



STUDYING THE PROPERTIES OF IMPARTING ANTIBACTERIAL FEATURES TO COTTON FABRICS WITH ALOE VERA EXTRACT

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ABSTRACT

Health and hygiene are one of the main factors for a person to live comfortably and work with maximum safety. For this reason, a number of scientific studies are being carried out on a global scale. One of the pressing issues in scientific directions in the textile industry is the production of environmentally friendly protective textile products. Currently, there is a demand for the production of textile products with antibacterial properties, processed in an environmentally friendly, technologically efficient and cost-effective manner, based on natural products

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A large number of scientific studies have been conducted by scientists around the world on imparting antibacterial properties to textile products. These researchers have conducted studies on antimicrobial agents applied to cotton fabric with various types of binders. During the research, many scientists achieved results against wash-resistant and perfect microbes. However, they provided no information about the toxicity or environmental compatibility of antimicrobial agents and binders. [1-5].

In addition, due to their structures based on natural fibers, cellulose, and protein, they are more susceptible to microbes compared to synthetic fibers. These ingredients serve as a source of nutrition for microbes in hot and humid conditions. As a result, there is a great demand for textiles resistant to microorganisms. Moreover, finished textile products must not be toxic to humans and must not harm the environment. The main features of this antimicrobial finishing are not only to eliminate incoming pathogenic microbes and odor-

producing microbes and limit the spread of diseases, but also to be safe for human skin, suitable for industrial-scale use, and resistant to washing, drying, and laundering [6].

Taking the above into account, this research studied the possibilities of imparting antibacterial properties to cotton fabrics using a solution based on the Aloe Vera plant. As the research object, 100% cotton fiber supreme knitted fabric and an aqueous extract obtained from Aloe Vera grown under the conditions of Uzbekistan were selected. In the study, in order to enhance the antibacterial properties of aloe, the plant was stored in a glass container at 2-4°C for 5 days, after which an aqueous extract was prepared, and fabric samples were modified with various concentrations of Aloe Vera extract.

In the research study, Aloe Vera was used in modifications specifically to give it antimicrobial and antibacterial properties. The main polysaccharide that gives Aloe Vera its antibacterial property is acemannan. Its molecular formula: $C_{66}H_{100}NO_{49}$. [7]

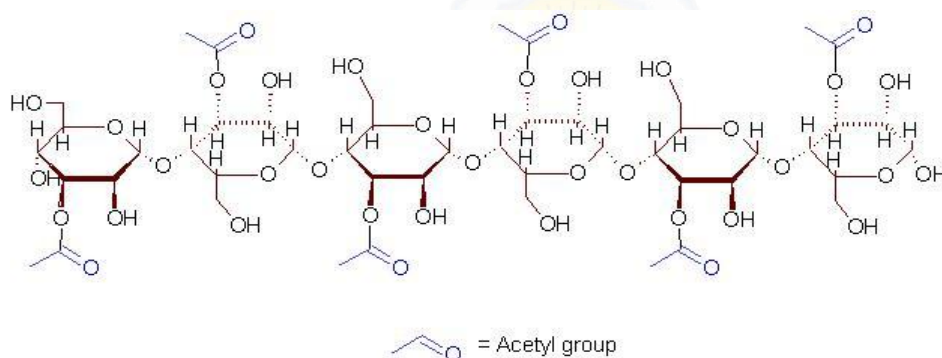


Figure 1. The structural composition of Acemannan

Model bacteria such as *Staphylococcus aureus* and *Escherichia coli* are commonly used to determine the antibacterial effectiveness of fabrics treated with Aloe vera. The antibacterial activity of the fabrics is determined by a reduction in the growth rate of microorganisms or a decrease in the ability of bacteria to form colonies.

The antibacterial activity of fabric treated with A. vera was evaluated both qualitatively and quantitatively using ISO AATCC-147 on samples (untreated and treated), and tested by inoculating bacterial culture media with *Staphylococcus aureus* (Gram-positive) and *Escherichia coli* (Gram-negative) bacteria according to the AATCC-100 method.

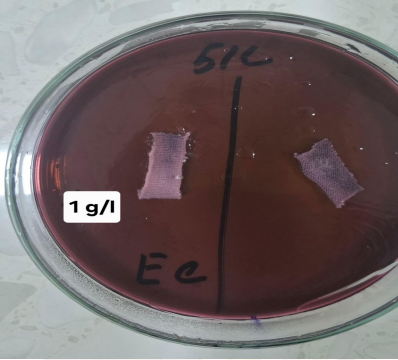
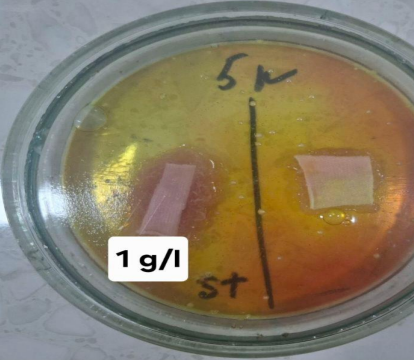
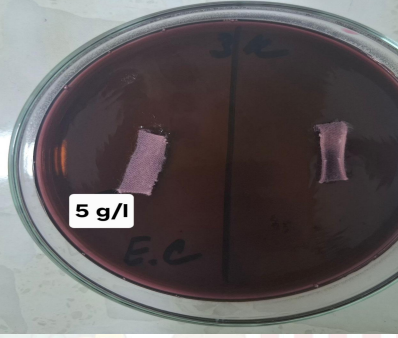
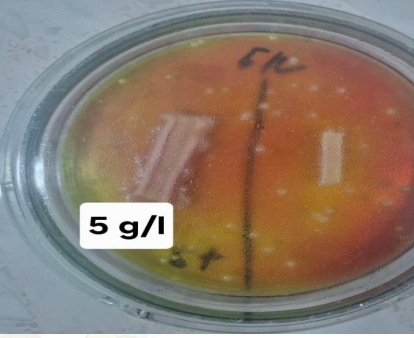
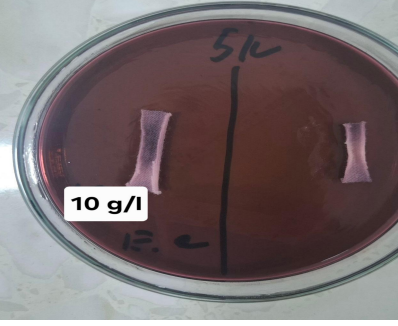
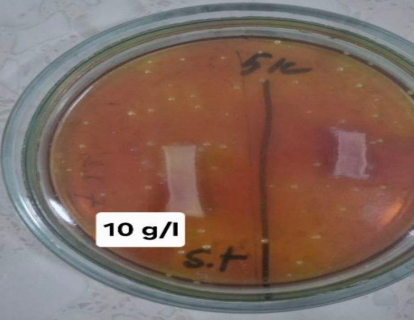
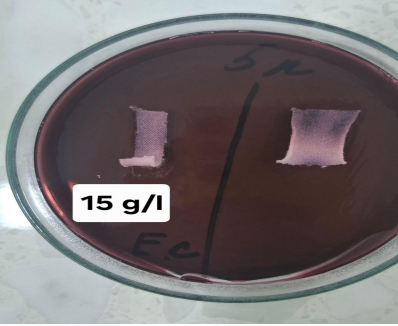
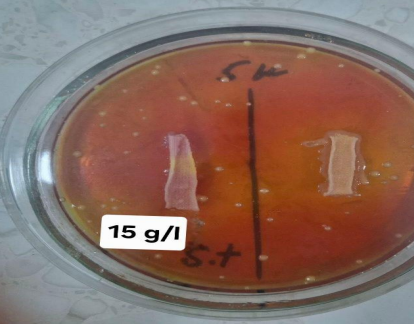
Staphylococcus aureus (Latin: *Staphylococcus* – spherical, anaerobic) is a non-motile bacterium. It usually lives on the skin and mucous membranes of almost every person. If the body's immune system is functioning normally, the normal microflora suppresses the activity of these bacteria. However, when the body's defenses are weakened, the microbe becomes active and causes various pathological diseases [8].

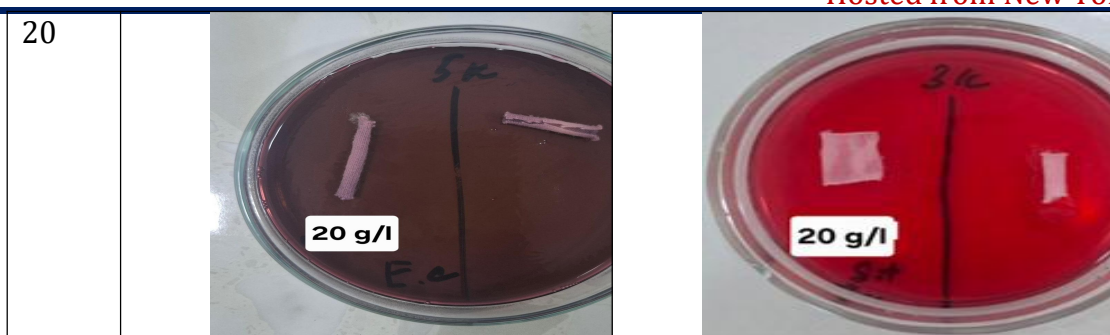
Escherichia coli (E. coli) is a bacterium commonly found in the lower intestines of warm-blooded organisms. Most strains of E. coli are harmless, but some strains can cause severe food poisoning.

If the growth around the samples treated with Aloe vera is reduced or completely stopped, it indicates the antibacterial effect of Aloe vera. As a result of evaluating the shape, color, and growth intensity of colonies through selective differential media, the antibacterial

efficacy of the Aloe vera-treated fabric was determined. This expands the possibilities of using plant extracts such as Aloe vera to create a natural protective layer on textile materials [9].

Table 1.

Results of testing the antibacterial activity of modified fabric samples in various concentrations of aloe vera extract stored for 5 days			
No	<i>Escherichia coli</i> (intestinal bacillus) is a Gram-negative bacterium EMB Agar (Levine)	<i>Staphylococcus aureus</i> (staphylococcus) gram-positive bacteria JSA (Jal Standard Agar)	
1			
5			
10			
15			



The conclusions drawn from the antibacterial testing method mentioned above indicate that fabric samples treated with aloe vera extract solutions at concentrations of 1, 5, 10, 15, and 20 g/l showed a high level of activity against *Escherichia coli*. When tested against *Staphylococcus aureus*, several colonies were observed. Moreover, at higher concentrations, the antibacterial activity was significantly stronger compared to lower concentrations.

In conclusion, we can say that a significant antibacterial activity was observed in laboratory-modified fabric samples with aloe vera.

List of references:

1. Xu Q, Ke X, Shen L, Ge N, Zhang Y, Fu F, Liu X (2018) Surface modification by carboxymethyl chitosan via pad-dry-cure method for binding Ag NPs onto cotton fabric. *Int J Bio Macromol* 111:796–803
2. Ahmed HB, Emam HE, Mashaly HM, Rehan M (2018) Nanosilver leverage on reactive dyeing of cellulose fibers: color shading, color fastness and biocidal potentials. *Carbohydr Polym* 186:310–320
3. Xu Q, Ke X, Cai D, Zhang Y, Fu F, Endo T, Liu X (2018) Silver-based, single-sided antibacterial cotton fabrics with improved durability via an L-cysteine binding effect. *Cellulose* 25(3):2129–2141
4. Xu Q, Ke X, Ge N, Shen L, Zhang Y, Fu F, Liu X (2018) Preparation of copper nanoparticles coated cotton fabrics with durable antibacterial properties. *Fiber Polym* 19(5):1004–1013
5. Luo G, Xi G, Wang X, Qin D, Zhang Y, Fu F, Liu X (2018) Antibacterial N-halamine coating on cotton fabric fabricated using mist polymerization. *J Appl Polym Sci* 134:1–7
6. Mao, Jianwen, and Lawrence Murphy. "Durable Freshness for Textiles." *AATCC Review* 1.11 (2001).
<https://www.scopus.com/inward/record.url?eid=2-s2.0.035509007&partnerID=10&rel=R3.0.0>
7. <https://www.who.int/ru/news-room/fact-sheets/detail/e-coli>
8. Воробьев, А.А. Общая и санитарная микробиология. / А.А. Воробьев, А.Л. Гинзбург, В.М. Малеев, Н.А. Семина. – М Издательство БИНОМ. – 2010. – С.350-355.
9. Basmatker, G., Jaiswal, A. (2015). Antibacterial textile using Aloe vera and Neem extract.