as nutrients for microbial growth. In this context, cotton constitutes around 90% of all natural fibers, being the most used for manufacturing clothing, home textiles, industrial products, and even hospital goods. Its cultivation is the main one in terms of natural fibers [1].

Functionalizing textiles to make them antimicrobial is a current practice with much potential for many applications. Among the techniques that achieve an antimicrobial effect, photoactive dyes that achieve light-driven antimicrobial photodynamic inactivation have significant advantages over their metallic counterparts due to their reduced toxicity, low cost and synthetic versatility. Among the dyes whose singlet oxygen production capacity has been widely demonstrated is the cationic dye Methylene Blue, classified as a basic dye (Cl. Basic Blue 9) and the anionic dye Rose Bengal (Cl. Acid Red 94), classified as an acid dye. Both dyes have been widely used in medical applications, but their use in textiles is minimal [2].

Especially in cotton dyeing, the literature on its use is very limited since none of these dyes has an affinity for cellulosic fibres. In the case of methylene blue, a mordant is needed to help the dye adhere since it is a basic dye. In the case of Rose Bengal, in addition to the mordant, a fixative is required to allow the dye to adhere to the fibre so that it does not come off during washing.

Given the affinity and solidity problems generated by dyes, the use of chitosan as a mordant has been studied because it is a cationic polysaccharide with multiple properties such as antibacterial action, biodegradability, hydrophilicity, non-toxicity, biocompatibility and adsorption properties [3].

The main objective of this study is to obtain photoactive cotton fabrics by optimizing the dyeing process in which two photoactive dyes, with opposite charges and no affinity for the fiber, are used. To achieve this goal, it will be necessary to apply treatments that increase affinity, such as mordanting with chitosan and to carry out the dyeing in different steps so that there is no interference between the charges of the dyes, as well as the final application of a fixative reagent, that helps to improve the fastness of the dyes. In the process, the concentration of the dyes in the

wastewater and the color of the fabrics obtained were determined to evaluate the efficiency, and different washes were applied to assess the loss of color. The biocide behavior was proven against some gram-positive, gram-negative bacteria and virus.

Keywords: Acid Red 94, Basic Blue 9, affinity, mordant.



Figure 1 Cotton fabric dye with Methylene Blue and Rose Bengal

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