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Technology for Production of Heterocomposite Polymer Materials for Mechanical Engineering and Use in Industrial Enterprises Using Local Raw Materials and Energy Resources

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ABSTRACT: The feasibility of structuring methods that allow the rational use of local raw materials and energy resources as an effective type of modification of heterocomposite polymer materials is based. Thermo-reactive binder epoxy resin ED-20-based composites and fillers for coatings as the object of study : kaolin, graphite, chlorinated polyethylene and silk processing waste (SWW) were obtained from local materials. Examined and shows the changes of deformation properties and intergovernmental heterogeneity plasticization of polymeric materials from the content and type of filler, as well as the technological compatibility of their use. This borders the amount of use of fillers based on the explanation of the obtained experimental data.

KEY WORDS: Heterocomposite polymeric materials (GKPM), roughness, glass transition temperature, plasticizer, filler, epoxy composition.

I. INTRODUCTION

It is important to improve the modern machine-building industry in the world, to create new advanced equipment, competitive and import-substituting technologies, machines and mechanisms for various industries, to conduct in-depth fundamental research, to address current scientific and technical issues. Also, the targeted use of high-performance composite polymer materials to ensure the operational reliability of cotton processing machines is one of the current scientific and technical problems that need to be addressed to reduce the negative impact of technological equipment on cotton surfaces through the use of new materials. In this regard, research centers in developed countries, including the United States, Germany, Japan, Russia, China, Turkey and other countries, pay special attention to ensuring resource savings in the production of products from polymer composite materials.
Particular attention is paid to the activation of research in materials science and new materials technology, which is one of the fundamental and practical foundations of the development of modern engineering in the world. It is necessary to develop new energy and resource-saving technologies for the formation of coatings based on efficient polymeric materials on the working surfaces of large technological, complex configuration machines of primary cotton processing enterprises [1].

Today, Uzbek scientists have conducted a lot of research in the development of polymer composite materials science. As a result, cotton retained its natural properties to a certain extent in exchange for protection from mechanical damage.

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However, in this work, insufficient attention has been paid from a scientific and practical point of view to the rational use of local materials and the discovery of their new properties. The quantitative effect of material structure and properties on the mechanical damage of cotton, especially cotton fiber, has not been studied or taken into account. Insufficient attention has been paid to the structural compatibility of heterocomposite polymeric materials with cotton and the rational use of local raw materials and energy resources in the development of new materials and technologies in this area. The creation of effective types of coatings based on heterocomposite polymer materials remains a pressing issue. [1-2]

II. SIGNIFICANCE OF THE SYSTEM

The paper mainly focuses on anti-corrosion coatings for large-size technological equipment of oil refining and cotton-processing production. The study of literature survey is presented in section III, Methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and Conclusion.

III. LITERATURE SURVEY

Belarusian scientists Bely V.A., Sviridenok A.I., Struk V.A. et al. conducted studies on the effect of mechanical properties and osmolecular structures on metal-polymer systems and antifriction-carrozion properties.
Currently, scientific successes have been achieved by scientists of Uzbekistan such as academicians S.Negmatov, M. Askarov, S. Rashidova, candidates of technical sciences, professors A. Ibodullaev, Z.Tajikhodzhaev, A. Umarov, A. Riskulov, O. Yoriev who are studying the development of polymer composite materials science and optimizing the surface structure, academician R. Makhkamov, control of technological parameters, professor U.Ziyamuhamedova structural compatibility of composite polymer coatings in cotton, professor N.Abed t he use of composite materials and their physical modification, professor A. Juraev structural optimization of technological equipment, professor A.Dzhumabaev improving the abrasion resistance of composite polymer materials and their coatings, Professor Kh. Akhmedkhodjaev evaluation of the effectiveness of cotton pneumatic conveying from composite polymer materials also achieved scientific success.
At the same time, it should be noted that based on local materials under the guidance of Professor A.A. Riskulov conducted research on the effective use of thermoplastic polymers based on new composites, in particular the effective use of fluorine compounds. Under the leadership of U.Ziyamuhamedova extensive research is being carried out to obtain multifunctional coatings on the working surfaces of technological equipment for cotton processing and their structural conformity, in particular, a wide range of scientific research is underway on a new activation heliotechnology for the production of antifriction, antifriction-carrozion structures from heterocomposite polymeric materials (GCPM).

IV. METHODOLOGY

The feasibility of structuring methods that allow the rational use of local raw materials and energy resources as an effective type of modification of heterocomposite polymer materials is based. Thermo-reactive binder epoxy resin ED-20-based composites and fillers for coatings as the object of study : kaolin, graphite, chlorinated polyethylene and silk processing waste (SWW) were obtained from local materials (Table 1).

Table 1
Materials selected for coating

№	Naming of materials	State Standard	Note
1.	Epoxy resin (ED-20)	ГОСТ 10587-72	Thermoreactive binder
2.	Dibutylphthalate (DBF)	**State Standard** 8728-76	Plasticizer
3.	Polyethylene polyamine (PEPA)	ТШ 6-02-594-70	Hardener
4.	Graphite(crumbly)	**State Standard** 44404-88	Filler (d≤20 μm)
5.	Angren kaolin	**State Standard** 6138-61	Filler (d≤20 μm)
6.	Silk recycling waste (SWW), sorter	Uz**StateStandard** 993-2011	Filler (d≤2 mm)
7.	Modified chlorinated polyethylene (XPE)	Uz**StateStandard**	outliner

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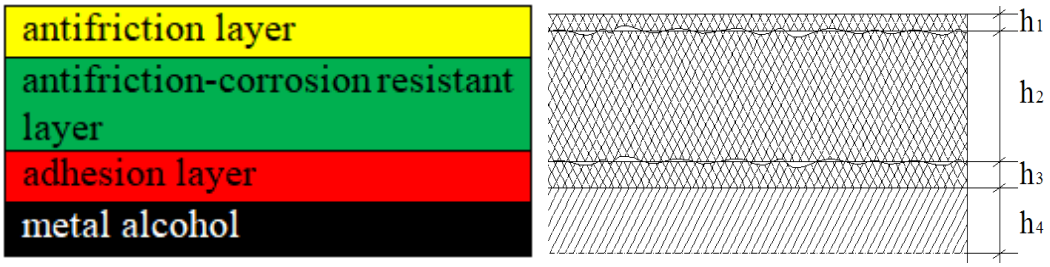
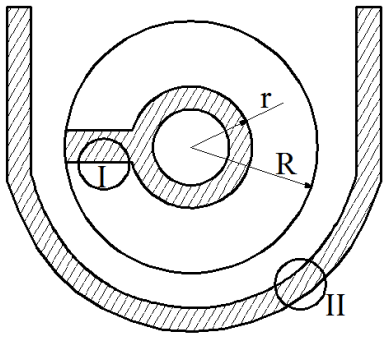
V. EXPERIMENTAL RESULTS

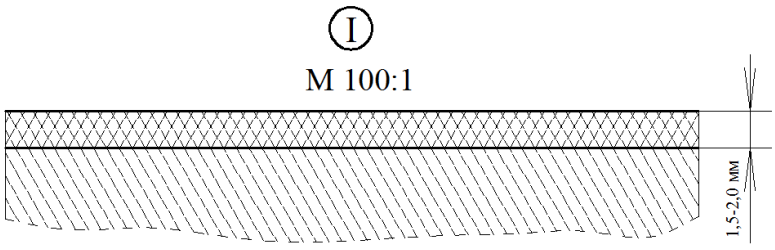
1. Binder epoxy compound -EDk = ED-20 (100 tablespoons) + DBF (18 tablespoons) + PEPA (12 tablespoons)
As a model and control sample was taken a sample construction material - steel (St3), which is widely used in the working bodies of large-scale technological machines for processing cotton.
Based on the goals and objectives of the study, the technology of obtaining an effective multilayer polyfunctional coating on large-scale, complex configuration cotton processing equipment was proposed [3].
In the solidification process of multilayer polyfunctional GKPQs, the layers are in a predetermined rheological state in which they are firmly bound to each other: 100-150 μm (layer 1); 1400-1700 μm (2nd layer); Experimental samples (Fig. 1) corresponding to the theoretically analyzed scheme (Fig. 5) at thicknesses of 100–150 μm (layer 3) were generated and a tribotechnical test was performed.
This method is characterized by simplicity of application and, most importantly, high efficiency of coating production with sufficiently high operational properties (average temperature 50-600C and a maximum duration of 10-20 hours) [2].



h1- antifriction layer, h2- antifriction-wear layer, h3- adhesion layer, h4-metal surface
Figure 1. Schematic representation of the surface structure of samples of GKP coatings

Technological regulations for the production of new heterocomposite polymer materials on the basis of local materials and resources and their application on the working surfaces of cotton ginning machines have been developed. The results of the study were obtained on the basis of the developed technological regulations. The expected economic efficiency of 5 billion soums has been achieved.
The following efficiency indicators were identified when using new heterocomposite polymer materials:
- The efficiency of the equipment increased by 10-15%;
- the service life of technological equipment is increased by 30-35% due to corrosion and corrosion protection;
- mechanical damage to the fiber decreased by an average of 0.45-0.90%;
- seed crushing decreased by 6-10%;
- Safety of life and ecological environment have been improved due to the reduction of noise levels by 2-3 times and air pollution by 1.2-1.5 times in the technological process of production.
No cases of large cracking and displacement of coatings were observed during the interval of preventive maintenance (repair) of screw conveyor (auger) parts.
The obtained results show that the economic efficiency (in 2017, 2018 prices) of technological equipment increased by 32.5%, 160 million soums of real and mechanical damage to the fiber decreased by an average of 0.45-0.90% and seed crushing decreased by 6-10%. The expected economic efficiency of UZS 1 million was achieved (the results of the study were confirmed by the Uzpakhtasanoan reference book).





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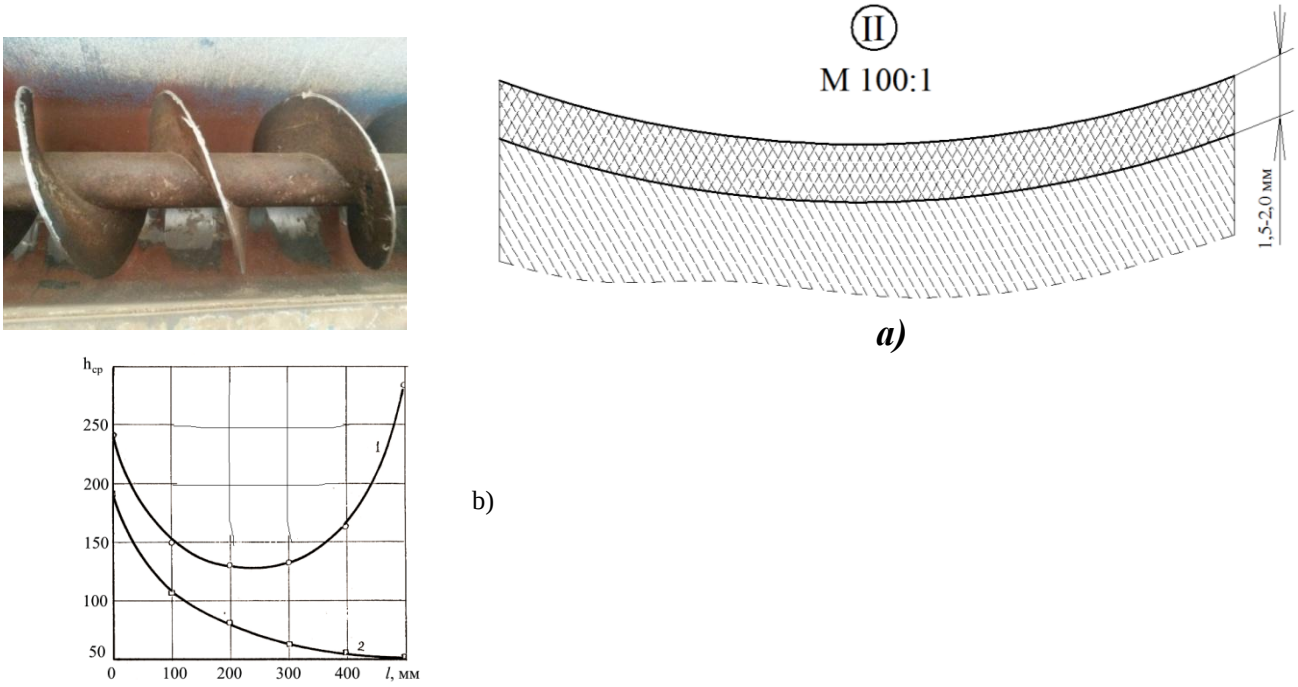

Figure 2. Scheme of obtaining multifunctional coatings containing GKP material -1,2,3 in cotton screw conveyor (distributor) screw and jellies (a) and their service life forecasting schedule (b).

a) The structure of PEVP (outgoing, without filling); b) PEVP + kaolin AKS-30, 10 mass.ch + graphite 2.5 mass.ch; v) PEVP + kaolin (10) + graphite (2.25) + OShPP (4.0). Figure 3-Microstructure of heterocomposite materials on the basis of PEVP

VI. CONCLUSIONS

Polyfunctional, antifriction, antifriction-abrasive, abrasion-resistant coatings required from heterocomposite materials based on local raw materials and resources, operating under the conditions of friction with cotton, using standard methods and improved technical means The possibility of obtaining new multi-layered high-efficiency new materials on the basis of a complex study is scientifically based and the principles of their targeted application have been developed. Based on the identification of structural and technological factors for the production of multilayer polyfunctional coatings from new heterocomposite polymer materials, which have a pre-designed operational property in the friction interaction with cotton, the following conclusions and recommendations are presented.

1. Introduced a mathematical model of the introduction of cotton to minimize mechanical damage to its valuable natural fibers and seeds in the interaction friction with cotton. Selection of theoretically necessary material with predetermined properties, taking into account the mechanical properties of the material and cotton fiber used in the working bodies of the process equipment, the wool model that determines the actual surface area, surface hardness and

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structural classifications of raw cotton (moisture, contamination, seeds and fiber) software calculation method (№06066 DGU) is proposed.

2. It is shown that the amount of fillers, changes in the effect of the type on the deformation properties of heterocomposite polymer materials and the plasticity of their structures, as well as their technological compatibility are of great importance. Regression equations are proposed that accurately represent the boundary quantities by type and composition of the additions to which the practical results obtained on the basis of the mathematical method of planning and optimizing experiments are added.

3. The results of research on the effect of types of kaolin fillers produced by local industry on the performance properties of composite materials are presented. The optimal granulometric composition, protected by the patent of the Republic of Uzbekistan № IAP 20180203, is proposed as a complement to the products of JSC "Angren kaolin".

4. The optimal technology for obtaining multilayer, multifunctional, high-performance GKP coatings on the surfaces of technological equipment for primary processing of cotton using local raw materials and energy resources by the method of activation-heliotechnology is proposed.

5. The results of the study 160 million soums of real and 1.2-1.5 billion soums received during the complex testing of technological equipment of JSC "Andijan No. 1 Cotton Ginning" in 2017-2019, including cotton air conveyors, screw conveyors, auger cleaners and distributors the expected economic efficiency was achieved.

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