PREPARATION AND APPLICATION OF COLORED ANTIBACTERIAL COTTON FIBER BASED ON MICROSTRUCTURAL CONTROL

Gafurov Adkhamjon,
Researcher, Namangan Engineering - Technology Institute, Namangan, Uzbekistan

Toshmatov Bilolxon
Researcher, Namangan Engineering - Technology Institute, Namangan, Uzbekistan

Abstract

Increasing competition in the world market of textile products increases the necessity of reducing wholesale prices due to the development of production technologies in the countries producing textile raw materials, to further improve the consumer characteristics of the product and reduce the production costs. Accordingly, in order to improve the quality of products produced in the field of textiles and light industry in the world market and reduce their cost, it is necessary to identify and eliminate factors that negatively affect product quality at all stages of production, as well as in the spinning process, to create resource-efficient, automated technologies that reduce product production costs and to implement them. implementation is of great importance.

Keywords: cotton fibre, fabric, colour, microstructure, copper powders, surface, crystalline, liquid solution.

Decree of the President of the Republic of Uzbekistan dated May 5, 2020, No. PF-5989 "On urgent measures to support the textile and sewing and knitting industry", No. PQ-4453 dated September 16, 2019 "Further development of light industry and finished products Implementation of the tasks specified in the resolutions "On measures to stimulate production" and PQ-4186 dated February 12, 2019 "On measures to further deepen the reform of the textile and sewing and knitting industry and expand its export potential" and other regulatory legal documents serves to increase [1-4].

To ensure the implementation of the above decree decisions, work is being carried out in cooperation with the Zhejiang Sci-Tech University located in the Republic of China.

The textile industry of the Republic of China ranks first in the world. High technology production fully meets international requirements.

Zhejiang Sci-Tech University (Hangzhou, China) is a province specializing in textiles, and its subject ranking ranks first in the country. It has been making important contributions to the development of textile technology, industry and economy in Zhejiang Province [5-9].

In the laboratory of Zhejiang Sci-Tech University, a coating of copper powder on the surface of cotton fibre was carried out.

The development of antibacterial self-dyed textiles will help the industry to develop high-quality products and alleviate environmental pollution problems.

By covering small particles based on copper on the fabric, the rainbow colour is formed due to the arrangement of small copper powders in a crystalline state on the surface of the fabric [10-14]. To carry out this process, a liquid solution is made from fine copper powders and the liquid solution is coated on a cloth. On the surface of the fabric, the copper powder is heated to a certain degree to form a crystal state, and on the surface of the fabric, the copper powder is arranged in a crystalline state [15-20]. When the copper nanoparticles in the crystalline state fall back on the surface of the fabric, they form a rainbow colour (Fig. 1).

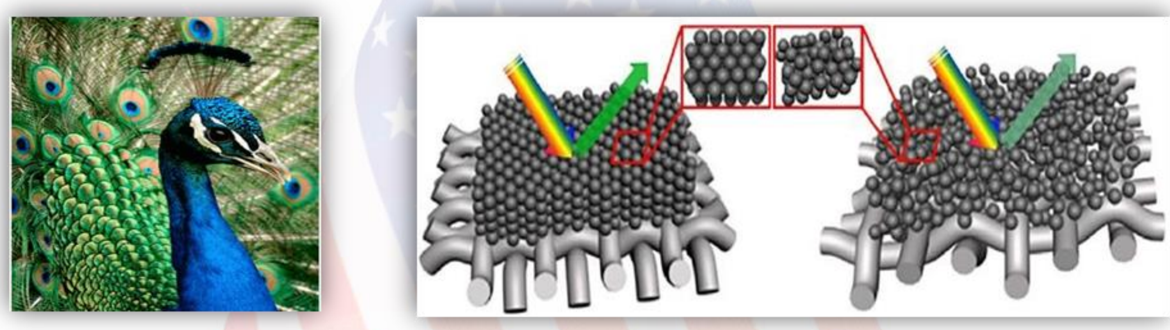
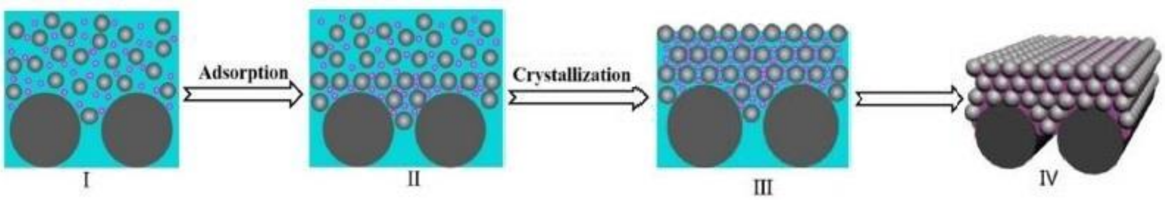


Figure 1. Construction of regular photonic crystal structures in fibrous bodies (colour saturation, iridescent effect)

The photonic crystal structure and its stability (colour stability) are implemented as follows:

1. Preparation and control of structure and properties of copper-based nanoparticles;
2. Optimizing the fibre body and building a self-assembly system;
3. Systematic construction and stabilization mechanism of photonic crystal micro-nano structures;
4. Mechanism of chromo-genesis and colour regulation of copper-based nanoparticles/fibres
5. Small-scale production and promotion of copper-based nanoparticle/fibrous products
6. Shape and size regulation of copper-based nanoparticles to achieve simultaneous antibacterial and colouring properties
7. Creating regular and highly stable photonic crystals that give the fibre an antibacterial, bright and durable structural colour.
8. Explain the process of assembling micro-nano structures on the surface of fibrous bodies and the mechanism of colour formation.



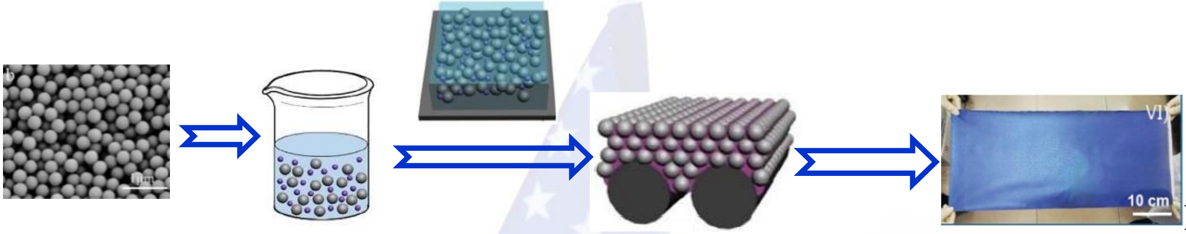


Figure 2. Optimizing the fibre surface and construction scheme of the self-assembly system.

The self-assembly system consists of nanoparticles and structural stabilizers such as hydroxyethyl acrylate and an ultraviolet photoinitiator, hydroxypropyl acrylate and thermal curing ammonium persulfate, etc., can form structural stabilizers. Digital jet printing technology is loaded onto photonic crystals and fibre bodies (Figure 2).

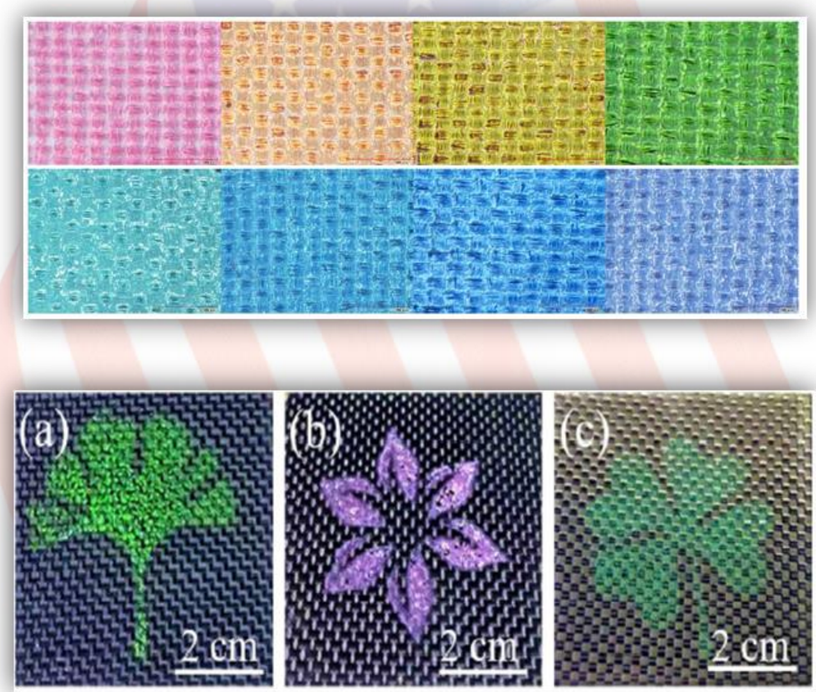


Figure 3. Colour-forming mechanism of copper-based nanoparticles/fibres and regulation scheme of its operation

The influence of self-assembly temperature, time and intensity of air convection on the surface morphology and mechanical strength of photonic crystal structures, evaporation of the dispersion medium and self-assembly behaviour of nanoparticles at the solid-liquid-gas interface was studied, for example, sedimentation, diffusion and crystallization processes. The relationship between the location and structural colour of photonic crystals was analyzed.

Conclusion

Copper-based nanoparticles are placed directly on fibre materials by the liquid reduction method, which effectively prevents the agglomeration of nanoparticles during their application. The morphology, size and size distribution of copper-based nanoparticles are controlled and regulated by adjusting the solution systems. At the same time, copper-based nanoparticles are embedded in fibre materials to realize micro-nano structure construction and regulation on the surface of fibre materials. Clarifies the light scattering and chromogenic mechanism of micro-nano structure on the surface of fibre materials to provide a theoretical basis for the design, development and application of self-chromogenic fibre products.

References

1. Lu, R., Yu, Y., Adkhamjon, G., Gong, W., Sun, X., & Liu, L. (2020). Bio-inspired cotton fabric with superhydrophobicity for high-efficiency self-cleaning and oil/water separation. Cellulose, 27(12), 7283-7296. https://doi.org/10.1007/s10570-020-03281-9.
2. Эркинов, З. Э. Ў., Ўғли, Ғ. А. Б., & Эргашев, М. М. Ў. (2018). Определение и анализ свойств крученой нити, выработанной из разноструктурной одиночной пряжи. Universum: технические науки, (6 (51)), 44-48. URL: https://7universum.com/ru/tech/archive/item/6049
3. Omonov, M. T., Turdialievich, T. S., & Bahromjonogli, G. A. (2021). Analysis of changes in fiber properties in processes opening, cleaning and carding. ACADEMICIA: An International Multidisciplinary Research Journal, 11(4), 96-104.https://doi.org/10.5958/2249-7137.2021.01043.0
4. Erkinov, Z., Abduvaliyev, D., Izatillya, M., & Qorabayev, S. (2020). Theoretical studies on the definition of the law of motion and the equilibrium provision of the ball regulating the uniform distribution of the torque along the yarn. ACADEMICIA: An International Multidisciplinary Research Journal, 10(11), 2338-2347.
5. Эркинов, З. Э. Ў., Абдувалиев, Д. М. Ў., Изатиллаев, М. М. Ў., & Иззатиллаевна, П. Қ. (2020). Исследование равномерного распределения крутки и показателя качества пряжи, выработанной на новом крутильном устройстве. Universum: технические науки, (6-2 (75)), 60-65.
6. Новиков, А. Н., & Матвеева, О. С. (2013). Алгоритмы распознавания видов брака ткани по ее изображению. Дизайн и технологии, (37), 96-102.
7. Musohon, I. M., Shuxratjonovich, R. B., Avaz, J. G., & Baxromjon, B. M. (2021). Tools to determine the tension of selected yarns on knitting machines by experiment. Збірник наукових праць ΛΌΓΟΣ.

8. Полякова, Л. П., & Примаченко, Б. М. (2003). Исследование влияния переплетения на процесс формирования ткани на ткацком станке. Известия вузов. Технология текстильной промышленности, (1), 69.
9. Сокова, Г. Г. (2014). Обзор современных методик автоматизированного проектирования ткацких переплетений. Изв. вузов. Технология текст. пром-сти, (6), 64.
10. Назарова, М. В., & Давыдова, М. В. (2011). О разработке автоматизированных методов проектирования тканей по заданным эксплуатационным характеристикам. Фундаментальные исследования.-2008.-1.-С, 77-78.
11. Ahmadjonovich, K. S., Lolashbayevich, M. S., Gayratjonovich, M. A., & Erkinzon, S. D. (2021). Characteristics of yarn spinned on different spinning machines. Збірник наукових праць ΛΌГOΣ.
12. РАХИМХОДЖАЕВ, С., РАСУЛОВ, Х., Изатиллаев, М., & Адхамжонов, Ш. (2019). Аналитические исследования натяжения нитей основы за цикл работы станка. ББК 60 С 56, 325.
13. Ugli, I. M. M. (2020). Experimental Studies Of Shirt Tissue Structure. The American Journal of Applied sciences, 2(11), 44-51.
14. Ahmadjanovich, K. S., Lolashbayevich, M. S., & Tursunbayevich, Y. A. (2020). Study Of Fiber Movement Outside The Crater Of Pnevmomechanical Spinning Machine. Solid State Technology, 63(6), 3460-3466.
15. Korabayev, S. A., Mardonovich, M. B., Lolashbayevich, M. S., & Xaydarovich, M. U. (2019). Determination of the Law of Motion of the Yarn in the Spin Intensifier. Engineering, 11(5), 300-306.
16. Korabayev, S. A., Matismailov, S. L., & Salohiddinov, J. Z. (2018). Investigation of the impact of the rotation frequency of the discretizing drum on the physical and mechanical properties of. Central Asian Problems of Modern Science and Education, 3(4), 65-69.
17. Izatillayev, M. M., & Korabayev, S. A. (2020). Experimental studies of shirt tissue structure. The American Journal of Applied sciences, 2(11).
18. Tursunbayevich, Y. A. (2021). Investigation of Influence ofa New Twist Intensifier on the Properties of the Twisted Yarn. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12(5), 1943-1949. https://doi.org/10.17762/turcomat.v12i5.2275
19. Axmedovich, A., Fakhritdinovna, V. Z., & Fakhritdinovna, M. S. (2021). Influence of the Geometric Dimensions of the Measuring Chamber on the Tone of the Wool Fiber on the Acoustic Device. Annals of the Romanian Society for Cell Biology, 25(6), 10158-10165.
20. Fakhritdinovna, V. Z., AkhmedovAkmalAxmedovich, O., & Ubaydullayeva Dilora Xamidovna, K. (2021). Possibility to Use Acoustic Device Pam-1 to Determine Quality Characteristics of Wool Fiber. Annals of the Romanian Society for Cell Biology, 25(6), 10166-10173.