THE STUDY OF THE MOLDING CAPABILITIES OF BACTERIAL CELLULOSE

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The work is devoted to obtaining biodegradable non-woven cloths (films) based on bacterial cellulose, studying its mechanical and molding properties and studying the possibility of designing garments made on its basis. To obtain films of bacterial cellulose, a symbiotic culture was used, which was the result of the synthesis of acetic acid bacteria acetobacter xylinum and osmophilous yeast strains of schizosaccharomyces pombe.

Key Words: BACTERIAL CELLULOSE, BIODESIGN, BIOCLOTHING, MOLDING, DYEING

1. INTRODUCTION

The permanent changing world introduces both new technologies in the development process of clothing and new materials got by the interaction of textile industry and the environment, microworld and high technology sphere. Widely developed biotechnology and the development of customer's purchasing susceptibility in fashion industry as well in last decades provide unlimited opportunities for innovative items development.

Recently, there are questions about the resumption of the cycle of clothing production and this is the reason why 'sustainable' fashion appeared. The 'sustainable' fashion is a part of growing philosophy of design and tendency of sustainable development, the purpose of which is to create a system that can be maintained indefinitely in terms of human impact on the environment and social responsibility. One of important aspects of the development of products on the principles of 'sustainability' is the use environmentally friendly and/or biodegradable textile materials.

The most interesting example is bacterial cellulose – the result of interaction of bio- and textile technologies. Bacterial or microbial cellulose (BC) is a biocompatible, versatile material which is already used in many spheres of application: from midical use as a wound dressings to microelectronics as a superabsorbent in biosensors [1, 2]. Biocellulose is a polymer consisting of fibrillar structures having a microporous structure. This in turn creates ample opportunities for its modification and, as a result, the production of various composite materials with much better characteristics [3]. Unlike plant cellulose, BC does not contain lignin and hemicellulose and accordingly is sufficiently pure, neutral and biocompatible [4].

Due to the materials high mechanical strength and leather like appearance, it could be possible to use the material for clothing design purpose.

The purpose of our work is to study the molding abilities of bacterial cellulose.

To do this, it is proposed to solve the following tasks:

- to develop a method of producing films of BC;
- obtain experimental samples of BC;
- develop and obtain experimental samples of drying preforms;
- to carry out research of molding abilities of BC.

The flow-chart of the entire study is presented in Fig. 1.

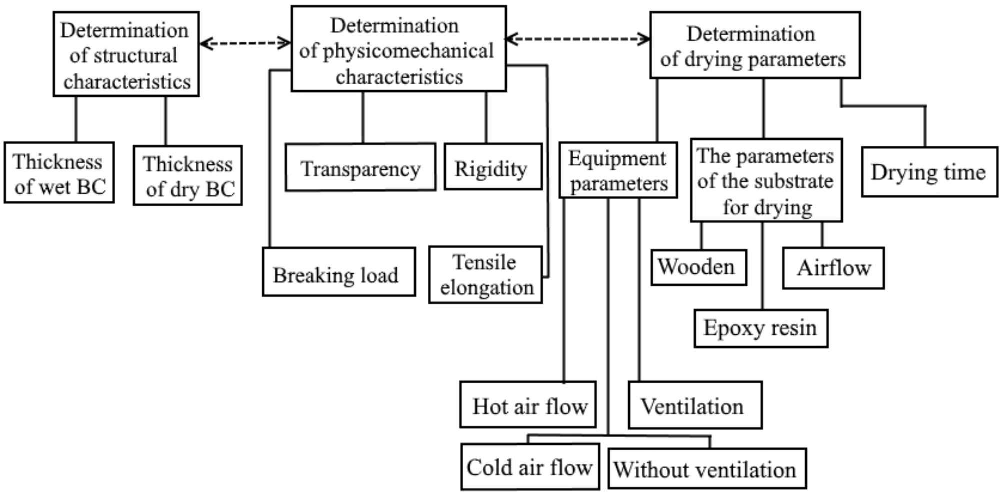

Figure 1. Flow-chart of research

2. EXPERIMENTAL

The BC films were obtained in the following way. Symbiotic crop resulting from the synthesis of acetic acid bacterium *Acetobacter xylinum* and osmophilic yeast strains *Schizosaccharomyces pombe* were placed in containers with a pre-prepared nutrient medium. Cultivation was carried out under static conditions of 25-26 ° C. During the period when the temperature fell to non-standard values, the medium was heated to the required temperature values. As a natural dye was used the *Vaccinium myrtillus* extract in a ratio of 1:10 in relation to the nutrient solution. The dye was added a day before removal from the solution. *Vaccinium myrtillus* extract allowed to achieve a rich ruby-red color. The obtained BC films were removed from the containers with a nutrient medium and a symbiotic crop after 1, 2 weeks. Further, the bacterial films were cleaned in 2 % NaOH solution, and the subsequent purification in distilled water from the solution residues. The next step is drying the films on wooden substrates within 2 – 4 days.

The results of the study of physical and mechanical characteristics of the obtained BC films are presented in Table 1.

Table 1. Physico-mechanical characteristics of BC films

Sample cultivation time, weeks	Film thickness, mm	Elongation at break, %	Breaking load, MPa
1	3.25	19.3	5.2
2	7.80	14.9	7.3

To study the molding ability, we applied dyed films (2 weeks of cultivation) to a preform - dummy made of epoxy resin (Fig.2). Drying was carried out by hot air flow with enhanced air conditioning. A sample of the resulting molded product is shown in Fig. 3.

Figure 2. Preform - dummy covered with samples of dyed BC films with variable thickness

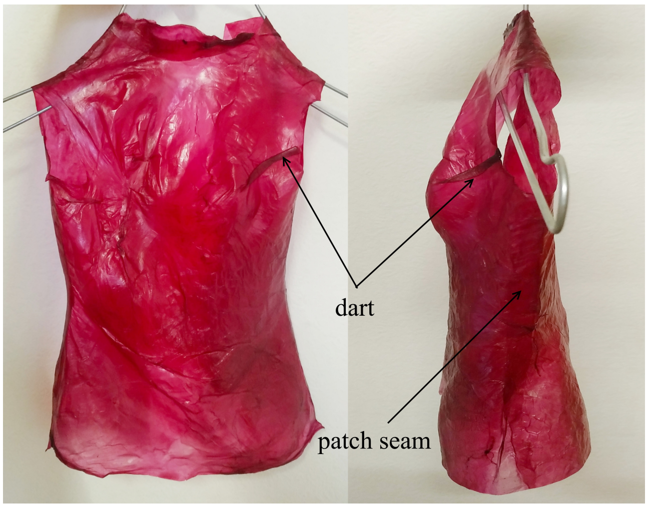

Figure 3. Molded garment prototype made from dyed BC

It should be noted the enormous prospects for the use of BC in the clothing design. Research carried out in this direction will significantly advance in the direction of a sustainable fashion and apparel industry.

3. REFERENCES

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