USA SCIENTIFIC JOURNALS PUBLISHING CENTRE OF AMERICA
AMERICAN JOURNAL OF MULTIDISCIPLINARY BULLETIN
ISSN: 2996-511X (online) | ResearchBib (IF) = 9.512 IMPACT FACTOR
Volume-3| Issue-6| 2025 Published: |30-06-2025|

ANALYSIS OF TECHNOLOGICAL PARAMETERS OF MIXED FIBER MATERIALS AT THE STAGES OF THEIR CHEMICAL PROCESSING

https://doi.org/10.5281/zenodo.15709292

Makhfuza Khasanova
Nargiza Norkulova
nargizanorqulova6@gmail.com

Abstract

This article investigates the boiling and bleaching processes of cellulose-based fabrics using various methods. Experiments were conducted with different concentrations of chemical reagents used in the boiling and bleaching of cellulose-based fabrics, and the optimal concentration was determined for mixed fiber bamboo-cotton fabric.

In the textile industry, bamboo fiber is being proposed as an alternative to cotton as well as to various synthetic fibers. [1]. Bamboo fiber is actively used in textiles, especially in the clothing industry [2].

The porosity of bamboo fiber allows for the production of brightly colored textile products. [3].

Given the close chemical composition of cotton and bamboo fibers, new properties were proposed for blended cotton/bamboo fiber fabrics. Experiments were conducted to develop a chemical finishing technology for these blended fabrics while maintaining their inherent properties. The characteristics of blended fiber fabrics were analyzed by comparing them with quality indicators of pure cotton fiber fabrics.

Various woven fabrics were produced in industrial settings using 100% bamboo, three types of bamboo/cotton blends, and 100% cotton yarn (36.90 tex) commonly used in the textile industry. These fabrics were tested for dimensional stability, air permeability, water absorption, and tear resistance [4].

Knitted fabrics based on bamboo (art. MG'-511) and cotton fibers were selected, and surface analysis of bamboo fibers was carried out using an OLYMPUS 400 laser scanning microscope.

Capillarity and water absorption of fabrics were determined according to GOST 29104.11-91 and GOST 3816-81. The capillarity of bamboo fabric was found to be 39.5 mm higher than that of cotton, indicating that the capillarity of bamboo-based knitted fabric is 38.5% greater. [5].

AMERICAN JOURNAL OF MULTIDISCIPLINARY BULLETIN
ISSN: 2996-511X (online) | ResearchBib (IF) = 9.512 IMPACT FACTOR
Volume-3| Issue-6| 2025 Published: |30-06-2025|

Boiling and bleaching processes were performed using both continuous and discontinuous methods, and the quality indicators of bleached cotton and cotton/bamboo fiber fabrics were evaluated. [6].

The purpose of boiling is to clean the fabric from water-insoluble natural by-products and to give it high absorbency properties. The boiling process can be organized in a continuous and discontinuous method.

Continuous experiments were conducted on a degreased and 5 x 30 cm fabric sample boiled in the following solution: g/l:

Sodium hydroxide 10-12

Surfactant 0.3-0.5

Sodium silicate (d=1.44) 2 - 3

Sodium hydrosulfite (NaHSO3) 4-6

Bath modulus 50.

For continuous boiling, a sample is prepared as above, soaked for 5 minutes in the following boiling solution heated to 700C, g/l:

Sodium hydroxide 25-30

Sodium silicate (d=1.44) 3-5

38% - NaHSO3 2-3

Soaker SFM 1-2

Then the fabric is compressed to 130% and steamed at 1000C for 60 minutes, washed in boiling and cold water. During the experiments, fabric samples were subjected to a bleaching process.

The purpose of bleaching is to whiten the fabric by breaking down the dyes and colored substances formed as a result of the destruction of natural by-products in the cotton fiber. Various oxidizing agents are used for bleaching, under the influence of which, along with the destruction of colored substances, cotton cellulose can also be oxidized. For this reason, the quality of bleached fabric is evaluated by the degree of whiteness (W,%) and the viscosity of the copper-ammonia solution of the sample. Continuous bleaching with hydrogen peroxide is carried out in a vat for boiled fabric. The fabric is boiled in a bleaching solution at 85-900C for 2 hours, in a bath module 50 solution, the composition of the solution, g/l:

Hydrogen peroxide 2

Sodium silicate (d=1.44) 8

Sodium hydroxide 2

The softener consists of SFM 0.5-1.

Continuous bleaching is carried out by the peroxide evaporation method. In the continuous method, the boiled fabric is soaked in a solution of H_2SO_4 with a

AMERICAN JOURNAL OF MULTIDISCIPLINARY BULLETIN
ISSN: 2996-511X (online) | ResearchBib (IF) = 9.512 IMPACT FACTOR
Volume-3| Issue-6| 2025 Published: |30-06-2025|

concentration of 5 g/l at room temperature for 2 minutes, squeezed and washed in cold water until neutral. Then the fabric is kept in a bleaching solution heated to 500 C for 5 minutes.

Bleaching solution composition, g/l:

Hydrogen peroxide, 100% - li 3-4

Sodium hydroxide 3

Sodium silicate (d=1.44) 15

SFM -0.5

The fabric, compressed to 130%, is steamed at 1000C for 60 minutes and washed in both hot and cold water. The degree of whiteness of the fabric and the chemical changes in the cellulose are determined using qualitative methods [7].

Table 1

Sample classification

Fiber composition of fabric	Zichligi	Eni, mm
65% cotton; 35% bamboo	**190.2g/m²**	**180**
100% cotton	**220g/m²**	**180**

Determining the permeability of a fabric after washing:

The permeability of a fabric is determined by the change in dimensions as a result of washing and is determined by the difference between the dimensions before and after washing. A square measuring 200 x 200 mm is drawn inside a 300 x 300 mm sample. The sample is washed in a SMAT washing machine for 30 minutes at 20-25°C in a solution of 4 g/l (60-72%) laundry soap and 1 g/l sodium carbonate, squeezed between rubber rollers, rinsed with cold water (20-25°C) for 2 minutes. After washing, the samples are ironed at 200°C, brought to room temperature for 10 minutes, and the square sides along the warp and weft threads are measured.

$$K_a=200-L_a/200\cdot 100,\%$$

$$K_t=200 - L_t/200\ \cdot 100,\%$$

Here: La and Lt are the dimensions of the square sides of the warp and weft threads after washing, mm.

When determining the permeability of the fabrics, the cotton fiber fabric had a permeability of 4% in the warp and 3.5% in the weft; the permeability of the cotton/bamboo fiber blend fabric was 4.5/3.5%, respectively.

AMERICAN JOURNAL OF MULTIDISCIPLINARY BULLETIN
ISSN: 2996-511X (online) | ResearchBib (IF) = 9.512 IMPACT FACTOR
Volume-3| Issue-6| 2025 Published: |30-06-2025|

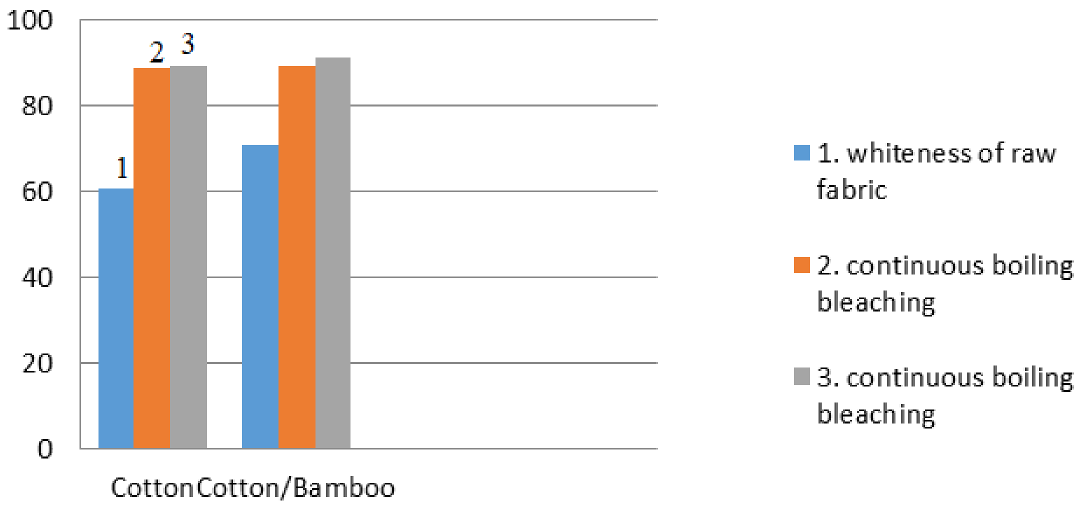

Figure 1. Whiteness level indicators of samples

To determine the capillarity of fabrics prepared for dyeing, a sample 30 cm long (along the body) and 5 cm wide (along the back) is lowered 1 cm into a potassium dichromate solution (3 g/l) and hung vertically above the container containing the solution. The rise of the colored solution along the sample is observed and the height of the rise is measured at 1, 5, 10, 20, 30 and 60 minutes. If the rise of the solution in 30 minutes is about 125 mm, and the rise is even, the fabric is considered well prepared for dyeing. To determine the smoothness of the boiling, the maximum and minute rise of the solution are measured and the difference is determined.

The smaller the difference, the more evenly the fabric is boiled. The whiteness of the samples was determined on a Minolta spectrophotometer. The spectrophotometer is calibrated against white and black standards. Then the following steps are performed sequentially: the fabric is placed in the spectrophotometer, OREN - AS - WHATEN. The measured fabric whiteness value on the screen is calculated according to four standards and displayed numerically and graphically.

The whiteness, air permeability, and water absorption of samples bleached in continuous and continuous methods were determined. Good results were observed in samples bleached in continuous method. Based on the results obtained, the kinetics of the continuous boiling bleaching process of cotton and cotton/bamboo fiber fabrics were analyzed. In the bleaching process carried out at different concentrations of H2O2, the whiteness level analysis gave good results when the concentration of H2O2 was 2.5 g/l and 2 g/l.

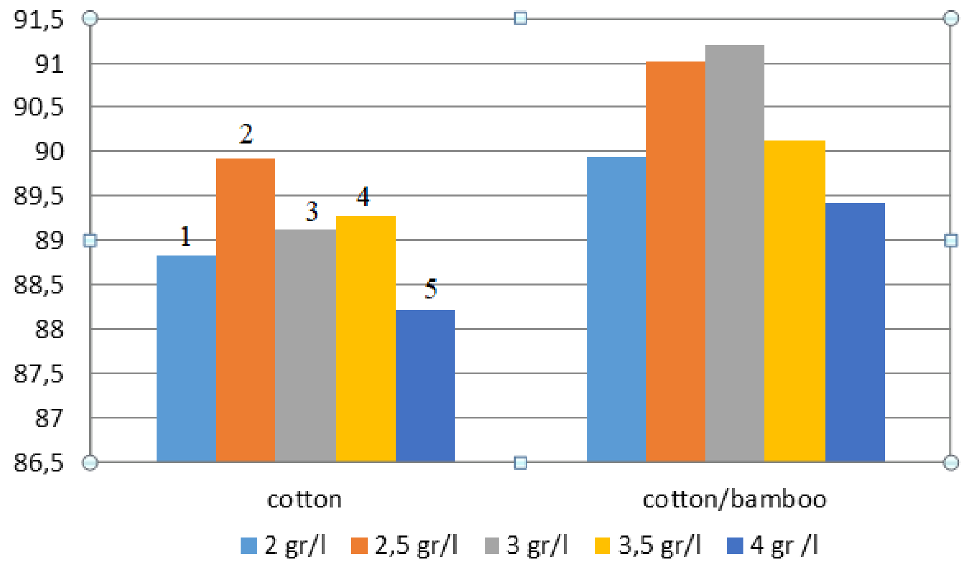

Figure 2. Study of the effect of H2O2 concentration on the whiteness of fabrics.

1-2.0 g/l; 2- 2.5 g/l; 3 - 3.0 g/l; 4- 3.5 g/l; 5-4.0 g/l

Continuous and continuous boiling bleaching processes were carried out and the quality indicators of bleached cotton and cotton/bamboo fiber fabrics were determined. The capillarity of samples subjected to continuous boiling gave satisfactory results. However, in the analyses of air permeability and water absorption, it was found that the optimal concentration of H2O2 for mixed fiber fabrics was 2 g/l.

In the bleaching process carried out at different concentrations of NaOH, good results were obtained from the analysis of the degree of whiteness, air permeability, and water absorption when the concentration of NaOH was 2.5 g/l. In preparing cellulose-containing fabrics for continuous finishing, the concentrations of H2O2 and NaOH of 2 and 2.5 g/l, respectively, were considered the optimal concentrations.

REFERENCES:

1. Lopamudra Nayak, Siba Prasad Mishra. Prospect of bamboo as a renewable textile fiber, historical overview, labeling, controversies and regulation. Fashion and Textiles (2016) Volume 3, N 2 . p.1-23. DOI 10.1186/s40691-015-0054-5

2. Khatri, F. Arsalan, R.A. Jhatial, Improvement in tensile strength of bamboo knitted fabric by sol–gel coating, Mehran Univ. Res. J. Eng. Technol. 32 (2013) 425–430.

3. Y. Lu, Q. Liang, L. Xue, Palladium-free catalytic electroless copper deposition on bamboo fabric: preparation, morphology and electromagnetic properties, Appl. Surf. Sci. 258 (2012) 4782–4787.

4. Effect of Fabric Weave and Weft Types on the Characteristics of Bamboo/Cotton Woven Fabrics

5. N. Minyazova, I. V. Krasina, S. V. Ilyushina Изучение физических свойств текстильного материала на основе бамбуковых волокон Вестник технологического университкта, 2026. Т.19, №16. С. 46.].

6. Y. Xu, Z. Lu, R. Tang, Structure and thermal properties of bamboo viscose, Tencel and conventional viscose fiber, J. Therm. Anal. Calorim. 89 (2007) 197– 201.

7. M.Z.Abdukarimova, I.A.Nabiyeva, G.X. Ismoilova "To'qimachilik mahsulotlarini pardozlash kimyoviy texnologiyasi fanidan laboratoriya va amaliy mashg'ulotlar uchun o'quv qo'llanma" 2012. pg 14-15