ACTUAL PROBLEMS OF MODERN SCIENCE, EDUCATION AND TRAINING

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CONTENTS

UDC: 574.3

CHECKLIST OF INSECT PESTS OF ONION OF THE NORTH-WESTERN REGION OF UZBEKISTAN

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Annotatsiya: Ushbu maqolada piyoz zararkunandalari hasharotlarining nazorat ro'yxati keltirilgan. Unda 8 turkum 28 oila, 48 avlodga mansub 62 tur bo'lib, ular orasida eng ko'p turlar Noctuidae oilasiga mansub turlar (11 avlod va 14 tur), undan keyin Chrysomelidae, Curculionidae, Anobiidae, Ephydridae, Aleyrodidae, Pentatomidae, Pieridae, Gryllotalpidae oilasiga mansub turlar kirishi belgilangan. Shuningdek maqolada ushbu zararkunandalarning piyoz o'simligining zararlaydigan vegetativ va generativ a'zolari hamda hasharotning zarar etkazuvchi bosqichi to'g'risida ma'lumotlar keltirilgan.

Kalit so'zlar: *piyoz bosh, ildiz, shira, psevdopoya Aphidomorpha, Xorazm viloyati, trips, qurt*

Аннотация: В этой статье представлен контрольный список насекомых-вредителей лука. Насчитывается 8 отрядов, 28 семейств и 62 вида, относящихся к 48 родам. Наиболее распространены виды, принадлежащие к семейству Noctuidae (11 родов и 14 видов), а также следующие семейства: Chrysomelidae, Curculionidae, Anobiidae, Ephydidae, Aleyrodidae, Pentatomidae, Pieridae и Gryllotalpidae. Также в статье приведены сведения о вегетативных и генеративных органах растения лука и вредоносной стадии насекомого.

Ключевые слова: *лук репчатый, корень, тля, псевдостеблевая, Aphidomorpha, Хорезмская область, трипс, личинки*

Annotation: This article provides a checklist of onion pest insects. There are 8 order, 28 families, and 62 species belonging to 48 genera. The species belonging to the Noctuidae family (11 genera and 14 species) were recorded the most common and following families also are recorded Chrysomelidae, Curculionidae, Anobiidae, Ephydridae, Aleyrodidae, Pentatomidae, Pieridae and Gryllotalpidae. The article also contains information about the vegetative and generative organs of the onion plant and the harmful stage of the insect.

Key words: *onion bulb, root, aphids, Pseudo-stem, Aphidomorpha, Khorezm region, thrips, maggots*

Introduction. Onion is one of the important onion bulb vegetables grown in India and other parts of the world. India ranks first in cultivation area and second in production [6] and is cultivated about 1.3 million hectares area with the annual production of 22.40 mt [5, 8]. In Uzbekistan, winter onions and garlic were planted on a total area of 88.2 thousand hectares and in the Republic of Karakalpakstan and the Khorezm region, onions - on 16,023 hectares, garlic onions - on 1,281 hectares [1, 2].

Number of insect pests including thrips, maggots, cut worms, leaf miner, aphids, beetles, earwigs and mites at different stages of crop growth, including seedling, bulging and blooming, attacks onion. In addition to direct damage, insect pest such as thrips *Thrips tabaci*, aphids *Myzus persicae* and *Aphis craccivora* as vector for deadly viral diseases such as iris yellow spot [9] and onion yellow dwarf virus [7]. Furthermore, some insect pests also injurious to harvested onion bulbs at storage, which reduce the quality and export potential of the produce. Being a major consuming, exporting as well as importing commodity to fulfill the domestic requirement, knowledge and information of insect pests is vital for pest management planning. Hence, an updated list of insect pests attacking onion at field as well as storage is necessary for devising preventive and effective IPM strategies. Therefore, in this report, a detailed list of onion insect pests is presented

The onion thrips (*Thrips tabaci* Lind) has spread to 13,600 hectares and the onion fly (*Delia antiqua*) to 10,600 hectares, posing a serious threat to crops. Invasive species and unknown pests also cause serious damage. The effectiveness of the recommended chemicals is insufficient [1].

This is based on studying the species composition of pests common in onion and garlic fields, identifying the main pests, developing the biological basis for combating the number of dominant pests based on determining the bioecological development, distribution area and the damage they cause, and the creation and introduction into production of agricultural technologies for comprehensive protection against them are considered scientific tasks. Late detection of diseases, as a result of which the drugs used do not have a good effect, requires the development of risk prediction tools based on environmental factors. It is also important to determine the area of pest infestation using modern GIS technologies.

Material and Methods

Study area

The Republic of Uzbekistan is located between the Amudarya and Syrdarya Rivers, and its total area is 448,900 km^2. The territory of the republic is 1,425 km from east to west and 930 km from north to south The Northeast biogeographic regional part of Uzbekistan is situated between the western part of the Tien Shan Mountains and the Syrdarya River [3, 12].

Uzbekistan’s position at the junction of several Central Asian bio-geographical regions predetermines a significant richness of its flora and fauna. At the same time, it is a reflection of the diversity of natural conditions in Uzbekistan, where vast plains occupied by different types of deserts, mountain steppes, forests and alpine meadows,

tugai thickets and water bodies form characteristic ecosystems. The study of the route covered all districts of the North-western region of Uzbekistan (Figure 1).

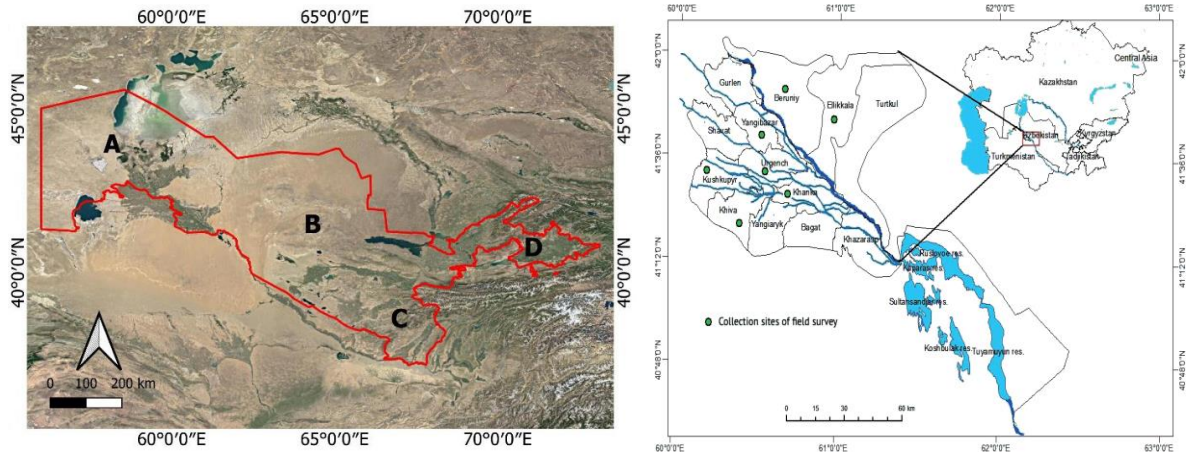

Fig. 1:Map Uzbekistan and location of North-western region of Uzbekistan

Collection sites for each species are presented in the same fashion as Drosopoulos et al. [10]. The reported locations for the collection sites were identified based on GIS [13].

The material was collected in different agro-and biocenoses of the Republic of Uzbekistan in 2019-2021. Insect material was collected using sweeping nets and glass containers, or by glass tube aspirators. Researches were carried out according to standard entomological methods. Night species were collected with a special trap on plants, roadsides, tree trunks and leaves. The samples killed in the killing bottles are then placed in petri dishes with blotter paper and information slips indicating when, where and from which plant they were collected. Insects were killed in glass tubes with ethyl-acetate or were directly stored in 70% ethyl-alcohol. Genitalia were prepared for observation under a Carl Zeiss Stemi 305 binocular stereoscope and Olympus CX23 binocular microscope by maceration in 10% potassium-hydroxide (KOH). All specimens were identified by the authors, according to keys and descriptions in references [10]. The species and modern classification, nomenclature of stink bugs were determined from scientific sources of [4, 11]. and information of species synonyms and distribution area was used from https://www.gbif.org,ru. [14]. Also, the results of the scientific work conducted by various researchers on the study of the insect pests of onion distributed in Uzbekistan and material of the collected species was deposited in the collection established by the fourth author, which is kept in the Laboratory of Khorezm academy Mamun of Sciences of the Republic of Uzbekistan.

Analysis and Results.

The present article provides an checklist of onion pests insects. Insect feedings were grouped according to their taxonomic level as well as their feed habits. The insect feeding stage, parts fed, distribution and corresponding references have been compiled and included. Order and family wise and genera (subgenera) and species are provided. Among these, a maximum number of species fall under Noctuidae (11 genera and 14 species), followed by Chrysomelidae, Curculionidae, Anobiidae, Ephydridae, Aleyrodidae, Pentatomidae, Pieridae, Gryllotalpidae. Our research revealed that leaf eating insects was dominant (40.3%) followed by onion bulb (21%), Seedling (8.2%),

Pseudo-stem / leaf (6.5%), Leaf / Umbel (4.8%), Leaf, onion bulb (4.8%), Onion bulb, Pseudo-stem (3.2%), Seedlings/leaf (3.2%),Onion bulb, Seed (3.2%), Root (1.6%), Leaf, root, pseudo-stem (1.6%), Pseudo-stem, leaf, Seedling (1.6%).

Onion thrips, *Thrips tabaci* are major sucking pests causing economic damage worldwide. Thrips act as vector for deadly virus in both the onion seed crop and the onion bulb crop. Beside aphids, *Myzus* sp. and *Neotoxoptera* sp were dominant sucking pests of onion. Onion maggot, *Delia antiqua* is a major dipteran pest of onion, particularly in the cooler regions.

To date, 62 species of onion pest's insects *have been reported by research scientists in Uzbekistan.*

Order: Coleoptera Linnaeus, 1758

Family: Chrysomelidae Latreille, 1802

Genus: *Altica* Geoffroy, 1762

1. *Altica splndia* (Linnaeus, 1758). **Common Name:** Flea beetle. **Insect feeding:** Leaf. **Damaging stage:** Larva / grub

Family: Curculionidae Latreille, 1802

Genus: *Ceuthorrhynchus* Champion, 1907

2. *Ceuthorrhynchus jakovlevi* Schultze, 1902. **Common Name:** Weevil. **Insect feeding:** Seedlings. **Damaging stage:** Larva / grub

Family: Elateridae Leach, 1815

Genus: *Agriotes* Eschscholtz, 1829

3. *Agriotes lineatus* (Linnaeus, 1767). **Common Name:** Wireworm **Insect feeding:** Seedlings. **Damaging stage:** Larva / grub.

4. *Agriotes mancus* (Say, 1823). **Common Name:** Wheat wireworm **Insect feeding:** Root. **Damaging stage:** Grub and Adult

Family: Nitidulidae Latreille, 1802

Genus: *Carpophilus* Stephens, 1829

5. *Carpophilus obsolutus* Erichson, 1843. **Common Name:** Dried fruit beetle, **Insect feeding:** Onion bulb. **Damaging stage:** Nymph and adult

Family: Anobiidae Fleming, 1821

Genus: *Lasioderma* Stephens, 1835

6. *Lasioderma serricorne* (Fabricius, 1972). **Common Name:** Cigarette beetle, **Insect feeding:** Onion bulb, Seed. **Damaging stage:** Nymph and adult

Family: Scarabaeidae Latreille, 1802

Genus: *Melolontha* Fabricius, 1775

7. *Melolontha melolontha* (Linnaeus, 1758). **Common Name:** Cockchafer, **Insect feeding:** Seedlings. **Damaging stage:** Larva / grub

8. *Melolontha hippocastani* Fabricius, 1801. **Common Name:** Cockchafer, **Insect feeding:** Seedlings. **Damaging stage:** Larva / grub

9. *Melolontha furicicauda* (Ancey, 1881). **Common Name:** Cockchafer, **Insect feeding:** Seedlings. **Damaging stage:** Larva / grub

Family: Dynastidae MacLeay, 1819

Genus: *Pentodon* Hope, 1837

10. *Pentodon bispinosus* Kust, 1852. **Common Name:** Potato scrabid, **Insect feeding:** Leaf. **Damaging stage:** Adult

Order: Dermaptera De Geer, 1773
Family: Forficulidae Latreille, 1810
Genus: *Euborellia* Burr, 1909
11. *Euborellia annulipes* (Lucas, 1847). **Common Name:** Ring legged earwig, **Insect feeding:** Onion bulb, Seedlings. **Damaging stage:** Nymph and adult
Order: Diptera (Linnaeus, 1758).
Family: Anthomyiidae Robineau-Desvoidy, 1830
Genus: *Delia* Robineau-Desvoidy, 1830
12. *Delia antiqua* (Meigen, 1826). **Common Name:** Onion fly, **Insect feeding:** Onion bulb, Pseudo-stem. **Damaging stage:** Maggot
13. *Delia platura* (Meigen, 1826). **Common Name:** Been fly, **Insect feeding:** Onion bulb, Pseudo-stem. **Damaging stage:** Maggot
Family: Drosophilidae Rondani, 1856
Genus: *Drosophila* Fallen, 1823
14. *Drosophila busckii* Conquillett, 1901. **Common Name:** Fruit fly, **Insect feeding:** Onion bulb. **Damaging stage:** Larva
Family: Ephydridae Zetterstedt, 1837
Genus: *Hydrellia*Robineau-Desvoidy, 1830
15. *Hydrellia griseola* (Fallen, 1823). **Common Name:** Rice leaf miner, **Insect feeding:** Leaf. **Damaging stage:** Larva
Family: Fanniidae Fanniidae Schnabl & Dziedzicki, 1911
Genus: *Fannia* Robineau-Desvoidy, 1830
16. *Fannia canicularis* (Linnaeus, 1761). **Common Name:** lesser housefly, **Insect feeding:** Onion bulb. **Damaging stage:** Larva
17. *Fannia scalaris* (Fabricius, 1794). **Common Name:** Latrine fly **Insect feeding:** Onion bulb. **Damaging stage:** Larva
18. *Fannia leucosticta* (Meigen, 1838). **Insect feeding:** Onion bulb. **Damaging stage:** Larva
19. *Fannia manicata* (Meigen, 1826). **Insect feeding:** Onion bulb. **Damaging stage:** Larva
Family: Heleomyzidae Westwood, 1840
Genus: *Suillia* Robineau-Desvoidy, 1830
20. *Suillia lurida* Meigen, 1830. **Common Name:** Garlic fly, **Insect feeding:** Onion bulb. **Damaging stage:** Larva
Family: Muscidae Latreille, 1802
Genus: *Muscina* Robineau-Desvoidy, 1830
21. *Muscina assimilis* Fallen, 1823. **Common Name:** Fly, **Insect feeding:** Onion bulb. **Damaging stage:** Maggot
22. *Muscina stabulans* Fallen, 1817. **Common Name:** Fly, **Insect feeding:** Onion bulb. **Damaging stage:** Maggot
Family: Syrphidae Latreille, 1802
Genus: *Eumerus* Meigen, 1822
23. *Eumerus strigatus* (Fallen, 1817). **Common Name:** Lesser bulb fly, **Insect feeding:** Onion bulb. **Damaging stage:** Maggot
Order: Hemiptera Linnaeus, 1758

Family: Aphididae Latreille, 1802

Genus: *Myzus* Passerini, 1860

24. *Myzus ascalonicus* Doncaster, 1946. **Common Name:** Shallot aphid, **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

25. *Myzus persicae* (Sulzer, 1776). **Common Name:** Shallot aphid, **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Genus: *Aphis* Linnaeus, 1758

26. *Aphis gossypii* Glover, 1877. **Common Name:** Cotton aphid, **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Genus: *Aulacorthum* Mordvilko, 1914

27. *Aulacorthum solani* (Kaltenbach, 1843). **Common Name:** Foxglove aphid, **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Genus: *Rhopalosiphum* Koch, 1854

28. *Rhopalosiphum maidis* (Fitch, 1856) **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Genus: *Schizaphis* Börner, 1931

Subgenus: *Schizaphis* Börner, 1931

29. *Schizaphis* (*Schizaphis*) *pyri* Shaposhnikov, 1952 **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Family: Aleyrodidae Westwood, 1840

Genus: *Bemisia* Quaintance & Baker, 1914

30. *Bemisia tabaci* (Gennadius, 1889). **Common Name:** Cotton and tomato white fly, **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Family: Cicadellidae Latreille, 1802

Genus: *Hebata* DeLong, 1931

31. *Empoasca decipines* Paoli, 1930. **Common Name:** Leafhopper, **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Genus: *Macrosteles* Fieber, 1866

32. *Macrosteles quadrilineatus* (Forbes, 1885) **Common Name:** Ash leafhopper, **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Family: Pentatomidae Leach, 1815

Genus: *Nezara* Amyot & Serville, 1843

33. *Nezara viridula* (Linnaeus, 1758). **Common Name:** Southern green stinkbug, **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Genus: *Carpocoris* Kolenati, 1846

34. *Carpocoris fuscipinus* Boh, 1851. **Common Name:** Shield bug, **Insect feeding:** Leaf

Genus: *Dolycoris* Mulsant & Rey, 1866

35. *Dolycoris baccarum* Linnaeus, 1785. **Common Name:** Shield bug, **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Order: Hymenoptera Linnaeus, 1758

Family: Formicidae Linnaeus, 1758

Genus: *Solenopsis* Westwood, 1840

36. *Solenopsis* sp **Common Name:** Red ant, **Insect feeding:** Onion bulb. **Damaging stage:** Adult

Order: Lepidoptera Linnaeus, 1758
Family: Glyphipterigidae Stainton, 1854
Genus: *Acrolepia* Curtis, 1838

37. *Acrolepia sapporensis* Matsumura, 1931. **Common Name:** Asiatic onion leaf miner, **Insect feeding:** Leaf. **Damaging stage:** Larva

38. *Acrolepia asiatica* (Gaedike, 1971). **Common Name:** Leek moth, **Insect feeding:** Leaf, onion bulb. **Damaging stage:** Larva

Family: Noctuidae Latreille, 1809
Genus: *Spodoptera* Guenée, 1852

39. *Spodoptera exigua* (Hubner, 1808). **Common Name:** Beet armyworm, **Insect feeding:** Leaf / Umbel. **Damaging stage:** Larva

40. *Spodoptera litura* (Fabricius, **1775**). **Common Name:** Cutworm, **Insect feeding:** Leaf / Umbel. **Damaging stage:** Larva

Genus: ***Agrotis*** Ochsenheimer, 1816

41. *Agrotis ipsilon* (Hufnagel, 1766). **Common Name:** Black cutworm, **Insect feeding:** Leaf, root, pseudo-stem. **Damaging stage:** Larva

Genus: *Helicoverpa* Hardwick, 1965 Ochsenheimer, 1816

42. *Helicoverpa armigera* (Hubner, 1809). **Common Name:** Old word bollworm, **Insect feeding:** Leaf and umbel. **Damaging stage:** Larva

Genus: *Chrysodeixis* Hübner 1821

43. *Chrysodeixis acuta* (Walker, 1858). **Common Name:** Green looper, **Insect feeding:** Leaf. **Damaging stage:** Larva

Genus: *Helicoverpa* Hardwick, 1965

44. *Heliothis assulta* Guenee, 1852. **Common Name:** Oriental tobacco budworm, **Insect feeding:** Leaf. **Damaging stage:** Larva

45. *Noctua pronuba* (Linnaeus, 1758). **Common Name:** Large yellow under wing, **Insect feeding:** Seedlings/leaf. **Damaging stage:** Larva

Genus: *Agrotis* Ochsenheimer, 1816

46. *Agrotis segetum* (Denis & Schiffermüller, 1775). **Common Name:** Turnip moth, **Insect feeding:** Leaf. **Damaging stage:** Larva

Genus: *Euxoa* Hübner, 1821

47. *Euxoa nigricans* (Linnaeus, 1761). **Common Name:** Garden dart moth, **Insect feeding:** Pseudo-stem, leaf, Seedling. **Damaging stage:** Larva

48. *Euxoa tritici* (Linnaeus, 1761). **Common Name:** White line dart moth, **Insect feeding:** Seedling / leaf. **Damaging stage:** Larva

Genus: *Hydraecia* Guenée, 1841

49. *Hydraecia mongoliensis* (Urbahn, 1967). **Common Name:** Onion stem borer, **Insect feeding:** Pseudo-stem / leaf. **Damaging stage:** Larva

Genus: *Thysanoplusia* Ichinosé, 1973

50. *Trichoplusia orichalcea* Fabricius, 1775. **Common Name:** Semilooper, **Insect feeding:** Leaf. **Damaging stage:** Larva

Genus: *Mamestra* Ochsenheimer, 1816

51. *Mamestra brassicae* (Linnaeus, 1758). **Common Name:** Cabbage moth, **Insect feeding:** Leaf. **Damaging stage:** Larva

Genus: *Xestia* Hübner, 1818

52. *Agrotis c-nigrum* Linnaeus, 1758. **Common Name:** Spotted cutworm, **Insect feeding:** Pseudo- stem / leaf. **Damaging stage:** Larva

Family: Pieridae Swainson, 1820

Genus: *Pieris* Hübner, 1819

53. *Pieris rapae* (Linnaeus, 1758). **Common Name:** Cabbageworm, **Insect feeding:** Leaf. **Damaging stage:** Adult

Family: Pyralidae Latreille, 1809

Genus: *Cryptoblabes* Zeller, 1848

54. *Cryptoblabes gnidiella* (Milliere, 1867). **Common Name:** Christmas berry webworm, **Insect feeding:** Onion bulb.

Genus: *Ephestia* Guenée, 1845

55. *Ephestia kuehniella* (Zeller, 1879). **Common Name:** Mediterranean flour moth, **Insect feeding:** Onion bulb. **Damaging stage:** Larva

Genus: *Cryptoblabes* Zeller, 1848

56. *Cryptoblabes gnidiella* (Millere, 1867). **Common Name:** Garlic moth, **Insect feeding:** Leaf / Onion bulb. **Damaging stage:** Larva

Family: Crambidae Latreille, 1810

Genus: *Loxostege* Hübner, 1825

57. *Loxostege sticticalis* (Linnaeus, 1761). **Common Name:** Beet webworm, **Insect feeding:** Pseudo Stem / Leaf. **Damaging stage:** Larva

Order: Orthoptera Latreille, 1793

Family: Gryllotalpidae Saussure, 1870

Genus: *Gryllotalpa* Latreille, 1802

58. *Gryllotalpa gryllotalpa* (Linnaeus, 1758). **Common Name:** Common mole cricket, **Insect feeding:** Pseudo-stem / Leaf. **Damaging stage:** Nymph and adult

Family: Acrididae MacLeay, 1819

Genus: *Eyprepocnemis* Fieber, 1853

59. *Euprepocnemis plorans* (Charpentier, 1825). **Common Name:** Clover grasshopper. **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Order: Thysanoptera Haliday, 1836

Family: Thripidae Stephens, 1829

Genus: *Thrips* Linnaeus, 1758

60. *Thrips tabaci* Lindeman, 1889. **Common Name:** Onion thrips, **Insect feeding:** Leaf, onoin bulb. **Damaging stage:** Nymph and adult

61. *Thrips flavus* Schrank, 1776. **Common Name:** Yellow flower thrips, **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

Genus: *Frankliniella* Karny, 1910

62. *Frankliniella occidentalis* Perganda, 1895. **Common Name:** Western Flower Thrips, **Insect feeding:** Leaf. **Damaging stage:** Nymph and adult

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UDK 546.562.712-547.32

SYNTHESIS AND STRUCTURE OF HETEROMETALLIC POLYNUCLEAR COORDINATION COMPOUND BASED ON COPPER (II) FORMAT AND MANGANESE (II) METACHRESOXYACETATE

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Annotasiya. Ushbu maqolada mis (II) formiati va marganes (II) metakrezoksiatsetati asosida geterometall poliyadroli koordinasion birikma sintezi qilish usuli va uning tuzilishini aniqlash maqsadida rentgenofazaviy tahlil natijalari keltirilgan. Rentgenofazaviy tahlildan olingan natijalar FullProf dasturi yordamida qayta ishlab struktura ko'rinishi ham isbotlangan.

Kalit so'zlar: mis (II) formiati, marganes (II) metakrezoksiatsetati, element tahlili, rentgenofazaviy tahlil, FullProf

Аннотация. В статье представлен метод синтеза гетерометаллического полиядерного координационного соединения на основе формиата меди(II) и метакрезоксиацетата марганца(II) и результаты рентгенофазового анализа с целью определения его структуры. Результаты, полученные при рентгенофазовом анализе, также подтвердили воспроизводимую структуру с помощью программы FullProf.

Ключевые слова: формиат меди(II), метакрезоксиацетат марганца(II), элементный анализ, рентгенофазовый анализ, FullProf.

Abstract. This article presents the method of synthesizing a heterometallic polynuclear coordination compound based on copper (II) formate and manganese (II) methacresoxyacetate and the results of X-ray phase analysis in order to determine its structure. The results obtained from the X-ray phase analysis were also proven to be reproducible structure using the FullProf program.

Keywords: copper (II) formate, manganese (II) methacresoxyacetate, elemental analysis, X-ray phase analysis, FullProf

Introduction. Studying the mechanism of action of drugs on the human body is one of the current problems of medicinal chemistry and pharmacology. The use of modern innovative technologies plays an important role in creating effective tools. In the production of such tools, it is of great importance to use materials with antimicrobial properties, as well as simple, cheap and well-known structures as raw materials.

Literature review. Cresoxyacetate and its derivatives have been found to have immunomodulatory properties, reduce microbes in the body, protect the liver and have many other biological activities [1-4].

In addition to homonuclear complexes with a network structure, heteronuclear coordination compounds are also reported in the literature, for example $[Fe(III)_2M_2]$, where M = Mn(II), Co(II), Ni(II) [5]. The formation of such compounds takes place in several stages. In the first step, a mononuclear complex consisting of $[Fe(Hpoap\text{-}H)(NO_3)(H_2O)_2](NO_3)_2{\cdot}2H_2O$ (Npoap-H is a neutral ligand with deprotonated O1 and protonated N5 atoms) was obtained and its structure is shown in Fig. 1.

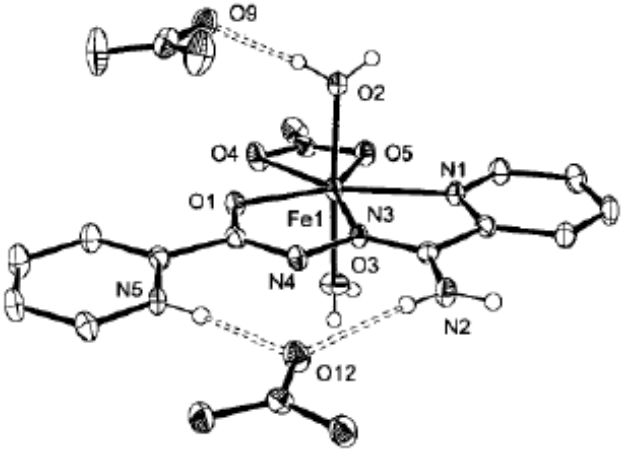


Figure 1. Structure of $[Fe(Hpoap\text{-}H)(NO_3)(H_2O)_2](NO_3)_2{\cdot}2H_2O$ complex

The coordination polyhedron is in the form of a pentagonal bipyramid. The Fe^{3+} ion is located in the equatorial plane and is connected to the ligand through two nitrogen atoms and one oxygen atom, as a result of which two options for further coordination appear:

- the connection of the second metal ion with the ligand goes through N2-N4-N5, in which a m-NN bridge can be formed between the metal ions;
- connecting the second metal ion with the ligand through N5 and O1 atoms; in which an ox-bridge is formed between the metal atoms (where the phenol ring is turned by 180º).

The second type of coordination takes place in the reaction of the iron mononuclear complex with copper (II) perchlorate [6]. The product of the reaction is a heterometallic tetrahedral complex of the [2x2] type, the composition is $[(poap\text{-}H)_4Cu^{II}{}_3Fe^{III}(NO_3)]_2(NO_3)_4(ClO_4)_4{\cdot}12H_2O$, the structure is shown in Fig. 2.

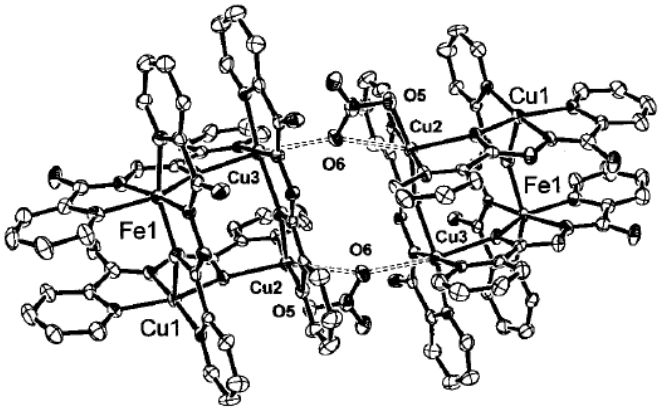


Figure 2. Molecular structure of $[(poap\text{-}H)_4Cu^{II}_3Fe^{III}(NO_3)]_2(NO_3)_4(ClO_4)_4 \cdot 12H_2O$ complex

The complex contains two $[FeCu_3(\mu\text{-}O)_4]$ subunits, which are joined by an ox-bridge involving the nitrate ion. Each subunit has four metal centers: two six-coordinated copper atoms, one five-coordinated copper atom, and one six-coordinated iron atom. Ligands are paired, parallel to each other above and below the plane formed by the metal cations.

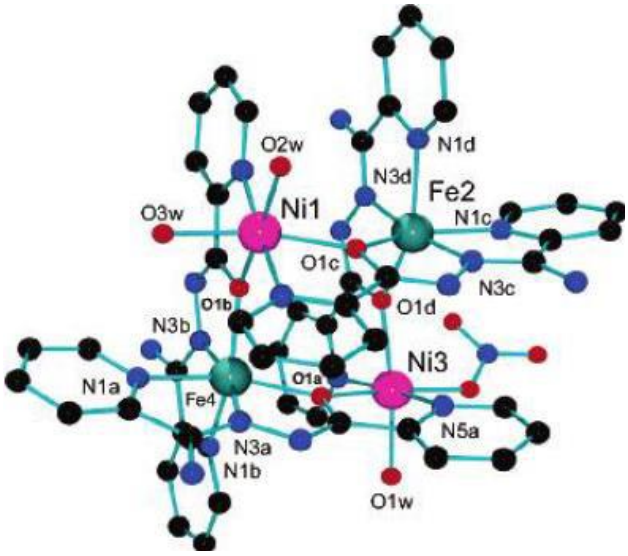


Figure 3. Structure of the complex containing $[Fe_2Ni_2(poap\text{-}H)_4(NO_3)(H_2O)_3](NO_3)_5 \cdot 2{,}5H_2O \cdot 1{,}75CH_3OH$

The magnetic moment of the complex at room temperature is shown by the temperature dependence of the magnetic absorption 6.68 μv. The minimum value of the magnetic moment when lowering the temperature to 35 K is 6.38 μv decreases to 0.2 K, and then rapidly increases to 7.2 μv constitutes The first jump corresponds to the intramolecular antiferromagnetic exchange between Cu(2)-Cu(3) and the large angle (Cu(2)-O(1)-Cu(3) 142.0°). The increase in the magnetic moment when the temperature drops below 30 K is explained by the intramolecular ferromagnetic exchange in the Cu(1)-O(4)-Fe(1) chain. Antiferromagnetic (Cu-Cu) and ferromagnetic (Fe-Cu) interactions at the boundary of one molecule lead to the ground state S=3 [7] brings.

It should also be said that the ratio Fe:M =1:3 is obtained only in the reaction of iron complexes with Cu(II). The interaction of mononuclear complex of iron with ions

of other metals (Mn(II), Co(II), Ni(II)) leads to the formation of complexes with a metal ratio of 2:2. For example, in the reaction of $[Fe(Hpoap-H)(NO_3)(H_2O)_2](NO_3)_2 \cdot 2H_2O$ with $Ni(NO_3)_2 \cdot 6H_2O$ $[Fe_2Ni_2(poap-H)_4(NO_3)(H_2O)_3](NO_3)_5 \cdot 2{,}5H_2O \cdot 1{,}75CH_3OH$ complex was obtained, its structure is presented in Fig. 3.

Research Methodology. The following salts were used for the synthesis of complex compounds: "pure for chemical analysis" brand manganese (II) acetate, m-cresoxyacetic acid, malachite and formic acid. The used organic solvents were also purified and dried by known methods [8-11].

The synthesis of the starting materials was carried out using the following methods: An alkali solution prepared in a 1:2 mol ratio was added to the metal salt solution. The resulting precipitate was washed by decantation until foreign ions disappeared. A salt solution was formed by adding meta-cresoxyacetic acid to the purified manganese hydroxide precipitate.

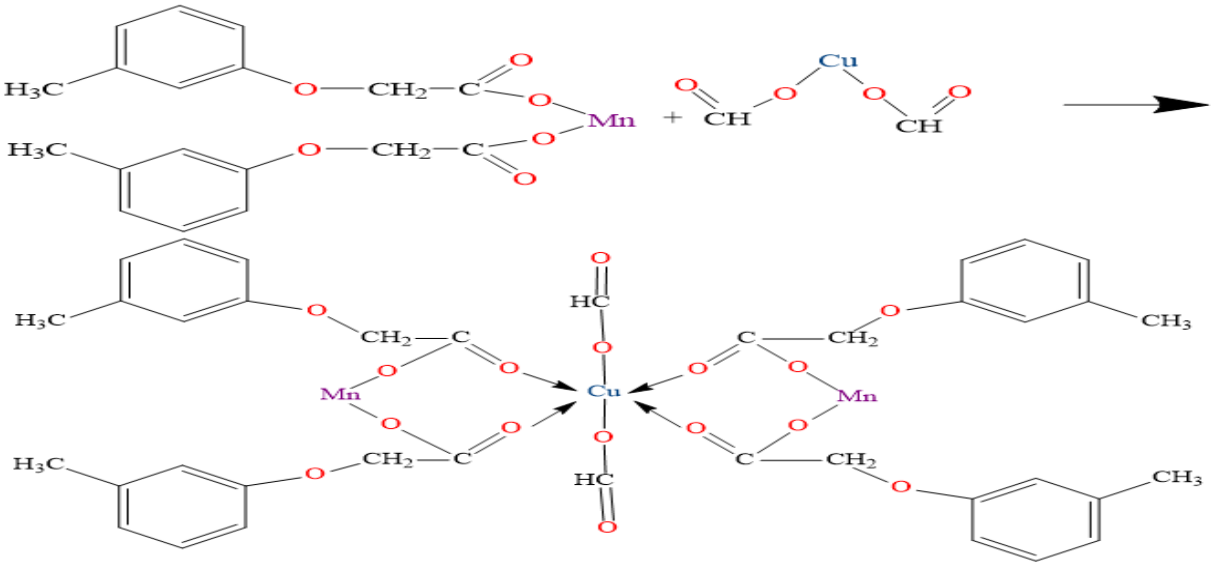
$Mn(CH_3COO)_2 + 2NaOH = Mn(OH)_2\downarrow + 2CH_3COONa$

$Mn(OH)_2\downarrow + 2\ CH_3\text{-}C_6H_4\text{-}O\text{-}CH_2\text{-}COOH = (CH_3\text{-}C_6H_4\text{-}O\text{-}CH_2\text{-}COO)_2Mn$

A 1:4 mole ratio of formic acid solution was added over malachite to form a solution of copper(II) formate.

$CuCO_3 \cdot Cu(OH)_2 + 4HCOOH = 2\ (HCOO)_2Cu + CO_2\uparrow + H_2O$

The synthesis of the complex compound was carried out according to the following method: 0.01 mol copper formate was dissolved in 15 ml of water. 0.02 mol in another beaker manganese methacreoxyacetate was dissolved in 20 ml of a 1:1 mixture of water:acetonitrile by heating in a hot water bath (at a temperature of 50-55 C). Then Cu(II) dropwise over the formate solution, manganese of a hot solution of methacreoxyacetate was added and the mixture was evaporated for 4 h until the volume was reduced by a factor of 1.5. The resulting solution was left for 2 days. The resulting powdery substance was dissolved in a mixture of 2 ml of distilled water and 2 ml of alcohol and left for 72 hours to recrystallize.The yield of the mass of the obtained substance compared to the mass of the initial substance was 76.8%.



Analysis and results. Elemental composition and some physical properties of the substances formed in all reaction processes were determined (Table 1).

In order to prove the individuality of the crystal lattice of the coordination compound synthesized with Mn(II) methacreoxyacetate of Cu(II) formate, X-ray phase analysis of the original and synthesized coordination compound was carried out and diffractograms were compared. It was found that the interplanar distances and intensity of the synthesized compound did not match (Fig. 4).

Table 1

Elemental analysis and some physical properties of synthesized primary substances and complex compounds

Compounds		$(HCOO)_2Cu$	$(C_9H_9O_3)_2Mn$	$[Cu(HCO_2)_2 \cdot 2(C_9H_9O_3)_2Mn]$
Cu	Calculated	41.56	-	6.93
	It has been determined	41.53	-	6.88
Mn	Calculated	-	14,14	11.91
	It has been determined	-	14,16	11.89
C	Calculated	15.58	55,53	49.35
	It has been determined	15.59	55,51	49.31
O	Calculated	41.56	24.68	17,16
	It has been determined	41.59	24.67	17.11
Compound color		Dark blue	Colorless	Blue
Liquefaction temperature, ^0C		132-133	148	196-197
Reaction yield, %		93.66	89.18	76.8
Solubility in solvents	Water	It dissolves	It dissolves	It dissolves
	Ethyl alcohol	Slightly soluble	Does not dissolve	Does not dissolve
	Acetonitrile	Does not dissolve	Does not dissolve	Slightly soluble
	Benzene	Does not dissolve	Does not dissolve	Does not dissolve
	Ethyl acetate	Does not dissolve	Does not dissolve	Does not dissolve
	DMFA	Does not dissolve	Does not dissolve	Does not dissolve

The interplanar distance and intensity values were calculated from the diffractograms and the obtained results are presented in Table 2. As can be seen from the interplanar distance and intensity values, the obtained compound does not repeat the initial compounds, and it was determined that the complexes synthesized based on the obtained data have a specific individual crystal lattice, which is not found in the crystallographic database.

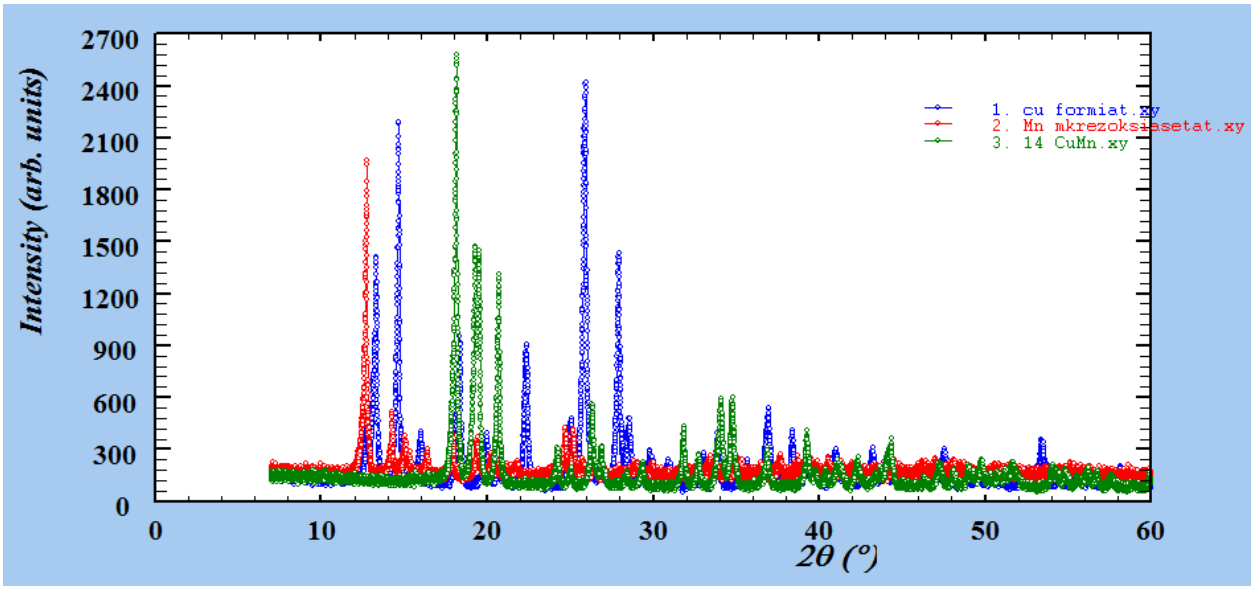


Figure 4. X-ray pattern of the complex compound [Cu(HCOO)$_2$·2Mn(CH$_3$-C$_6$H$_4$-OCH$_2$COO)$_2$] compared with the starting materials

Table 2

Interplanar distances and intensities of the coordination compound obtained on the basis of copper(II) formate and manganese(II) methacreoxyacetate

Angle [°2th]	Height [cts]	The distance between the planes [Å]	Intensity[%]	Three widths
16.3143	196.54	5.43339	100.00	0.0708
18.1671	157.03	4.88323	79.90	0.1134
19.5540	93.06	4.53990	47.35	0.0708
20.7319	126.09	4.28454	64.16	0.0567
26.5247	90.64	3.36051	46.12	0.1417
28.4449	120.23	3.13788	61.17	0.1134
28.6612	130.77	3.11469	66.54	0.1700
32.2505	79.43	2.77577	40.41	0.2267
42.7049	79.75	2.11735	40.58	0.3401

In order to prove the structure of the synthesized compounds, a structural analysis was carried out at the Scientific Research Institute of Nuclear Physics of the Republic of Uzbekistan on a modern diffractometer of the Malvern Pananalytical company, Empyrean, based on X-ray scattering. This device is one of the world's leading devices with stable, reliable operation due to its technical indicators, research capabilities, additional equipment, modern software, complete structure base based on diffraction results. Unlike other diffractometers, this diffractometer allows for studies at very small scattering angles in addition to small and wide scattering angles. It creates opportunities to improve their properties based on the determination of the structure of the product, material, compound and samples of different sizes and conditions, and the relationship between the structure and their properties.

Table 3 and Figure 5 show the crystallographic characteristics and X-ray structural analysis results obtained from the processing of the diffractogram results using the Fullprof program. **Table 3**

[Cu(HCO2)2·2(C9H9O3)2Mn]crystallographic data and details of the structure of the complex

Indicators	$[Cu(HCO_2)_2 \cdot 2(C_9H_9O_3)_2Mn]$
Molecular mass	932
Syngonia	Triclinic
Spatial group	P 1
a, Å	18.7910
b, Å	26.5745
c, Å	26.5745
a, b, g, deg	90.00, 90.00, 90.00
V, Å3	611.98
Z	1
D_x, g cm-3	1.645
m(CuKa), mm-1	1.929
Crystal size, [mm]	0.22×0.18×0.12
T, °K	298
th,°grad.	2.6, 52.4
Interval h,k,l	-9: 9; -15: 15; -17: 18

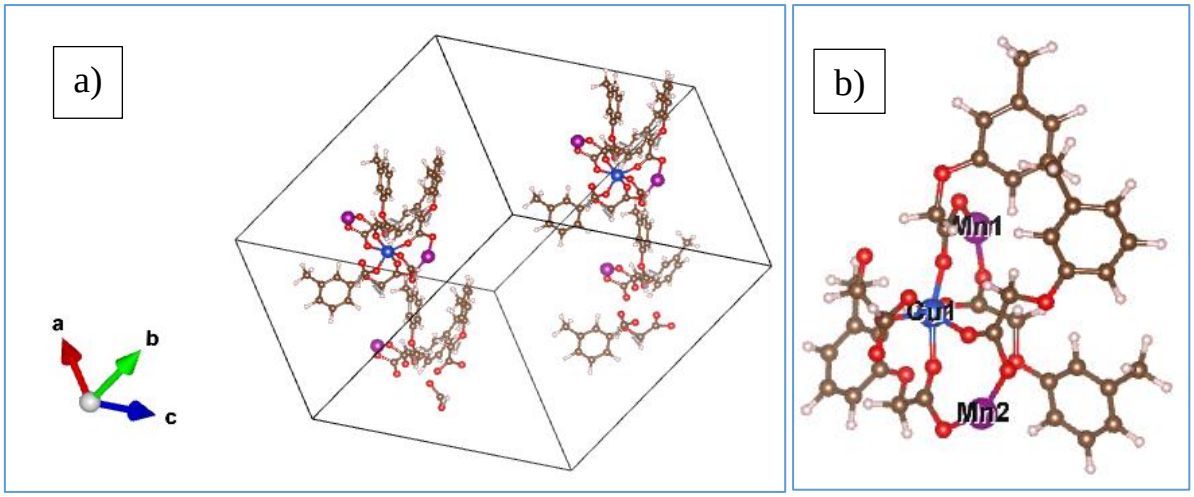


Figure 5. Structural form (a) and structure of the molecule (b) of the complex compound $[Cu(HCO_2)_2 \cdot 2(C_9H_9O_3)_2Mn]$

Conclusion. In order to prove the individuality of the crystal lattice of the coordination compound synthesized with manganese metachreoxyacetate of Cu(II) formate was analyzed using X-ray phase analysis. The data obtained in the analysis of radiographs showed that the synthesized complex has unique properties that are not found in the crystallographic database. As can be seen from the given structure, the coordination in the synthesized compound is connected through the copper (II) ion and the oxygen atoms of the cresoxyacetate carbonyl group. In this case, the coordination number of the ion is equal to 6, and the geometry of the coordination node is an octahedron.

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UDC: 54.052; 54.056.

INCREASING THE ACTIVITY OF β-GLUCOSIDASE ENZYME USED IN INDIGO OBTAINING FROM *INDIGOFERA TINCTORIA L*

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Abstract: Indigo dye is one of the dyes that has been used since ancient times and has maintained its importance to this day. Currently, indigo is obtained synthetically and from natural sources. Synthesis of indigo uses non-renewable resources, hurting the environment. This encourages research to improve the efficiency of natural methods that do not harm the environment. We studied the effect of ultrasound on the extraction of leaves of *Indigofera tinctoria L* and the acceleration of the fermentation process. The conducted studies showed that under the influence of ultrasound, the fermentation process time was shortened, and indigo dye was expected to be produced more efficiently.

Keywords: *Indigofera tinctoria L*, indigo, microelement, *Lactobacillus acidophilus*, β-glucosidase.

Аннотация: Краситель индиго – один из красителей, который использовался с древних времен и сохранил свое значение по сей день. В настоящее время индиго получают синтетически и из природных источников. Синтез индиго использует невозобновляемые ресурсы, нанося вред окружающей среде. Это стимулирует исследования по повышению эффективности естественных методов, не наносящих вреда окружающей среде. Изучено влияние ультразвука на экстрагирование листьев *Indigofera tinctoria L* и ускорение процесса ферментации. Проведенные исследования показали, что под воздействием ультразвука время процесса ферментации сокращается, а краситель индиго получается производить более эффективно.

Ключевые слова: *Indigofera tinctoria L*, индиго, микроэлемент, *Lactobacillus acidophilus*, β-глюкозидаза.

Annotatsiya: Indigo bo'yog'i qadim zamonlardan beri qo'llanilgan va hozirgi kungacha o'z ahamiyatini saqlab kelgan bo'yoqlardan biridir. Hozirgi vaqtda indigo sintetik va tabiiy manbalardan olinadi. Indigo sintezi qayta tiklanmaydigan resurslardan foydalaniladi va atrof-muhitga zarar yetkaziladi. Bu esa atrof-muhitga

zarar keltirmaydigan tabiiy usullarning samaradorligini oshirish bo'yicha tadqiqotlarni rag'batlantiradi. Biz ultratovushning *Indigofera tinctoria L* barglarini ekstraktsiyalash va fermentatsiya jarayonini tezlashtirishga ta'sirini o'rganib chiqdik. O'tkazilgan tadqiqotlar shuni ko'rsatdiki, ultratovush ta'sirida fermentatsiya jarayonining vaqti qisqartirildi va indigo bo'yog'ini yanada samarali olish imkonini berdi.

Kalit so‘zlar: *Indigofera tinctoria L*, indigo, mikroelement, *Lactobacillus acidophilus*, β-glyukosidaza.

1. Introduction

Indigo dye has been used since ancient times. In 2009, a 6,000-year-old indigo-dyed cotton fabric was found in Huaca Prieta, Peru [1]. Indigo-dyed clothes were found in the tomb of the ancient Egyptian ruler Tutankhamun [2].

Obtaining and using indigo dye is still important today. Synthetic indigo is produced more than natural indigo. However, it is necessary to take into account the consequences of industrial-scale production of indigo by synthesis, causing great damage to the environment. In addition, there are large amounts of raw materials and costs involved in synthesizing indigo. Due to these circumstances, the extraction of indigo from natural sources remains important until now, and there is a special interest in obtaining it by this method. Many studies are being conducted and studied in this regard [3].

Researchers Y. Raji and his colleagues focused their work on optimizing the method of indigo extraction and showed that it is possible to increase the yield to 0.9 % by adding 10 % sugar during the fermentation period (pH=10) of the resulting liquid. They showed that by using centrifugation at a speed of 7000 rpm instead of conventional filtration, it is possible to reduce the dye separation time to 5 minutes [4].

Prepared indigo dye blue pigment (powder form) from leaves of *Indigofera tinctoria L* using alkali solution (sodium hydroxide solution of different concentrations 2.0 M, 3.0 M and 4.0 M) and hydrogen peroxide. The highest yield of indigo dye in powder form (4.30 %) was obtained using 2.0 M sodium hydroxide solution, 3.61 % and 3.39 % respectively in 3.0 M and 4.0 M sodium hydroxide solutions [5]. However, the substances used in this method require additional costs, and cleaning the obtained product from additives can increase the cost even more.

Fresh leaves of four *Isatis species*, the cultivated form of *Indigofera tinctoria L* and the wild forms of *I. buschiana Schischkin, I. candolleana Boiss* and *Indigofera tinctoria subsp.* Fermentation and use of hot water to obtain indigo from corymbosa have been implemented. Optimization of extracted dyes with different pH and reducing agents was studied. The results showed that the reducing reagent concentration had no significant effect on the color quality. Although dark blue and blue colors are obtained from extracts of *Indigofera tinctoria L* and *I. candolleana*, *Indigofera tinctoria subsp. corymbosa* and *I. buschiana* mainly produced yellow-gray colors. The highest amount of indigo was determined spectrophotometrically as 4.19 mg/g and 2.53 mg/g in *Indigofera tinctoria L* and *I. candolleana*, respectively. In this study, harvest season was shown to be important for indigo production and the highest indigo yield was observed in mid-June [6].

Indigofera tinctoria L and *Baphicacanthus cusia Brem* are plants used as a natural source of indigo dye and found in northern Thailand. Research has been conducted to find optimal conditions for efficient extraction of indigo from these plants. It was found that cutting the raw material into small pieces, putting it in a cotton bag and soaking it in water for 24 hours can reduce the unpleasant smell and make it easier to get rid of the waste. Separation of the crude extract by thin layer chromatography (TLC) using chloroform-hexane-methanol (7:4:1 v/v/v) as the solvent system revealed two major bands with R_f values of 0.69 and 0.49, respectively blue and a red pigment was formed. The maximum absorption from UV-Vis spectroscopy and the infrared spectrum of the blue pigment were matched with indigo standards [7].

Fermentation is very important in the process of obtaining indigo from plants. Because the indican contained in the plant is hydrolyzed by enzymes and indoxyl is formed after extraction into the solution. This process takes more time (12-24 hours). Hydrolysis processes of indican using different enzymes have been studied [3, 8].

β-glucosidase is one of the most widely used enzymes in indigo production.

One of the common enzymes produced by lactic acid bacteria is β-glucosidase, which is involved as a catalyst in the hydrolysis of glucosides through hydrolysis reactions [9, 10]. However, the rapid implementation of the above processes, that is, the bioconversion of substances, is usually prevented by the cell membrane of lactic acid bacteria, as a result of which the effective transport of glycosides and β-glucosidases decreases. As a result of increasing the permeability of the cell membrane of bacteria, it is possible to improve the transport of enzymes. Ultrasound can be used to do this. W.S. Liu and his colleagues developed a methodology to increase the activity of the β-glucosidase enzyme of *Lactobacillus acidophilus* BCRC 10695 by ultrasound exposure. In this case, ultrasound (20 kHz, amplitude 20 %) was exposed to the stationary phase of the growth of *Lactobacillus acidophilus* BCRC 10695 for 2 minutes and re-incubated for 24 hours, and β-glucosidase activity was found to increase by 3.91 U/mL [11].

Taking into account the research data presented above, we studied the effect of ultrasound to increase the activity of β-glucosidase, which is involved in the hydrolysis of indoxyl-β-D-glucoside in the plant *Indigofera tinctoria L*, grown in the grassy alluvial soils of Khorezm region.

2. Materials and equipment. Dried *Indigofera tinctoria L* leaves, distilled water, 0.1 N NaOH solution, Lactobacillus acidophilus colony, dimethylformamide (DMF), PH100B digital stationary pH meter, 1 L conical flask, 1 L beaker, digital magnetic stirrer hot plate (MS7-H550-S, China), funnel, Centrifuge (DLAB, DM0424), 50 ml volumetric flasks, 200 ml volumetric flask, Ultrasonic bath (40 kHz, GT SONIC), UV-3200 spectrophotometer, ISP-MS (Nexion 2000) device.

2.1. Obtaining indigo dye. 20 g of dried *Indigofera tinctoria L* leaves were cut and placed in a 1 L flask and 300 mL of distilled water was poured over it. After the plant mass in the flask was mixed with water, the mixture in the flask was exposed to ultrasound (40 kHz) at a temperature of 50°C for 10 minutes. Aqueous extract was separated from the leaves, and 1 mL of *Lactobacillus acidophilus* colony was added to the solution and placed in a thermostat at a temperature of 37°C for 12 hours. During these 12 hours, ultrasound was applied 4 times (for 5 minutes). At the end of the

specified time, 0.1 N NaOH solution was added to the solution in the flask until the pH indicator reached 8-8.5. Air was passed for 1-1.5 hours until blue precipitates were formed through the solution, the pH indicator of which was brought to the specified value. Blue precipitates were separated by centrifugation.

In the second experiment, plant leaves were fermented without separating them from the aqueous mixture. Only leaves before oxidation were extracted.

The indigo powders isolated in each experiment were dissolved in dimethylformamide, and UV spectra of the indigo substance in the resulting solution were obtained in a spectrophotometer.

To study the amount of nitrogen element in the plant *Indigofera tinctoria L*, the amount of total protein was determined by the Keldal method.

Determining the amount of micro- and macroelements in the plant was also carried out. For analysis, the sample is first dissolved. For this purpose, 0.5 g of the sample is placed in Teflon autoclaves and humidification is carried out. Then, 4 ml of concentrated nitric acid and 3 ml of hydrogen peroxide were poured into the autoclaves, the autoclaves were closed and placed in a microwave digester. Sample decomposition time includes 25-40 minutes. After decomposition, the samples were transferred to a 100 ml volumetric flask and 0.5 % nitric acid was added up to the mark. Further analyzes were performed on the ISP MS device. Multielement standard and Hg standard were used as standards. The analysis was performed three times and the arithmetic mean of the results was determined.

3. Results and discussion. Ultrasound accelerates the extraction of indoxyl-β-D- glucoside contained in the plant *Indigofera tinctoria L*, grown in alluvial soils of the Khorezm region, into an aqueous solution faster and at a lower temperature. Because under the influence of ultrasound, water molecules penetrate the plant mass at a high speed. The use of this effect makes it possible to save several times the energy provided by heat (80°C).

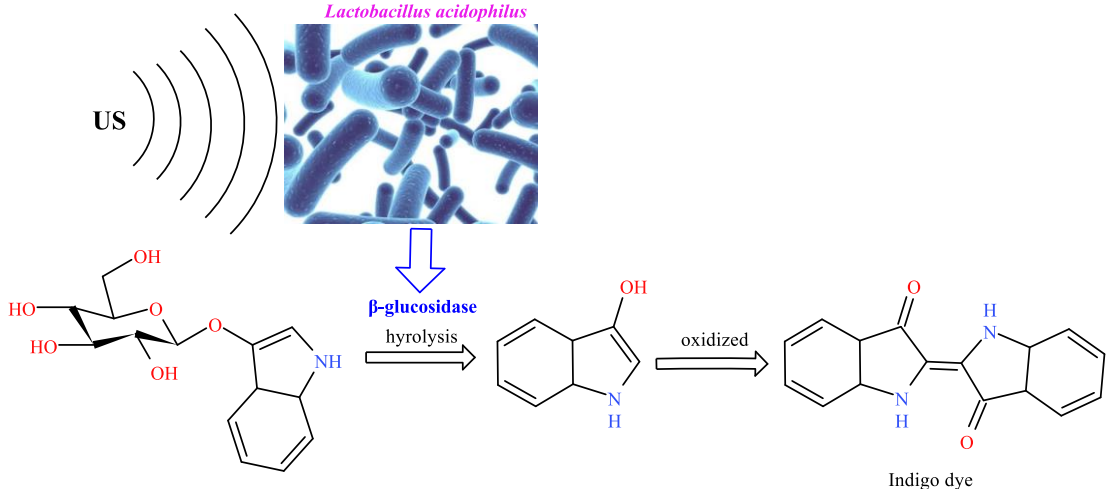

Figure 1. Hydrolysis of indoxyl-β-D-glucoside by the enzyme β-glucosidase activated by ultrasound

During the fermentation process, the reason for putting the mixture in a thermostat for 12 hours at a temperature of 37°C is that it is most convenient for *Lactobacillus acidophilus* bacteria to multiply at this temperature [12]. Indoxyl and

glucose are formed due to hydrolysis of indoxyl-β-D-glucoside released from the plant mass into the aqueous environment with the participation of β-glucosidase enzyme produced by *Lactobacillus acidophilus* bacteria. As a result of ultrasound exposure, the exchange of β-glucosidase and indoxyl-β-D-glucoside through the thick walls of *Lactobacillus acidophilus* bacteria increases. This leads to an increase in β-glucosidase activity and an acceleration of the hydrolysis of indoxyl-β-D-glucoside (Figure 1).

In the process of hydrolysis, indoxyl is formed, and as a result of its oxidation, indigo dye is formed. The resulting blue indigo dye substance precipitates in the solution.

Indigo precipitates were quickly separated by centrifugation, dried, and mass determined. In the first experiment, the mass of indigo powder obtained from 20 g of leaves was 0.5892 g, and in the second experiment, it was 0.4245 g. Comparatively, 29.5 g of indigo powder can be obtained from 1 kg of leaves in the first method, and 21 g in the second method.

When the leaves were fermented without separation after extraction, it was observed that the mass of the obtained indigo dye was less. The main reason for this is that a certain amount of oxidation occurs in the solution during the longer fermentation. As a result, indigo particles settle on the surface of plant leaves. It is almost impossible to separate paint particles on the surface of leaves in an aqueous environment. Therefore, a certain amount of indigo dye mass is lost during fermentation without separation of plant leaves. Therefore, in the process of obtaining indigo, it is advisable to separate the leaves after extraction and then carry out the fermentation process. It can be shown that centrifugation is more efficient than filtration of the resulting indigo precipitate.

The obtained indigo powder was dissolved in DMF and the UV spectrum of the indigo substance in the resulting solution was obtained. Its characteristic light absorption was observed in the UV spectrum, and a peak was observed in the wavelength region of 610 nm.

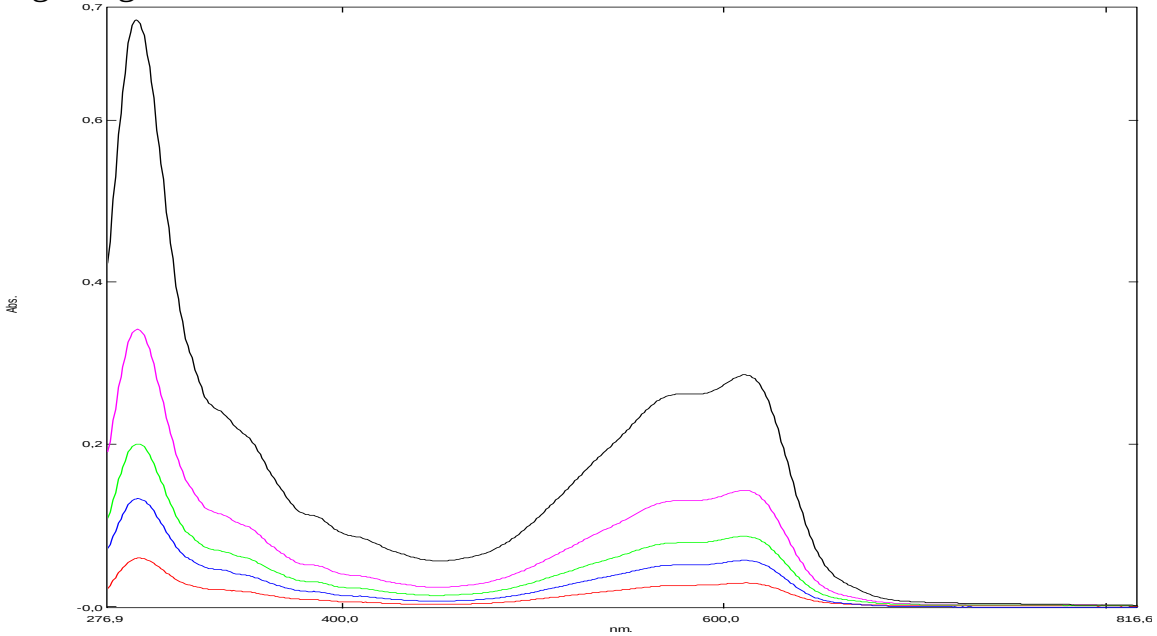

Figure 2. UV spectrum of a solution of indigo in DMF

Purposeful use of plant residues (waste) produced during indigo production is one of the important issues, for which it is necessary to know what elements are contained in it and what quantity. Plant residues produced in the process of indigo production are mainly used in the production of biofertilizers or humus. Plant protein can be the main source of nitrogen. Therefore, the amount of total protein in the plant *Indigofera tinctoria L* was determined. The amount of total proteins was studied using the Keldal method [13]. This method consists of calculating the amount of total protein by determining the amount of nitrogen. The obtained results are presented in Table 1 below.

Table 1.

Total protein content of *Indigofera tinctoria L*

№	Plant organs	The amount of total protein, %
1	Stem and leaf	12.711
2	Seed	30.673
3	Root	6.475

If we pay attention to the results, it can be seen that the total protein content is high in the seed (30.673 %). But most of the seed is always harvested for replanting. It is possible to see the presence of less amount of protein in stems and leaves than in seeds (12.711 %). The root contains the least protein. When plant parts are turned into humus, most of the proteins contained in them are converted into nitrates and ammonium salts [14]. As a result of the breakdown of DNA, RNA, glycophosphate, phospholipids and other phosphorous compounds, phosphate salts are formed [15].

The leaves and young green stems of the *Indigofera tinctoria L* plant are mainly used to obtain indigo [16]. Ammonium and nitrate salts are formed from the protein in them when these parts of the plant, which become waste, rot. In addition, the amounts of macro- and microelements in the plant *Indigofera tinctoria L* were determined (Table 2).

Elemental analysis of above-ground, below-ground and seed of *Indigofera tinctoria L* was carried out by inductively coupled plasma mass spectroscopy on an ISP-MS (Nexion 2000).

Table 2.

Amounts of micro and macro elements in the plant *Indigofera tinctoria L*

№	Elements	leaf (µg/L)	Root (µg/L)	Seed (µg/L)
1	Ge	0.008	0.005	0.006
2	As	0.152	0.252	0.222
3	Se	-1.256	-0.970	-0.754
4	Rb	2.058	1.776	1.452
5	Sr	13.357	140.186	17.412
6	Zr	0.130	0.135	0.152
7	Nb	0.062	0.008	0.009
8	Mo	0.672	0.584	0.191
9	Ag	0.010	0.014	0.010
10	Cd	0.020	0.012	0.014
11	In	0.000	0.000	0.000
12	Sn	1.191	1.271	1.172
13	Sb	0.024	0.018	0.037
14	Cs	0.022	0.009	0.010

15	Ba	9.616	4.466	2.493
16	Ta	0.002	0.001	0.001
17	W	0.016	0.005	0.011
18	Re	0.000	0.004	0.000
19	Hg	0.704	0.549	0.441
20	TI	0.008	0.006	0.006
21	Li	1.508	0.310	0.735
22	Be	0.120	0.121	0.126
23	B	11.913	19.963	6.572
24	Na	77.669	126.948	1623.060
25	Mg	1229.015	3780.151	917.939
26	Al	226.033	87.139	106.373
27	Si	364.111	339.130	353.764
28	S	632.744	675.461	711.995
29	K	2189.217	4246.795	260.945
30	Ca	8032.058	17766.94	7885.205
31	Ti	52.343	21.998	6.812
32	V	0.987	0.418	0.672
33	Cr	1.937	2.367	2.319
34	Mn	16.283	29.178	8.919
35	Fe	1724.166	1530.221	785.455
36	Co	0.250	0.198	0.137
37	Ni	0.856	1.633	1.298
38	Cu	3.711	3.616	3.309
41	Zn	14.233	9.502	4.197
42	Ga	0.558	0.240	0.154
43	Pb	0.218	0.391	0.320
44	Bi	0.003	0.003	0.003
45	U	0.039	0.038	0.085

The plant *Indigofera tinctoria L* showed that it contains 44 macro- and micronutrients. In its leaves, roots and seeds, it was found that the most elements Sr, Ba, B, Na, Mg, Al, Sr, S, K, Ca, Ti, Mn, Fe and Zn are found in larger quantities than other elements. Therefore, it can be considered that the plant *Indigofera tinctoria L* has the property of accumulating more of these elements. If compost or biofertilizer is obtained from plant residues after the indigo extraction process, it contains N, P and many micronutrients. The use of a sample with such a composition can have a positive effect on the productivity of plants.

4. Conclusion

The use of ultrasound to increase the activity of enzymes in the extraction of indigo from the *Indigofera tinctoria L* plant accelerated the fermentation process and reduced time consumption while maintaining the product yield. The reason for this was shown to be an increase in the exchange of β-glucosidase and indoxyl-β-D-glucoside through the thick walls of *Lactobacillus acidophilus* bacteria under the influence of ultrasound, which increases the activity of β-glucosidase and accelerates the hydrolysis of indoxyl-β-D-glucoside. After extraction, it was found that the yield of indigo from the solution obtained by fermentation without extracting the leaves of the plant decreased. The main reason for this is that a certain amount of indigo, formed during

fermentation, remains on the surface of the leaves of the plant and remains in their composition when the leaves are separated from the solution. Therefore, in indigo production, it is recommended to separate the leaves from the solution after extraction and then ferment them.

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UDC: 547.962.94

VOLUMETRIC SWELLING PROPERTIES OF SILK FIBROIN FIBER IN WATER, ACIDIC AND ALKALINE SOLUTIONS

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Annotatsiya: Ipak fibroin (IF) ko'plab foydali materiallarni tayyorlash uchun ajoyib xom ashyo hisoblanadi. Fibroin materiallari turli muhitlarda ishlatilishi mumkin. Shu sababli, qaysi eritma muhitida fibroin bo'kishi miqdori va uning bo'kish tezligi haqida ma'lumotni bilish juda muhimdir. Shuning uchun biz dastlabki tadqiqotlar o'tkazdik va turli xil muhitli eritmalarda ipak tolasi chiqindilaridan olingan SF tolalarining shishish xususiyatlarini o'rgandik. Natijalar shuni ko'rsatdiki, ishqoriy muhitga ega bo'lgan eritmada SF tolasining umumiy qisqarish darajasi nisbatan yuqori, shishish tezligi ham yuqori ekanligi aniqlandi.

Kalit so'zlar: Ipak fibroin (IF), bo'kish, kinetika, ATR-FTIR spektri, amorf qism, kristall qism.

Аннотация: Фиброин шелка (ФШ) является отличным сырьем для изготовления многих полезных материалов. Фиброиновые материалы можно использовать в различных средах. По этой причине очень важно знать информацию о величине набухания фиброина в какой растворной среде и скорости его набухания. Поэтому мы провели предварительные исследования и изучили свойства набухания ФШ - волокон, полученных из отходов шелкового волокна, в растворах различных сред. Результаты показали, что в растворе с щелочной средой степень общей набухания ФШ - волокна наблюдается относительно высокая, а также высокая скорость набухания.

Ключевые слова: Фиброин шелка (ФШ), набухание, кинетика, ATR-FTIR-спектр, аморфная часть, кристаллическая часть.

Abstract: Silk fibroin (SF) is an excellent raw material for making many useful materials. Fibroin materials can be used in various environments. For this reason, it is very important to know the information about the amount of fibroin swelling in which solution medium and its swelling speed. Therefore, we have conducted preliminary research and studied the properties of swelling of SF fibers obtained from silk fiber waste in different media solutions. The results showed that in the solution with an alkaline medium, the degree of total shrinkage of SF fiber was observed to be relatively high, and the swelling rate was also found to be high.

Key words: Silk fibroin (SF), swelling, kinetics, ATR-FTIR spectrum, amorphous part, crystalline part.

1. Introduction

Even now, silk fiber is of great importance in textiles. Many expensive fabrics are made based on natural silk fiber and exported worldwide. However, a large amount of fibrous waste is produced in the process of spinning silk fibre. Obtaining valuable materials from these fibrous wastes is one of the most difficult problems. It is important to know the conditions of the silk fibre-based materials in the environments in which they are used. Various sorbents and hydrogels from SF are used in industry and medicine. It is of great importance to study the properties of the silk-based materials used for these purposes.

Information about the water absorption properties of natural silk fiber is given in the literature, and it can absorb up to 30-40 % by mass. It has been shown that the diameter of silk fiber increases by 3.8 % at 60 % relative humidity, and by 8.9 % at 90 % [1, 2].

It was determined that silk fiber can be swell in water at a temperature of 20°C and the length of the fiber increases by 1.3÷1.7 % and its diameter by 19÷46 %. In the swollen state, fibroin macromolecules are observed to switch to the following conformations, which rotate to each other under conditions of high mobility.

Amorphous parts of natural IF absorb 70 % of moisture, and crystalline parts absorb 30 % of moisture. In acids and especially in alkaline solutions, the swelling of fibroin increases. Alkaline swelling of fibroins can be irreversible. In diluted solutions of NaCl and $NaNO_3$ salts, IF swelling is observed as in water [3].

Mass and volume indicators are used to express the degree of swelling of substances, that is, changes in the values of its mass or volume during the absorption of a substance in liquids are taken into account [4, 5].

There are directions for determining the total particle size of high molecular compounds and the degree of swelling of individual particles. The degrees of swelling of IF and materials obtained on its basis in various liquids and solutions were determined. Methods for determining the degrees of swelling are given in the literature [6-12]. External effects on frozen samples of SF, in particular, changes in crystallinity during freezing, were studied in the environment of NaCl solution [13].

By analyzing the data presented in the above literature, it was aimed to study the properties of SF in different environments. The results of this study suggest that it is

important to predict the rates and kinetics of swelling of materials made with SF in the environments in which they are used.

2. Materials and equipment

Silk fiber waste, 0.03 M solution of $NaHCO_3$, 3 % hydrochloric acid, 3 % KOH solution, distilled water, 500 mL beaker, Schott funnel, 25 mL measuring cylinder.

3. Experiment part

The fibrous waste of silk is cut into 1-2 mm lengths and the cut fiber samples are placed in a solution of 0.03 M of $NaHCO_3$ in a ratio of 1:100 (w/v) and heated at a temperature of 90-95°C for 40 minutes.

The fibers in the solution are filtered in a Schott funnel and the salts are completely washed with distilled water. Washed fiber samples are dried at 70°C.

The obtained fibroin fiber samples with a mass of 1.5 g are placed in measuring cylinders with a volume of 25 mL and distilled water, 3 % hydrochloric acid and 3 % KOH solutions are poured over them. The volume of the samples is measured every 3-5 minutes. Based on the obtained results, the maximum swelling degrees and swelling kinetics indicators are determined.

4. Results and discussion

Volumetric swelling of SF was studied for 150 minutes. Swelling degrees were determined from the following formula (1):

$$\alpha_V = \frac{V_t - V_0}{V_0} \cdot 100\% \quad (1)$$

Here, α_V is the degree of swelling (%), V_t is the swelling volume of the sample at time t (cm^3), V_0 is the initial volume of the sample (cm^3).

The results show that the degree of volumetric swelling of fibroin in the fibrous state in water was 4.44 %, and the degree of volumetric swelling in acidic and alkaline conditions was 4.44 % and 30.55 %, respectively (Fig. 1). It was observed that the degree of swelling of fibrous SF was constant after 130 minutes in water and acidic solution and after 21 minutes in alkaline solution. A high degree of swelling in an alkaline environment is associated with a decrease in the number of crystalline parts and an increase in the number of amorphous parts of SF fiber.

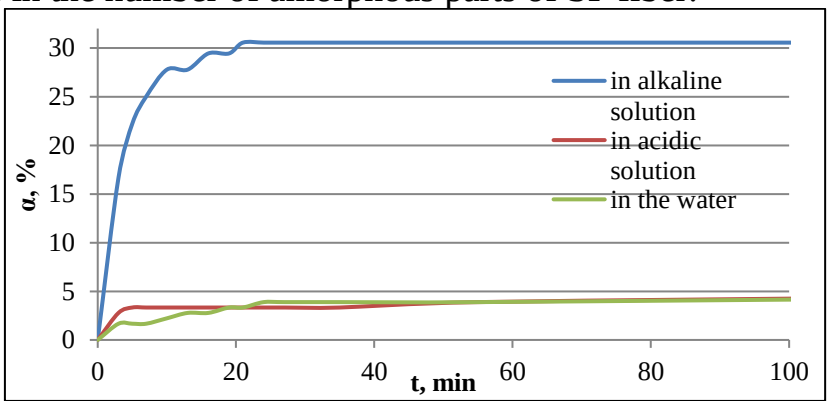

Figure 1. Volumetric swelling of SF fiber in water and solutions in various environments (at a temperature of 20°C)

The second-order kinetic equation (2) was used to determine the swelling kinetics of SF fiber in water, acidic and alkaline medium solutions at a temperature of 20°C [14].

$$\frac{t}{\alpha} = \frac{1}{\alpha_t^2 \cdot K} + \frac{1}{\alpha_t} \cdot t \quad (2)$$

Here α is the degree of swelling (%), t is time, K is the kinetic constant of swelling. The value of K is determined from the dependence graph of t/α and t. For this purpose, dependence graphs of t/α and t were made for SF swelling processes in acidic (3 % hydrochloric acid), alkaline (3 % potassium hydroxide) and water solutions (Fig. 2). As a result of the analysis of the graph, the constant values of the SF fiber swellng kinetics in different environments were determined. The kinetic constant values were observed to decrease from neutral to alkaline.

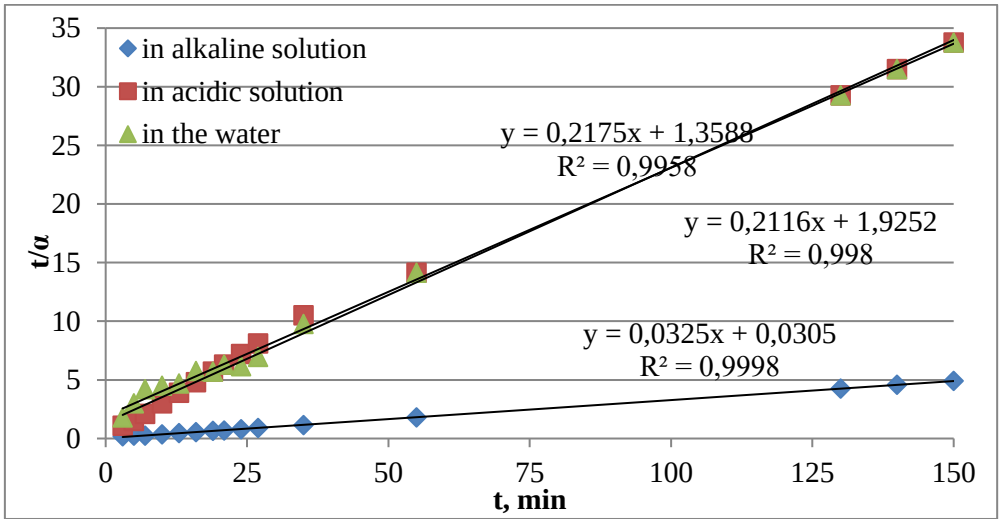

Figure 2. Graphs of kinetics of volumetric swelling of SF fiber in different environments

Table 1. Constant values of swelling kinetics of SF fiber in different environments

Indicators	in the water	Acidic In solution	Alkaline in solution
K	0.2116	0.2175	0.0325
$\alpha_{v,\ max}$, %	4.44	4.44	30.55

The small value of the kinetic constant of SF fibers in an alkaline medium means that the rate of swelling in this environment is relatively high. During the drying of SF in an alkaline environment, the amorphous parts of the fibroin increase, and as a result, the entry of water molecules between the macromolecules becomes easier. Because fibroin macromolecules form random chains from an ordered state, the spaces between the chains increase, as a result, the penetration of solvent molecules accelerates. It should also be said that ionization of fibroin macromolecules is also observed in an alkaline environment. This process also leads to an increase in the distance between macromolecules. Therefore, it is observed that the samples of fibroin in an alkaline medium are highly swollen. To confirm these opinions, ATR-FTIR spectra of samples swollen in different environments were obtained and analyzed (Fig. 3).

Decreasing water content in SF reduces the ratio of amide I to amide II height (1642/1508 cm^{-1}) and the pre-helical structures and random chains present in the raw materials are converted to β - sheet, resulting in 1642, 1547, and 1245 cm^{-1} absorption decreases. The relative absorbance of these β-sheet peaks serves as an indicator of protein crystallinity. Peaks at 1699 and 1620 cm^{-1} in the amide I region are usually used to identify antiparallel β-sheet composition, but this may overlap with neighbouring components of fibroin and other compounds present in the cocoon.

The Amide III band from 1200 cm^{-1} to 1300 cm^{-1} is a complex spectral region, with overlapping portions of different amide side chains at different ease The components include β-sheets at 1219 cm^{-1}, a random chain at 1240 cm^{-1}, and a peak at 1232 cm^{-1} corresponding to the form of Bombyx mori Silk I for the α-parts. Finally, the absorption at 1308 cm^{-1} is due to β-turns. The spectrum of amorphous fibroin has a broader, less defined line in the Amide III band. Absorptions in the region of 1350–1420 cm^{-1} also represent vibrations of $-CH_3$ groups in polypeptides of different conformations. Absorption in the range of 1443 cm^{-1} corresponds to asymmetric vibrations of CH_3- in β-sheets of polyalanine $(Ala)_n$ and Ala-Gly. For amorphous fibroin, the absorption at 1456 cm^{-1} is due to more common (CH_3-) vibrations in bound alanine and valine. The absorption at 1625 cm^{-1} in amide I represents β-sheets and 1648 cm^{-1} is associated with disordered structures and distributed chains. In addition, other Silk I, and II twists (1647-1654 cm^{-1}), and α-chains (1658-1664 cm^{-1}) are associated with them.

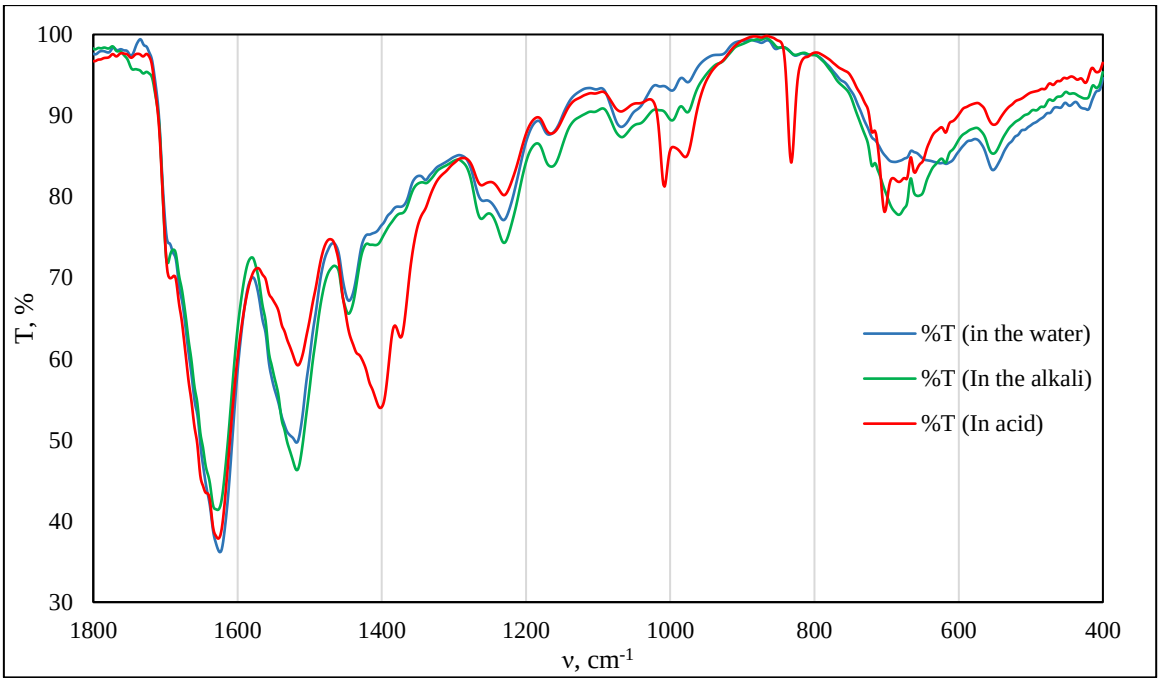

Figure 3. ATR-FTIR spectra of SF samples swollen in water, acidic and alkaline solutions

Based on the above information, the chain changes in the molecules of SF swollen in alkaline and acidic solutions were determined. To determine the changes, attention was paid to the data in Figure 3. It can be seen that the absorption in the ATR-FTIR spectrum of the SF swollen in an acidic medium solution in the 1230 cm^{-1} region is reduced compared to the 1260 cm^{-1} region. (compared to the non-cured SF).

Absorption in the 1245 cm^{-1} region is reduced. On the contrary, the results of the ATR-FTIR spectrum of SF swollen in an alkaline medium solution showed an increase in absorption in the 1230 cm^{-1} region compared to the 1260 cm^{-1} region. In alkaline solution, it can be concluded that amorphous parts increase in SF.

5. Conclusion

It was found that the maximum swelling levels of SF in acidic solutions and water have the same value, and there are differences in swelling speeds. It was shown that SF fiber has the highest degree of shrinkage in an alkaline solution (30.55 %) and the speed of swelling is also high. The main reasons for the high swelling properties of SF fiber in an alkaline environment were explained by the decrease of crystalline parts and the increase of amorphous parts. Because the formation of random, irregular and α-chains of macromolecules increases, amorphous parts increase. As a result, it is observed that there are opportunities for solvent molecules to quickly and more penetrate between fibroin macromolecules. These views were also confirmed by analyzing the ATR-FTIR spectra of the samples.

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UDC: 547.962.95

EXTRACTION OF SERICIN FROM SILK FIBER WASTE UNDER THE INFLUENCE OF MICROWAVES AND ULTRASOUND IN A WATER ENVIRONMENT

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Annotatsiya: Hozirgi vaqtda olimlar ipak tolasi tarkibidagi seritsinni ajratib olishning bir qancha usullaridan foydalanmoqdalar. Masalan, an'anaviy termal usul, ultratovush va mikroto'lqinli (O’ta yuqori chastotali – O’YCh nurlari) usullari. Ushbu usullarni solishtirganda mikroto'lqinli usulning samaradorligi isbotlangan. Har bir usul uchun optimal sharoitlar tanlangan. Biz mikroto'lqinli pechlar va ultratovush kabi fizikaviy ta’sirlar yordamida ipak tolasidan seritsinni olish bo'yicha tadqiqotlar o'tkazdik. Tadqiqotlar asosida biz eng maqbul sharoitlar va usullarni topishga harakat qildik.

Kalit so'zlar: Ipak, seritsin, ultratovush, mikroto'lqinli pechlar, etil spirti.

Аннотация: В настоящее время ученые использовали несколько методов извлечения серицина, содержащегося в шелковом волокне. Например, традиционный термический метод, ультразвуковой и микроволновый (сверхвысокочастотный – лучи СВЧ) методы. При сравнении этих методов доказывается эффективность микроволнового метода. Для каждого метода были

выбраны оптимальные условия. Мы провели исследования по извлечению серицина из шелкового волокна с помощью физических воздействий, таких как микроволны и ультразвук. На основе исследований мы постарались найти наиболее приемлемые условия и методы.

Ключевые слова: Шелк, серицин, ультразвук, микроволны, этиловый спирт.

Abstract: Currently, scientists have used several methods of extracting sericin contained in silk fiber. For example, the traditional thermal method, ultrasonic and microwave (ultra-high frequency - UHF rays) methods. When these methods are compared, the effectiveness of the microwave method is proven. Optimal conditions were selected for each method. We have conducted studies on the extraction of sericin from silk fiber using physical effects such as microwaves and ultrasound. Based on research, we tried to find the most acceptable conditions and methods.

Keywords: Silk, sericin, ultrasound, microwaves, ethyl alcohol.

Introduction. Until now, several methods of extracting sericin from silk fiber have been used. For example, they are obtaining sericin using the traditional thermal method, ultrasonic and microwave methods. When these methods are compared, the effectiveness of the microwave method has been proven. Optimal conditions were selected for each method. Great attention is paid to the quality and yield of sericin.
The following studies were conducted to extract sericin from Bombyx mori cocoons.

The cocoons are cut into small pieces to obtain sericin in distilled water and heated in a hot bath at 1:30 for 30, 60, 90 and 120 minutes at 60-80°C.
When obtaining sericin in a sodium carbonate solution, the cocoons are divided into small pieces and mixed in a distilled water bath in a ratio of 1:30, experimental work is carried out in the same way as above.

For precipitation of sericin, 40 g of ammonium sulfate is added to each 100 ml of solution, and as a result, a precipitate is formed. The resulting precipitate is filtered and dried at room temperature. The resulting residue is dissolved in distilled water and dialyzed. To remove ions and sub-molecular compounds mixed with sericin is usually done mainly by dialysis. To do this, the sericin solution is poured into a membrane bag and put into distilled water. Additional molecules and ions in the solution gradually leave through the membrane [1].

Traditional methods of extracting sericin from raw silk with Na_2CO_3 solution and steam treatment have been studied. Raw silk in Na_2CO_3 solution without pressure is boiled for 30 minutes in 0.5 g/L Na_2CO_3 solution in a 1:100 ratio of material to solution. This process is repeated 4 times.

Steam separation is carried out using a modified pressure vessel (autoclave) (AQDB37, Wonder Chef, Japan, equipped with a pressure gauge on the lid). A specific weight of raw silk is immersed in deionized water for 30 minutes to fully soak the fibers. Then it is placed in an autoclave and heated at a temperature of 120°C for 30 minutes. As a result, an aqueous solution of sericin is formed [2].

Extraction of sericin from silk fibers in a microwave oven has also been studied. Experiments on sericin release by different reagents were conducted using silk fibers in a microwave oven (Samsung M 245, 1550 W operating at 2450 MHz frequency). In all cases, the process was carried out under the influence of microwave rays with a

power of 30-100%. The results of a microwave oven study showed that sericin release increased with increasing oven power [3].

Based on the literature reviewed above, we conducted research to extract sericin from silk fiber.

2. Experimental part

2.1. Necessary tools and equipment: electronic analytical balance aczet CY224C, 2 1000 ml flat bottom flasks, water bath, heater, thermometer, ultrasonic bath with 40 kHz frequency and 300 W ultrasonic power GT Sonic-D13 Ultrasonic cleaner, 2450 MHz microwave (UHF rays) frequency microwave oven SAMSUNG ME81KRW-1KBW, pipettes, measuring cups, stirrer, tripod, porcelain or Buchner funnel, filter cloth, filter papers, large containers (for storing the obtained sericin solution), glass rods, petri dish, vacuum pump Diaphragm Vacuum Pump Model LH-85, driving device with a router (for driving and cleaning used alcohol) DLAB RE 100-Pro, drying cabinet ShS-80-01 SPU, moisture meter aczet MB 200, UV Spectrophotometer UV1800 Shimadzu, IR-spectrophotometer JASCO FT/IR-4600.

2.2. Reagents: 2 L volume of 96 % ethyl alcohol, distilled water, 35 g of silk fiber, n-hexane.

2.3. The performance of the work: To extract sericin using the thermal method, cotton-like fibrous waste from the cocoon and its upper shell was used. For this purpose, natural silk waste is first cleaned of branches and leaves of mulberry trees. 5 g of cocoon clippings (0.5-1 cm) and silk waste fiber are weighed, then the measured fiber is added to distilled water at a ratio of 1:50, and the experiment is carried out in 3 different ways. These are the traditional thermal method, the methods of extracting sericin from natural silk fiber under the influence of UHF rays (power of 300, 600 and 800 W), ultrasound and UHF rays. The experiment is continued until the mass of the fiber does not change (up to 200 minutes on average). The treated fiber is thoroughly washed with distilled water before being left to dry for a certain period. The washed fiber is dried in a drying cabinet at 60-70°C.

An absolute alcohol solution is used to precipitate sericin from the obtained sericin solution. It takes 24 hours for sericin to completely settle. After a clear solution is formed on the precipitate, the clear part is carefully separated into a separate container using a pipette. Ethyl alcohol is the main part of the solution taken in a separate container. A certain amount of alcohol remains in the remaining precipitate. The sericin in the remaining solution is separated by centrifugation and washed with alcohol. The resulting sericin is placed in a petri dish and dried in a drying cabinet at 60-70°C.

The ethyl alcohol solution taken in a separate container is purified by driving it in a rotor driving device. The distilled alcohol is used to precipitate sericin from the remaining sericin solutions.

Take the completely dried sericin from the petri dish and wash it with n-hexane. Then we dry the sericin thoroughly, grind it to a powder state, and save it for further research.

The mass of the sericin sample obtained by the methods mentioned above is found by the following formula:

$$m_{ser}=m_{waste\ fiber}-m_{fiber}$$

m_{ser}- a mass of extracted sericin

$m_{waste\ fiber}$- mass of silk fiber waste obtained for the experiment

m_{fiber}- the remaining fiber mass after sericin extraction

The percentage of waste fiber of the product obtained in the experiment is determined by the following formula:

$$\omega = \frac{m_{ser}}{m_{waste\ fiber}} \cdot 100\%$$

The sericin obtained as a result of the experiment is analyzed using physical research methods. UV spectrophotometer-UV 1800 SHIMADZU and IR-spectrophotometer JASCO FT/IR-4600 are used for this.

Discussion and results. To extract sericin from the cottony waste formed from the silkworm cocoon and its upper shell, a simple thermal method, UHF rays and ultrasound effects were used in an aqueous environment. Initially, a simple thermal method was used to extract sericin from cocoon clippings. The release of sericin from the cocoon and its fibrous waste in an aqueous medium at a temperature of 100°C for different periods was studied by a simple thermal method.

5.0058 g of cocoon clippings were weighed on an electronic analytical balance, 250 ml of distilled water was poured onto it at a ratio of 1:50, and then the temperature of the mixture was brought to 100°C by thermal heating, the process was stopped every 30 minutes, and the fiber mass change has been determined. Fibers taken from the mixture at different times were dried in a drying cabinet at a temperature of 60-70°C until they reached a constant mass, and their mass was determined. In this case, the mass of fiber treated by ordinary thermal method for 30 minutes after drying was 4.5223 g. Distilled water was added to the measured fiber at a ratio of 1:50 and it was thermally treated for another 30 minutes. When the total time spent was 60 minutes, the fiber was dried again and measured. At this time, the fiber mass was equal to 4.2086 g. The fiber mass was found to be 3.9224, 3.6552, and 3.3719 g at 90, 120, 150, and 180 minutes, respectively. The mass of the fiber did not change after it was equal to 3.3719 g (Figure 1).

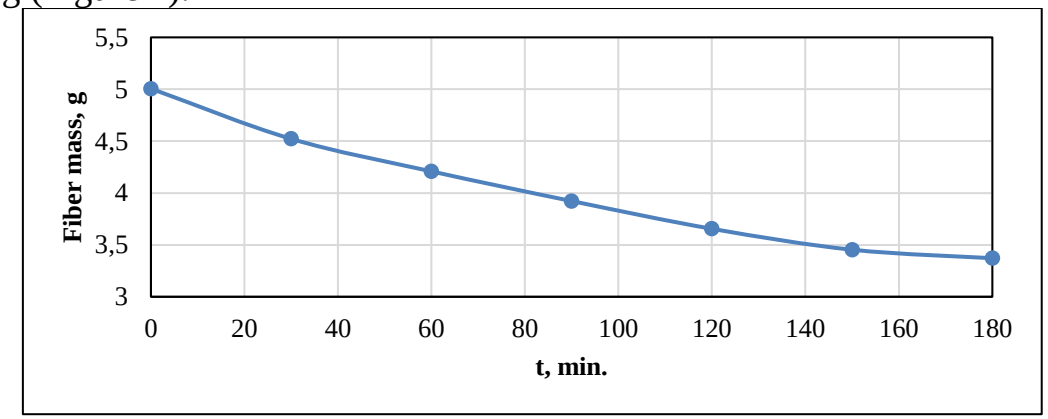

Figure 1. Time-dependent graph of sericin extraction from silk fibrous waste by conventional thermal method

The mass of the sample of sericin, which was maximally released from the silkworm cocoon by the traditional thermal method, was 1.6339 g. The mass of sericin is 32.64 % of the mass of the cocoon. The total time spent for this method is 180

minutes. Extraction of sericin from the cottony waste formed from the outer shell of the cocoon in the traditional thermal method was carried out in the above order, and the process took 200 minutes (Figure 2).

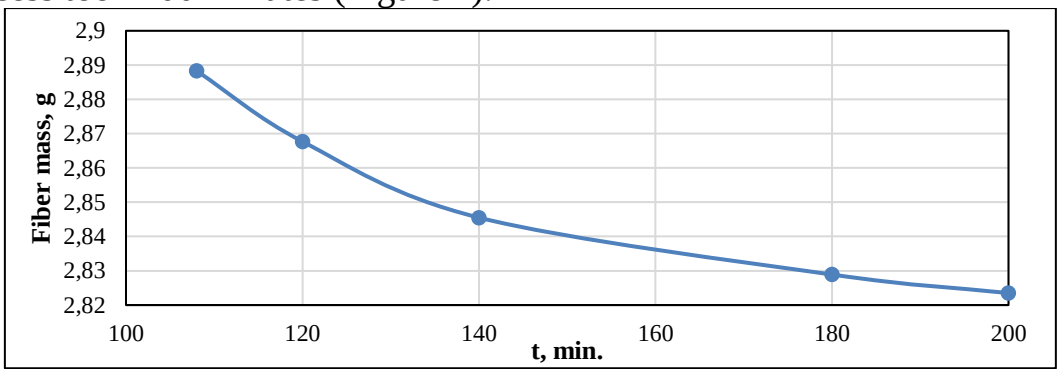

Figure 2. Time dependence graph of sericin extraction from natural silk fiber waste by thermal method

At the end of this experiment, a sample of 2.8235 g of sericin was obtained.

The separated amount of sericin was 43.6 % compared to the waste fiber (cottony) mass. Therefore, compared to the silkworm cocoon, the amount of sericin in its cottony fiber waste is higher. It is acceptable to use this type of fiber waste in the effective extraction of sericin. Therefore, this type of fibrous waste was used in further studies. However, a large amount of energy is spent to obtain sericin in the traditional thermal method.

To extract sericin from the cottony waste of silkworm cocoon, the effects of UHF and ultrasound in an aqueous medium were used.

300, 600 and 800 W rays were used to isolate sericin under the influence of UHF rays. The release of sericin from fiber waste in an aqueous medium under the influence of UHF rays at different time intervals was studied. The time for fiber mass to remain unchanged was 140 minutes (41.75 %) when using 300 W power, 124 minutes (43.56 %) when using 600 W power, and 116 minutes (43.63 %) when using 800 W power.

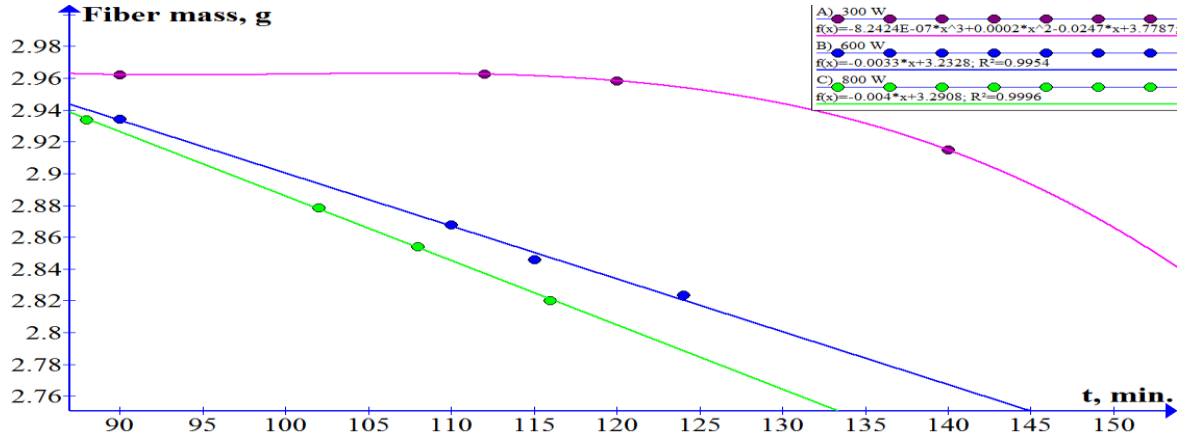

Figure 3. Time-dependent graph of sericin release under the influence of 300, 600 and 800 W of UHF radiation

The mass of the obtained sericin sample was equal to 43.63% compared to the mass of cottony waste when exposed to 800 W UHF rays. The completion time of the procedure was 116 minutes (Figure 3).

If we calculate the energy spent for experiments, it is necessary to use the following formula [4].

$$E = P \cdot t$$

where P is power (W), t is time spent (s).

Optimum conditions for obtaining sericin can be chosen depending on energy consumption. It is desirable to obtain sericin with a higher yield while consuming less energy. The energy used to separate sericin under the influence of UHF rays was calculated and the results were compared (Table 1).

Table 1.

Dependence of rays power on sericin production in aqueous medium under the influence of UHF rays from silk fiber waste

Power	Time spent	Energy spent	The percentage of released sericin in the waste fiber mass
300 W	140 min.	2520 kJ	41.75 %
600 W	124 min.	4464 kJ	43.56 %
800 W	116 min.	5568 kJ	43.63 %

The amounts of sericin obtained under the influence of 600 W and 800 W UHF rays were very similar, and less energy consumption was observed at 600 W. Therefore, it can be considered that the process of obtaining sericin under the influence of 600 W UHF rays is the most optimal condition from the point of view of energy.

To extract sericin from the cottony waste of the cocoon, UHF rays and ultrasound effects were used in an aqueous environment. In the experiments, the above-mentioned powers of UHF rays and ultrasound with a power of 300 W with a frequency of 40 kHz were used (Table 2).

Table 2.

Time and fiber mass for sericin extraction under 300 W power of UHF rays and ultrasound

№	Time (min)			Fiber mass (g)
	UHF rays	Ultrasound	Total time	
1	60	30	90	3.9615

During the total time spent in the process of extracting sericin from the fiber waste of silk, the mass of fiber dried in the drying cabinet was measured. After drying, the mass of the fiber treated under the influence of 300 W UHF rays and ultrasound for a total of 90 minutes was 3.9615 g. The amount of the separated sericin sample was 20.77 % of the initial fiber mass. We estimated that the yield of the obtained mass was very low compared to previous methods, and without spending too much time on research, we stopped the experiment at this point without making measurements in the next time interval.

It was observed after 132 minutes that fiber mass remained unchanged in the extraction of sericin under the influence of 600 W of UHF rays and ultrasound. The mass of the sericin sample was 42.64 % of the fiber mass (Table 3).

Table 3.

Time and fiber mass for sericin extraction under 600 W power of UHF rays and ultrasound

№	Time (min)			Fiber mass (g)	Energy spent
	UHF rays	Ultrasound	Total time		
1	60	30	90	2.9870	2700 kJ
2	72	36	108	2.8896	3240 kJ
3	88	44	132	2.8718	3960 kJ

It took a total of 132 minutes to extract sericin from the fiber waste of natural silk under the power of 800 W of UHF rays and ultrasound, and the mass of the sericin sample released into the solution was 43.87 % compared to the fiber mass (Table 4).

Table 4.

Time and fiber mass for sericin extraction under 800 W power of UHF rays and ultrasound

№	Time (min.)			Fiber mass (g)	Energy spent
	UHF rays	ultrasound	Total time		
1	60	30	90	2.8549	2700 kJ
2	72	36	108	2.8291	3240 kJ
3	88	44	132	2.8079	3960 kJ

If we pay attention to the obtained results, it can be observed that the method treated with UHF rays and ultrasound consumes the least amount of energy. Based on this, it can be considered that the production of sericin in an aqueous environment by treatment with UHF rays and ultrasound is the most energetically efficient.

It is known that additives interfere with processes, and as a result, the accuracy of the results decreases. To eliminate such situations, the natural silk cocoons and fibrous waste taken for the experiment were also cleaned from various foreign bodies, such as mulberry silkworm cocoons and their secretions, dried twigs and leaves of mulberry trees, and a certain amount of dust. All chemical containers were rinsed in distilled water. Only distilled water was used to boil the fiber. After boiling, UHF rays and ultrasound together, the fibers obtained were washed with hot distilled water to extract as much sericin as possible.

96 % alcohol is also used to precipitate sericin from the resulting sericin solution. From the information given in the literature, it is clear that silk fiber contains 70-75 % fibroin (protein substance), 20-25 % sericin, 2-3 % various mineral substances, and 1-1.5 % wax and oils [5]. Based on these data, n-hexane was used to dissolve and purify the additives contained in sericin.

Sericin was purified using n-hexane. With the help of n-hexane, sericin gets rid of waxy, oily, organic solvent-soluble substances that are mixed in n-hexane.

The process was repeated several times until the mass of sericin remained unchanged, under normal conditions, with a vacuum pump, filtering through a Schott funnel. Considering that the mass loss as a result of the process is approximately 1%, this amount does not significantly affect the mass value of sericin obtained.

In the ATR-FTIR spectrum of isolated sericin, absorptions typical of sericin protein were observed (Figure 4).

The peak at 3500-3000 cm^{-1} is associated with N-H stretching vibration. The O-H stretching line is located at 3600-3200 cm^{-1}, which coincides with the N-H stretching

vibration peak at 3500-3000 cm^{-1}. C=O symmetry stretching is observed at approximately 1398.14 cm^{-1}.

In the ATR-FTIR spectra, the proteins show characteristic vibrational regions in the region of 1617.9 cm^{-1} (C=O stretching) for amide I, 1513 cm^{-1} (secondary N-H bending) and 1275.68 cm^{-1} for amide II. For amide III, absorption at 1237 cm^{-1} is characteristic (C–N and N–H functions). Furthermore, the positions of these bands correspond to protein materials such as 1650 cm^{-1} (random chain) and 1630 cm^{-1} (β-sheet) for amide I; 1540 cm^{-1} (random chain) and 1513 cm^{-1} (β-sheet) for amide II, 1275.68 cm^{-1} (β-sheet) and 1230 cm^{-1} (random chain) for amide III [6].

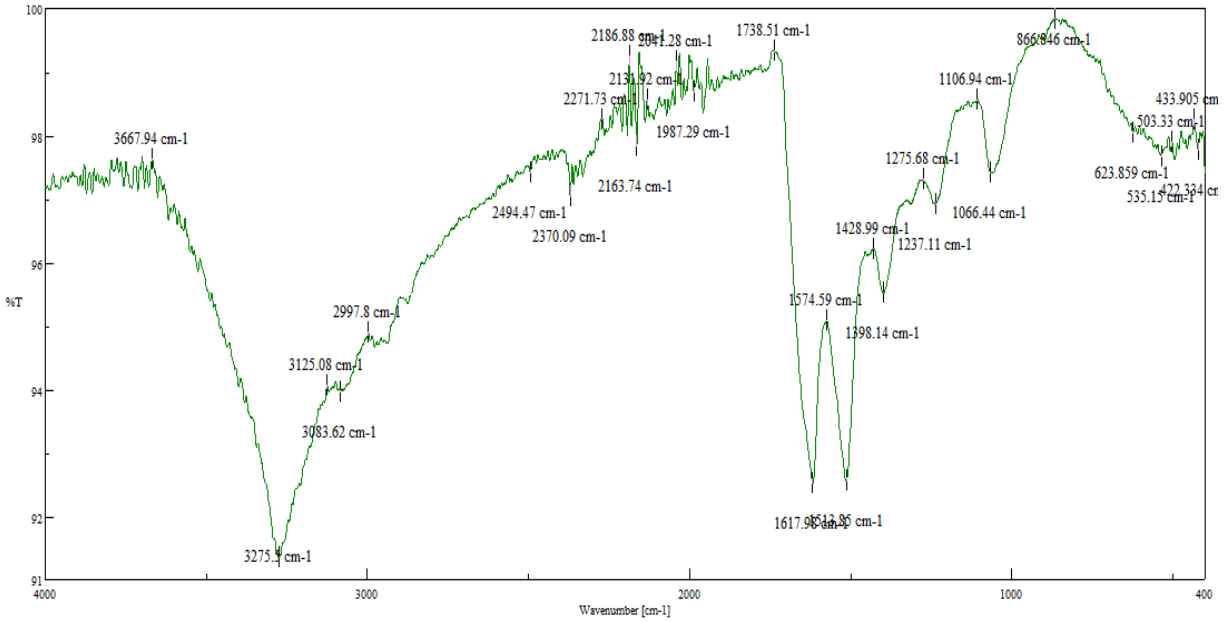

Figure 4. ATR-FTIR spectra of sericin obtained from silk waste

Sericin is a protein substance. It contains 18 types of amino acids, and serine, aspartic acid and glycine are very important amino acids that depend on the physicochemical and polyfunctional properties of sericin. In addition, 18 amino acids contain 70 % hydrophilic amino acids, which are one of the main reasons for sericin's good solubility and water-swelling properties. On the other hand, the amount of aromatic amino acids can be only 6.6 % of the 18 types of amino acids determined by the UV spectrum [7]. Proteins usually have two absorption peaks in the UV region, the first at 215-240 nm and the second at 260-290 nm. Peptide bonds of amino acids absorb 215-240 nm of UV rays. Ultraviolet radiation in the 260-290 nm range (due to $\pi \rightarrow \pi^*$ transitions) is absorbed by aromatic amino acids such as tryptophan, tyrosine, and phenylalanine. The silk sericin solution shows absorption peaks at 216 nm and 275 nm, indicating that sericin has UV resistance (Figure 5) [8, 9].

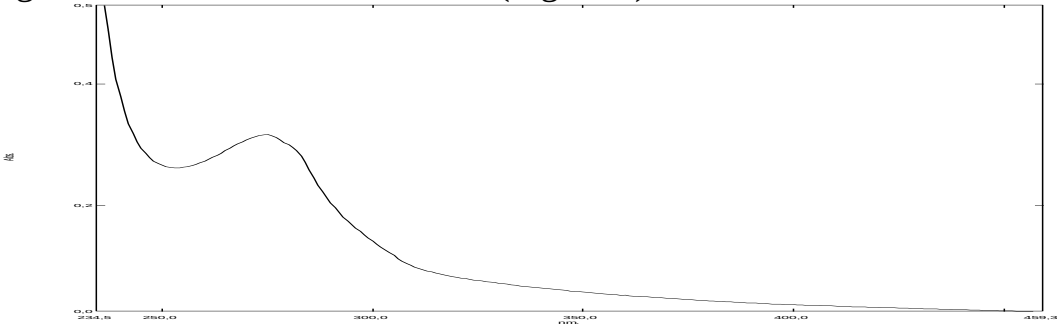

Figure 5. UV spectrum of sericin

Conclusion. It was found that the content of sericin was the highest (43.87 %) in the cottony waste coming out of the upper part of the silkworm cocoon. It was determined that the use of UHF rays and ultrasound effects in extracting sericin from cottony waste of silk in an aqueous environment is the most optimal from an energetic point of view. The composition of the obtained sericin was studied using physical research methods and its characteristic indicators were revealed.

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UDC: 502/504

POSSIBILITIES OF RAINFED HORTICULTURE DEVELOPING IN THE ADYR AREAS OF NAMANGAN REGION

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Annotatsiya. Ushbu maqolada Namangan viloyatining Uychi tumanida joylashgan adir hududlarida lalmikor sabzavotchilik va polizchilikni kompleks rivojlantirish bo'yicha 2020-yilda olib borilgan tajriba natijalari yoritilgan. Tajribalar politilen plyonka yordamida plastik mulchalash agrotexnologiyasidan foydalanib amalga oshirilgan. Tajribalar sabzavot ekinlaridan pomidor va bodring, poliz ekinlaridan tarvuz, qovun va oshqovoq ekinlari ustida olib borilgan.

Kalit so'zlar: lalmikor sabzavotchilik va polizchilik, suv tejamkor sug'orish usullari, mulchalash agrotexnologiyasi, adir hududlari.

Аннотация. В данной статье представлены результаты проведенного в 2020 году эксперимента по комплексному развитию богарного овощеводство и бахчеводство в адырных территориях Уйчинского района Наманганской области. Эксперименты проводились на основе агротехнологии пластикового мульчирования с использованием полиэтиленовой пленки. Опыты проводились на томатах и огурцах из овощных культур, арбузе, дыне и тыкве из бахчевые культуры.

Ключевые слова: богарного овощеводство и бахчеводство, водосберегающие методы орошения, мульчирующая агротехника, адырных территориях

Annotation. In this article, the results of the experiment conducted in 2020 on the comprehensive development of rainfed horticulture in the adyr areas of Uychi district of Namangan region. Experiments were carried out on the basis of agrotechnology of plastic mulching using polyethylene film. Experiments were carried out on tomatoes and cucumbers from vegetable crops, watermelon, melon and pumpkin from melon crops.

Keywords: rainfed horticulture, water-saving irrigation methods, mulching agro-technology, water-saving irrigation methods, adyr areas.

Introduction. The unique agro-climatic conditions of the adyr areas of Namangan region provide an opportunity to obtain high yields from various fruit trees, vegetables and melon crops. However, due to the decrease of water resources in recent times, as well as problems in providing electricity to the pumps that supply water to the cultivated areas in the high regions of adyr areas, irrigated agriculture is creating difficulties. In such a situation, researching the possibilities of rainfed farming developing using water-saving agro-technologies effectively in the adyr areas is one of the urgent issues.

These days, many countries are using various water-saving technologies to usage water sparingly in agriculture. Examples of these comprise irrigation technologies such as drip irrigation, rain irrigation, fog irrigation, sub-soil irrigation. In order to save water, not only water-saving irrigation technologies are widely used, but also agro-technologies that preserve moisture for a long time. One of such agrotechnologies is “Mulching” which is one of the most broadly used measures in the agriculture of the countries of the world.

Literature Review. Mulching is the process of covering the surface of the soil around agricultural crops with various mulch materials (for example, leaf litter, straw or peat, etc.) in order to prevent ineffective evaporation of soil moisture and the growth of weeds. According to some sources, the word “mulch” is derived from the German word “molsch”, which is the process of covering the surface of the soil around crops with straw and leaf litter, which has the characteristic of soft decomposition [1].

Mulching diminishes soil degradation and protects soils from erosion, controls weed growth and water evaporation. Consequently, it supports the soil retain more moisture and helps control temperature fluctuations. It improves the physical, chemical and biological properties of the soil, as it adds nutrients to the soil. As a result, it increases the growth and productivity of crops. In addition, in rainfed lands, the yield of mulched crops can increase by 50-60 percent compared to the yield of non-mulched crops [2, 3, 4].

There are two types of mulching which are organic and inorganic mulching. Organic mulching means covering the soil surface with organic materials. Organic materials include straw, rice husks, wood shavings, compost, plant leaves, etc. Inorganic mulching means covering the soil surface with chemical plastic mulching materials.

It has been found that soil moisture can be maintained for a long time even when mulched with organic and inorganic methods. An increase in the ability to conserve soil moisture allows plants to survive in dry and hot periods. When irrigation is carried out together with plastic mulching, the possibility of saving most of the water used for irrigation increases. Irrigation of vegetable crops under mulch permits to rise productivity compared to additional irrigation systems [5].

In Central Asia, mulching with the help of mulching paper was carried out in the early 1930s in vegetable crops (N.N. Balashev and D.D. Kutepov), cotton and other crops. L.N. Babushkin, I. Rabinovich and A. Pudovkin conducted an experiment on mulching non-irrigated cotton at the Bozsuv agrometeorological station in 1932-1934s [6]. The drive of the experiment was to determine the consequence of mulch on soil and air temperature and humidity as well as on crop growth. As a outcome, it was concluded that if the mulch material is mature enough, it helps to preserve moisture in the soil, increase the temperature at the beginning of vegetation and increase the yield by 25-30%.

B.A.Kamolov and S.T.Abdurahmanov who are the professors of the Ecology and climatology department of Namangan State University have also conducted a series of experiments on harvesting vegetable crops without irrigation using agrotechnology of mulching. According to the results of the experiments carried out during 2011-2016 years, it was found that it is possible to develop rainfed vegetable

cultivation using mulching agrotechnology in the adyr areas of Namangan region [7, 8].

Dr. B.A. Kamolov and Dr. M.R. Koriyev from the Department of Ecology and climatology of the Namangan State University carried out researches on making a rainfed garden using mulching agrotechnology. According to the outcomes of the research which has been ongoing since 2013, it has been determined that it is possible to advance rainfed horticulture using mulching agrotechnology in the adyr areas of Namangan region [9, 10, 11].

Research Methodology. Field experiment, phenological and field observations, geographical generalization and statistical analysis methods were used in the research work. In particular, in the adyr areas of Uychi district of Namangan region field experiments were conducted on the development of rainfed vegetable growing and melon growing using polythene film mulching agrotechnology.

Figure 1. Complex organization on experiments of rainfed gardens and rainfed melon growing and rainfed vegetable growing.

An important aspect of conducting the experiment is that, first of all, this experiment was organized in a non-irrigated rainfed orchard. The main reason for this is, first of all, the rainfed orchard is not irrigated between the rows. This is convenient for experiments on rainfed vegetable growing and melon growing. Secondly, effective use of the free land between the rows of the rainfed garden is defined as the main goal. In addition, tomatoes, cucumbers, watermelons, melons and pumpkins were also planted in single rows and complex experiments were conducted (Figure 1.).

It should be noted that together with rainfed vegetable growing, experimentations were conducted on the development of rainfed melon growing. Firstly, mulching was carried out using polyethylene film on April 25, 2020. After that, pumpkin and watermelon seeds from April 27 and melon and cucumber seeds were planted in mulched rows from April 29. To plant the seeds, they were planted in the middle parts of the orchard where the sun rays are the most and the shade of the trees is the least. The reason for selecting these parts of the orchard was to accomplish a comfortable growth of these crops. At this point, it is worth saying that small holes

with a diameter of 10-15 cm were opened in the middle of the film covered with the egate, at the closest distance to the place where the seeds were planted. About 5 kg of rotted manure was placed on top of these holes. Soil was thrown on the back side of the humus placed in the egates, that is, on the lower side of the slope, and a small dam was formed. The purpose of this was to collect the rainwater that fell during the growing season in front of each melon crops and ensure that the humus dissolves the manure and seeps into the soil through the holes. This process helps increase soil moisture and fertility (Figure 2.).

After that, vegetables and melon crops were planted on mulched fields. In particular, seeds of cucumber, pumpkin, watermelon and melon crops were planted on April 25, 2020 and tomato seedlings were planted on May 1. For the experiment, “Shom F1” which ripens in a middle time of cucumber variety, “Golosemyanka” which ripens in a middle time of pumpkin variety, “Krimson sweet” which ripens in a middle time of watermelon variety, “Shakarpalak” which ripens in a middle time of melon variety and “Stalingirad” variety of tomatoes were selected.

Figure 2. The process of collecting rainwater and applying compost around the melon crops.

Analysis and Results. Field monitoring was carried out from the day of planting tomatoes, cucumbers, pumpkins, melons and watermelons. According to the results of the experimental observation, positive results were recorded in the germination and productivity of these crops planted in the rainfed method and on the basis of agrotechnology of plastic mulching.

Tomato. According to observations, tomato seedlings began to bloom from May 15 and fruiting from May 25. The beginning of ripening of the fruits coincided with June 28. An average of 0,2 kg was harvested from each bush of tomato seedlings until the end of vegetation. Out of 600 seedlings planted in the experimental area, 500 plants grew well and yielded an average of 100 kg. The remaining 100 bushes dried up due to various reasons (for example: they were damaged in the process of bringing seedlings and planting, the roots were cut by insect larvae, etc).

The growth and development of vegetable crops in the experiment, pumpkin, melon, watermelon and cucumber belonging to the pumpkin family were constantly supervised.

Cucumber. “Shom F1” which ripens in a middle time of cucumber variety was taken for the experiment. The first crop is harvested 45-50 days after germination. Productivity is 20-35 tons in per hectare, 15-20 tons in the summer season. The fruit is smooth, dark green in color, the length is 15-25 cm, the average weight is 150-200 grams. Cucumber seeds were sown on April 25, 2020, in rows mulched with polythene film in the experimental area and in the middle parts of the fruit garden on April 29, where the sun rays are the most and the shade of the trees is the least. Cucumber sprouts began to germinate in 3-4 days. From May 18, it began to grow rapidly. It began to bloom from May 25 and fruiting from May 30. the picking of the first ripe crops began from June 11.

An average of 1.0 kg was harvested from each bush of cucumber seedlings until the end of vegetation. Very few cucumber seeds were planted in the experimental field. That is, 3 cucumber seeds were sown in a total of 20 nests in only 1 field, and 2 bushes in each nest, a total of 40 seedlings were nurtured. They grew well and gave a pronounced harvest. It was 40 kg on average.

Pumpkin. “Golosemyanka” which ripens in a middle time of pumpkin variety was chosen for the experiment. It is a variety with a vegetation period of 110-120 days. The fruit is round, green-yellow in color and can weigh up to 4-5 kg.

Pumpkin seeds were planted in rows mulched with polythene film on April 25, 2020 in the experimental area and in the middle parts of the orchard with the most sunlight on April 27. Pumpkin sprouts began to germinate in 4-5 days. From May 19, it began to grow rapidly. Flowering began on May 30, fruiting began on June 5 and harvesting of the first ripe fruits began on July 10.

On average, 3 crops were harvested from each bush of pumpkin seedlings until the end of the growing season. The average weight of pumpkin fruit was 1.0 kg. 3 pieces of pumpkin seeds were planted in 30 nests in the experimental area and 1 bush in each nest, a total of 30 seedlings were nurtured. They grew well and gave a pronounced harvest. That is, a total of 90 harvests were obtained and the average weight was 90 kg.

Watermelon. “Krimson sweet” which ripens in a middle time of watermelon variety was selected for the test. Its fruit is large, weighing up to 8-12 kilograms. The skin is thin and smooth, very sweet. Seedlings ripen in 60-65 days under optimal conditions. Vegetation period is 80-85 days. Resistant to anthracnose and fusarium wilt diseases. Suitable for transportation and long-distance shipping.

Watermelon seeds were planted in rows mulched with polyethylene film on April 25, 2020 in the experimental area and in the middle parts of the orchard where the sun rays fall the most on April 27. Watermelon sprouts began to germinate in 3-4 days. From May 18, it began to grow rapidly. It started flowering from June 2 and fruiting from June 5. Watermelon harvest began on July 15, the first crop ripened, and the harvest began on July 25.

On average, 1-2 fruits were harvested from each bush of watermelon seedlings until the end of vegetation. The average weight of a watermelon was 2.5 kg. A total of 250 nests in the experimental field were planted with 3 pieces of watermelon seeds, from which 1 bush was planted in each nest and a total of 250 seedlings were cultivated.

They grew well and gave a pronounced harvest. That is, a total of 400 crops were harvested and it was 1 ton on average.

Melon. "Shakarpalak" which ripens in a middle time of melon variety was chosen for the research. Its fruit is long ovoid, medium in size, 26-32 centimeters long, 2-4 kilograms in weight. The surface is flat, the mesh has large cells and it is medium coarse. The color is light green. The skin is hard, the thickness of the flesh is 4-4,5 centimeters, white, gentle, crunchy, very sweet, fragrant. After the seed germinates, the crop ripens in 75-90 days. Productivity is 200-250 s/ha. It is resistant to Fusarium (white powdery mildew) disease. Suitable for transportation and long-distance shipping.

Melon seeds were sown on April 25, 2020 in rows mulched with polyethylene film in the experimental area and on April 29, in the middle parts of the orchard with the most sunlight. Melon sprouts began to germinate in 4-5 days. From May 24, it began to grow rapidly. Flowering began on June 4, fruiting began on June 8 and harvesting of the first ripe fruits began on July 20.

On average, 1-2 fruits were harvested from each bush of melon seedlings until the end of vegetation. The average weight of melon fruit was 1.5 kg. A total of 20 nests in the experimental area were planted with 3 pieces of melon seeds, from which 1 bush was grown in each nest, a total of 20 seedlings. They grew well and gave a pronounced harvest. That is, a total of 30 harvests were obtained, and it was 50 kg on average.

Conclusion. As it can be seen from the given data, it is effective to plant rainfed vegetables and rainfed melon crops using plastic mulching for efficient use of rainfed garden rows. After all, as a result of the experiment, 100 kg of tomatoes, 40 kg of cucumbers, 90 kg of pumpkins, 1 ton of watermelon and 50 kg of melons were grown from a 0,2 hectare rainfed garden.

In the conditions of increasing water shortage in our country, the comprehensive development of rainfed horticulture that does not require irrigation as well as rainfed vegetable growing and rainfed melon growing among these rainfed gardens will satisfy the population's demand for agricultural products, that is, food security will greatly help in providing.

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UDK: 608.1

BIOETHICS AS AN EDUCATIONAL DISCIPLINE, ITS CONTENT, PURPOSE AND TASKS

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Annotatsiya: Mazkur maqolada zamonaviy tibbiyotda bioetikaning gumanistik, falsafiy tahlili yoritilgan. Bioetika, klassik tibbiyot etikasidan farqlanuvchi soha sifatida jadal rivojlana boshlagan. Bioetika - yangicha dunyoqarash, o‘ziga xos insonparvarlik va rahmdillik to‘g‘risidagi yangi fandir.

Kalit so‘zlar: bioetika, transplantologiya, gen injeneriyasi, deontologiya.

Аннотация: В данной статье представлен гуманистический, философский анализ биоэтики в современной медицине. Биоэтика возникла как отдельная область от классической медицинской этики и начала бурно развиваться. Биоэтика — это новое мировоззрение, новая наука о человечности и сострадании.

Ключевые слова: биоэтика, трансплантология, генная инженерия, деонтология.

Abstract: In this article, the humanistic and philosophical analysis of bioethics in modern medicine is covered. Bioethics, as a different field from classical medical ethics, appeared and began to develop rapidly. Bioethics is a new worldview, a new science of humanity and compassion.

Key words: bioethics, transplantology, genetic engineering, deontology.

Introduction. The development and study of bioethics helps to form new ethical postulates, to convey them to the medical and scientific community, to fully understand the ethical dilemmas that doctors, medical workers and researchers face not only in their daily work, but also in the adoption of the latest biomedical technologies. First of all, it was doctors who faced the problems of biomedical technology and their consequences. The existence of these problems and their solution are directly related to the physical, mental, social and spiritual health of people, which are addressed today and are provided for in the priorities of the action strategy for 2017-2021. The ancient traditions of the spiritual foundation left by the Arab-linguistic scholars of East and Central Asia continue to search for new values of biomedical ethics such as kindness, charity, consent, solidarity.

Research Methodology. Bioethics emerged in the early 1970s and was a "cry for help" by people faced with the dangers and negative consequences of biomedical technologies. It emerged as a response to the technological challenges in medicine, the long-term survival of humanity. Like an intuitive sense that a simple and stable civilization can only emerge in the development of a new ethic.

What is bioethics? The term "bioethics" consists of two words: "bio" means life, and "ethics" is a system of values guided by moral and philosophical science-people. Traditionally, ethics is considered a human philosophy and is one of the manifestations of humanity. Thus, bioethics is the ethics of life. In the broadest sense of the word, bioethics is interdisciplinary research, public debate, and related to the understanding, discussion, and resolution of various ethical issues that drive the latest advances in biomedical science and health care practice. is the field of political solutions.

According to American philosopher A Johnsen (A Johnsen), the birth of bioethics dates back to 1961 and is the beginning of the public debate surrounding the work of the ethical committee at the center of the "artificial kidney" in the city. However, the term bioethics has entered a scientific turn in the United States, first proposed in the 1970s by the American oncologist Van Rensselaer Potter (Van Rensselaer Potter) in the book "Bioethics as a Bridge to the Future" (1971) to denote a special branch of environmental ethics. The main idea of Potter depends on the need to combine the efforts of humanities and biological sciences to solve the problems of saving life on earth, to take into account the long-term consequences of scientific and technological progress (especially in the field of biomedical technologies). A new impetus to the development of bioethics was the American obstetrician and embryologist Andre Helleghers (Amer. doctor) (1926-1979) (Hellegers). He was the one who began to use the term "bioethics" to indicate the interdisciplinary research that deals with the ethical problems of biomedicine, primarily the need to protect the dignity and rights of patients. A. Hellegers presented bioethics as a new way to understand and solve ethical conflicts produced by high-tech medicine. It was Hellegers who gave bioethics a scientific status and contributed to its recognition in the biomedical sciences, politics and mass media. Helleghers founded the Kennedy Institute of Ethics in 1971 and organized the first bioethics training courses for doctors, philosophers, and other professionals. Since then, bioethics has developed rapidly as an interdisciplinary field of study in the United States, and later spread to Western Europe and the rest of

the world. Today, it has all the features of an established and rapidly developing scientific discipline, many books and manuals have been published, bioethics departments exist in universities and medical colleges, and symposia and conferences are organized. (World bioethics congresses have become traditional), new national and international bioethics organizations are being created. Bioethics changes the nature of scientific activity, as new social institutions form ethical committees. Bioethics was considered by Potter as a "new discipline" that BIOETHICS bridges the gap between biology and ethics to solve the long-term task of human survival as a species in ensuring a decent quality of life. Bioctics will be the science of survival. "The science of survival should be not only a science, but a new wisdom that combines the two most important and necessary elements - biological knowledge and universal human values" (W.R. Potter), Today, bioethics is not only a new field of knowledge, but also a science-it is a space of social communication aimed at harmonizing the interests of science with human interests.

Bioethics is a multidisciplinary field of knowledge arising from the union of philosophy, law, medicine, sociology, political science, demography, cultural studies, and religious studies. It examines the ethical aspects of man's relationship to life and death and includes the broadest socio-economic, ethical and legal problems of modern medicine. In this sense, bioethics refers to the moral and ethical foundations of protecting the health of a person and the general population, protecting the quality of life, protecting the physical and mental integrity of a person and his human dignity. In this sense, bioethics is the concept of moral foundations of protecting the health of a person and the general population, the quality of life, the physical and mental integrity of a person, and his human dignity. It examines the conflict between the health interests of individuals and their communities, and advances in biology, medicine, and pharmaceuticals that may directly or indirectly harm health and quality of life.

Today, it is necessary to talk about the reality of three types of bioethics: the research direction, the practice of ethical committees, and the academic discipline (only in medical universities). The origins of bioethics go back to medicine and biology (advances in these areas of scientific knowledge have consequences that go beyond these disciplines). Man "creates" not only the natural world, but also himself, that is, he goes beyond natural processes. Here, the delay of moral principles is unacceptable and havili. Ethical assessment and philosophical reflection of the consequences of human activity is required. Representatives of various specialties should be able to do this, so bioethics unites doctors, biologists, philosophers, ecologists, lawyers, theologians, and others. So, it is clear how important the outlook, psychological and practical training of future medical specialists is to participate in the process of solving current social and medical problems. Bioethics is a moral attitude to life, the need for time, which has no alternative to human life as the highest value.

Bioethics cannot be considered as a separate science, because the science does not fit into the heritage of traditional science, which has its own test persons and theories. Bioethics is a multidisciplinary science. The object of bioethics is life, life in general, human life, considered as the highest value. The above cannot be covered by any science separately, even philosophy, if it is "disconnected from biological, medical and ecological knowledge, does not go beyond general conclusions and

abstractions. Bioethics cannot be clearly connected with humanities or natural sciences. Bioethics is academic As a discipline, holistic knowledge, bioethics is a synthesis of philosophical foundations, biological, medical, ecological and deontological knowledge. For example, bioethics in the philosophical part includes problems from responsibility for life to the biological, ecological and medical literacy of a person. Bioethics As for the philosophical foundations, due to the integration of environmental, biomedical, deontological knowledge, by teaching the human duty of a certain profession, the philosophical part of the discipline brings the problems to the level of worldview. The main idea of bioethics is that universal human values should not be separated from biological facts. is a part of it, it needs healthy food, clean air, clean water, wild corners of nature, it cannot exist without not only ecological resources, but also animals, plants, rivers and soil, which are the basic conditions for human survival. The goal of bioethics is to develop ethical standards, requirements and principles, and other mechanisms that ensure the use of scientific and technical achievements only for the benefit of man and nature. Thus, bioethics includes a number of closely related activities.

First, it is a multidisciplinary field of study of the conditions and consequences of scientific and technological progress in biomedicine. The problems facing humanity are studied by doctors, biologists, philosophers, imams, lawyers, psychologists, political scientists and representatives of other disciplines.

Secondly, this is the field of academic, educational activity.

Thirdly, it is a rapidly developing social institution. It has a complex system of international (at the level of UN, UNESCO, WHO, Council of Europe, etc.), national (in the system of state and professional organizations), regional and local (in the structures of research and practical organizations) ethical committees. In particular, bioethics is part of the human rights movement in health care. The UNESCO Charter defines the structure of bioethics:

UNESCO

1) theoretical and philosophical bioethics (philosophical aspects of biological, medical, pharmaceutical and veterinary sciences: bioethics in different socio-cultural contexts; history of bioethics):

2) biomedical ethics (clinical bioethics);

3) pharmaceutical bioethics;

4) bioethics of drug development and clinical research. Bioethics deals with the analysis of human actions based on moral values in biology and medicine, so the content of bioethics includes:

1. Searching for dialogue and solidarity of citizens in protecting good and resisting evil in situations that have arisen as a result of scientific and technical progress in the field of medicine.

2. Axiological problems of modern medicine.

3. Moral attitude to life and death.

4. Ethical and legal relations of the "patient doctor".

5. Man's moral attitude to all living things is that he cannot exist without not only ecological resources, but also animals, plants, rivers and soil, which are the main conditions for the survival of mankind.

Conclusion/Recommendations

In short, the goal of bioethics is to develop ethical standards, requirements and principles, and other mechanisms that ensure the use of scientific and technical achievements only for the benefit of man and nature. Thus, bioethics includes a number of closely related activities.

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UDC 519.6

SIMULATION OF THE PROCESS OF SEPARATING GRAIN MIXTURES BY A CENTRIFUGAL SEPARATOR

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Annotasiya: Maqolada silindrik shaklda markazdan qochma ajratgichdagi zarrachalar harakatini tavsiflovchi don aralashmalarini ajratish jarayonining matematik modelini ishlab chiqdi. Texnologik jarayonning matematik modelini ishlab chiqishda quyidagi parametrlar hisobga olindi: markazdan qochma kuch inertsiyasi; normal reaktsiya kuchi; zarraning og`ilik kuchi; OXYZ tizimidagi zarrachalarning qarshilik kuchi; zarrachalarga ta'sir qiluvchi ko`chish kuch; Coriolis inersiya kuchi. Qo‘yilgan masalani sonli yechish algoritmi va Python da dasturiy vositasi ishlab chiqilgan hamda ko'rib chiqilayotgan jarayon parametrlarining turli qiymatlari uchun hisoblash tajribalari o'tkazildi. O‘tkazilgan tajriba natijalari grafiklar ko‘rinishida taqdim etilgan hamda ularning tahlili maqolaning hulosa qismida keltirilgan.

Kalit so‘zlar: matematik model, sonli algoritm, texnologik jarayon, murakkab aralashma, dasturiy ta'minot, hisoblash tajribasi.

Аннотация: В статье разработана математическая модель процесса разделения зерновых смесей, описывающая движение частиц в центробежном сепараторе. При разработке математической модели технологического процесса учитывались следующие параметры: центробежная сила инерции; нормальная сила реакции; сила тяжести; сопротивление частиц в системе OXYZ; переносная сила, действующая на частицы; сила инерции Кориолиса. Для решения поставленной задачи были разработаны численный алгоритм и программные средства Python и проведены вычислительные эксперименты при различных

значениях параметров рассматриваемого процесса. Результаты выполненных расчетов представлены в виде графических объектов, а анализ результатов исследований приведен в заключении данной работы.

Ключевые слова: математическая модель, численный алгоритм, технологический процесс, сыпучий смесь, программное средства, вычислительный эксперимент.

Abstract. The paper developed a mathematical model of the process of separating grain mixtures that describes the movement of particles in a centrifugal separator. When developing a mathematical model of the technological process, the following parameters were taken into account: centrifugal force of inertia; normal reaction force; gravity; particle drag in the OXYZ system; portable force acting on particles; Coriolis force of inertia. To solve the problem, a numerical algorithm and software tools were developed and computational experiments were carried out for various values of the parameters of the process under consideration. The results of the calculations performed are shown in the form of graphical objects and the analysis of the results of the studies is given in the conclusion of this work.

Keywords: numerical algorithm, centrifugal separation, mathematical model, technological process, grain mixture, software, computational experiment

Introduction. It should be noted that the process of separating, sorting grain mixtures and other bulk products, as well as liquid solutions, as one of the main stages of the technological process, is widely used in flour-grinding, fat-and-oil, pharmaceutical, mining and processing industries.

The main factor in the above technological process is to reduce the cost of the output product and raw materials and improve their quality.

As mentioned above, the processes of separation of individual components or phases of complex mixtures are an integral part of numerous industries. Sorting of cotton seeds and their hulling products, seeds of various agricultural crops and many others can serve as an example of the use of separation technology.

This requires a thorough analysis of the technological processes used and the mathematical models related to them. The development of a reliable mathematical model and the use of effective numerical methods for solving practical problems often make it possible not only to analyze the technological process but also to successfully control it.

Extensive studies on the separation of grain mixtures have shown that switching to highly efficient separating equipment is a promising solution. This type of equipment utilizes centrifugal forces to release particles through a separating surface. Therefore, it is essential to conduct a comprehensive theoretical and experimental study of centrifugal separators, including the separation process and the development of new, efficient separator designs. This is an urgent task that needs to be addressed.

The tasks of studying the separation of difficult-to-separate mixtures have been considered by many scientists. Particularly article [1] provides an assessment of the efficiency of the vibrating separator of the NH CR9080 grain harvester. The study determined the loss of seeds on the separating unit of the New Holland CR9080 combine harvester. The seed loss estimation model was developed using the multiple

regression method. In addition to these indicators, the rotor speed, grain harvesting speed and engine speed of the New Holland CR9080 combine were determined.

"The study mentioned in article [1] evaluates the effectiveness of the vibrating separator of the NH CR9080 grain harvester. The research also assessed the amount of seed loss on the separating unit of the New Holland CR9080 combine harvester. The seed loss estimation model was created using the multiple regression method. Along with these factors, the research also determined the rotor speed, grain harvesting speed, and engine speed of the New Holland CR9080 combine."

In the work of [2], a modernized conical grain separator with air flows was investigated, which is used for secondary cleaning of grain. The design of the grain cleaning unit is described, which has a grate-screen in a conical shape. The efficiency of cleaning grain from light impurities with the help of an air flow is determined. It has been determined that at a height of 20 mm, the probe rises above the edge of the cone, which gives the best result in removing light impurities.

In the work [3] proposed a model of straw with bound particles when cleaning the grain mixture in a combine harvester. Based on the developed mathematical model, the results were obtained and compared with experimental data. The proposed model can accurately describe the process of separating grain from straw and evaluate the efficiency of the separating unit (combine).

In [4] presented a numerical solution and analysis of the separation of gas and solid particles in a rotary separator. The separator, which cleans fine particles from the gas, is effective in laminar flow. The separation efficiency and the critical particle diameter in the separator were modeled using the CFD package (FLUENT 6.0). Simulations have shown that the efficiency of particle separation can be significantly reduced due to the turbulence of the flow. Simulations have shown that the Suffman force has very little effect on separator performance [5].

The conducted studies of the process of separating and separating hard-to-separate grain mixtures and other agricultural products have shown that it is necessary to first clean them from impurities and other associated waste [6]. For the separation of the above raw materials and products, it is advisable to pre-clean using a separator that separates the mixture into fractions based on centrifugal forces [7].

Based on the above, in order to conduct a comprehensive study, it is necessary to develop an effective tool that replaces the object of study with a mathematical apparatus - a mathematical model, algorithm and software.

FORMULATION OF THE PROBLEM

To develop a mathematical model of the process of separating grain mixtures, we assume that the particles are affected by gravity, centrifugal inertia force, normal reaction force of the cylinder, particle resistance forces, portable and Coriolis inertia forces. A schematic view of the model is presented in fig. 1. At the same time, the sieve surface performs a uniform rotational movement and harmonic oscillations in a plane perpendicular to the axis of rotation. The drum of the centrifugal separator rotates around the Oz axis with a pulsating change in speed with a frequency ω and an amplitude ψ.

Taking into account the laws of classical mechanics, the mathematical model of the process of gravitational enrichment and separation of grain mixtures, we take the equations of the balance of forces.

$$\vec{F}_n + \vec{F}_N + \vec{F}_G + \vec{F}_s + \vec{F}_p + \vec{F}_k = 0. \qquad (1)$$

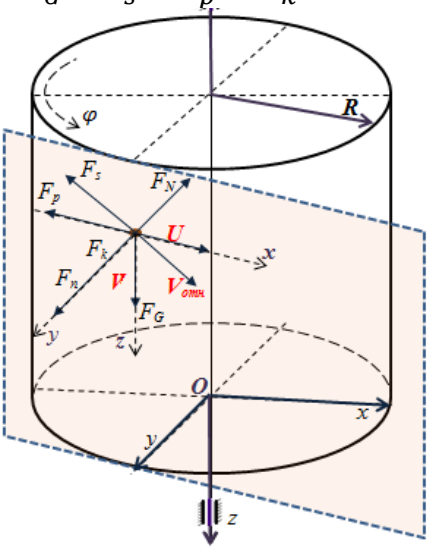

Fig. 1. Scheme of forces acting on a particle in a drum of a centrifugal separator.

Here $F_n = mR\dot{\phi}^2$ - centrifugal force of inertia; F_N - the force of the normal reaction of the rotating cylinder; $F_G = mg$ - gravity; F_s - particle resistance forces in the system of *Oxyz;* $F_p = fF_N$ - п portable force acting on particles; $F_k = 2m\dot{\phi}U$ - Coriolis force of inertia.

It should be emphasized that the friction force is directed opposite to the relative velocity vector (Fig. 1.), and then it can be determined as follows:

$V_{rel} = \sqrt{U^2 + V^2}$Using equations (1) and the laws of classical mechanics to determine the trajectory of particles in a cylindrical separator under the influence of the above forces, we obtain a mathematical model describing a system of ordinary nonlinear differential equations. These equations describe the movement of particles of loose mixtures entering the hopper of a centrifugal separator. Pulsations of the speed of rotation of the drum are set by the ratio $\phi = \Omega t + \psi \sin \omega t$. Then:

$$\frac{dU}{dt} = R\psi\omega^2 \sin \omega t - f(RR_1^2 + 2UR_1)U_1; \qquad (2)$$

$$\frac{dV}{dt} = g - f(RR_1^2 + 2VR_1)V_1; \qquad (3)$$

$$R_1 = \Omega + \psi\omega \cos \omega t; U_1 = \frac{U}{\sqrt{U^2 + V^2}}; V_1 = \frac{V}{\sqrt{U^2 + V^2}}$$

with the condition of rest of the particles $U(0) = 0; V(0) = 0$; at $t=0$. (4)

Here is the U, V - respectively, the speeds of movement of particles horizontally and vertically, Ω- cylinder angular velocity, R-radius of the cylinder, ω - frequency of rotation of the cylinder, ψ - angular oscillation amplitude, f- drag coefficient.

METHODS FOR SOLVING AND DISCUSSING RESULTS

As follows from the formulation of the problems, equations (2) and (3) with conditions (4) are described by a system of nonlinear differential equations. It is difficult to solve such problems analytically [10]. For numerical integration of the problem posed, we use the Runge-Kutta method of the fourth-fifth order [8]. Further, according

to this numerical algorithm, a software tool was developed in the Embarcodero xe3 environment [9], which can conduct numerical experiments. For a comprehensive study of the technological process, computational experiments were carried out for various values of water parameters and operating modes of the centrifugal separator, the results of which are presented in Fig. 2 and Fig. 3.

In the Fig. 2 shows the results of a numerical calculation on a computer system for various values of the angular velocities of rotation of the cylinder. As can be seen from the curves in Fig. 2, with an increase in the speed of rotation of the cylinder, the horizontal component of the speed of movement of particles in the cylinder increases. At a value of *Ω=16(1/sec)*, the particles entering the hopper of the unit are vertically released to the bottom under the action of gravity. Computational experiments have established that the main physical and mechanical properties that directly affect the relative speed of movement of particles are density, mass, linear size, as well as windage.

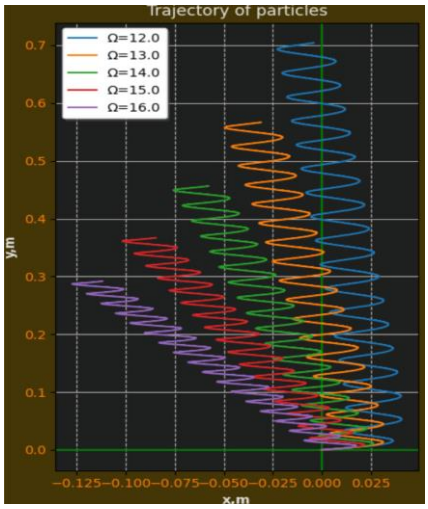

Fig. 2. *Trajectory of the relative motion of particles at different angular velocities (1/seconds) of the cylinder*

From the calculations (Fig. 3), we can say that the trajectory of particles in a cylindrical drum is strongly related to the pulsation frequency of the cylinder. With an increase in the pulsation frequency by w=55/sec, the particles begin to rapidly fall down due to a decrease in the centrifugal force of the particles.

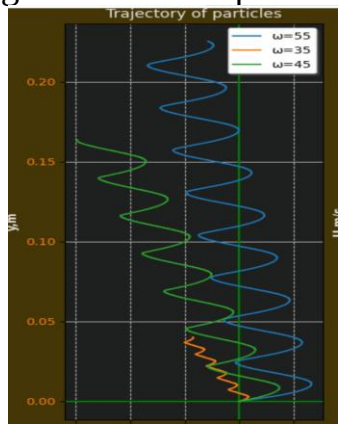

Fig.3. The trajectory of the relative motion of particles at different pulsation frequencies (1/seconds) of the cylinder

Conclusion. A mathematical tool has been developed - a model, algorithm and software that replaces the object of study, i.e. the process of separating loose mixtures in a centrifugal separator with a pulsating change in speed, it is possible to conduct a comprehensive study for an effective process of separating a mixture depending on the trajectory of the particle. The analysis of numerical calculations showed that with an increase in the speed of rotation of the cylinder, the horizontal component of the speed of movement of particles in the cylinder increases, and at *Ω = 16 (1/seconds)*. particles entering the bunker of the unit under the action of gravity are vertically released to the bottom.

Computational experiments have established that the main physical and mechanical properties that directly affect the relative speed of movement of particles are density, mass, linear size, as well as the parity of particles in loose mixtures.

The numerical experiments performed have established that with an increase in the value of the cylinder pulsation frequency, the component of the horizontal particle movement velocity increases proportionally, and at high values of the cylinder rotation frequency, chaotic movement of particles occurs. Uniform movement of particles in the cylinder occurs when the interval $45<w<55$.

A computational experiment has established that the maximum velocity of particles moving along the vertical corresponds to the minimum values of the rotational speed of the cylinder. With an increase in the rotational speed of the hopper, the horizontal component of the speed of movement of particles increases.

The numerical calculations performed show that an increase in Ω leads to a decrease in the particle velocity due to an increase in the Coriolis force, friction force and centrifugal force.

A detailed analysis of the obtained numerical calculations showed that the increase in the technical and economic indicators of centrifugal separators is greatly affected by the rotation speed, frequency and amplitude of drum vibrations [11-12].

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UDC: 62.2

SCIENTIFIC AND TECHNICAL DISCIPLINE IN THE FIELD OF MECHANICAL ENGINEERING

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Annotation: This article is devoted to forecasting the form, content and progress of science and technology in mechanical engineering.

Keywords: scientific and technical, technological, production, development, educational, scientific forecast extrapolation method, expert method, modeling method.

Аннотация: Мазкур мақола машинасозликда илмий-техник тараққиётнинг шакли, мазмуни ва фан-техника тараққиётини олдиндан кўра билишга бағишланган.

Таянч сузлар: фан-техника, тараққиёт, ишлаб-чикариш, ривожлантириш татбиқий, илмий башорат экстрамоляция усули, эксперт усули, моделлаш усули.

Аннотация: Эта статья посвящена прогнозированию формы, содержания и прогресса науки и техники в машиностроении.

Ключевые слова: научно-технический, учебный,технологический,производственный, развивающий, научный прогноз метод экстраполяции, экспертный метод, метод моделирования.

Introduction. In the ever-evolving landscape of technological and scientific advancement, humanity continually pushes the boundaries of knowledge and innovation. These advancements, spanning various forms and content areas, shape the way we live, work, and interact with the world around us. From groundbreaking

discoveries in materials science to revolutionary developments in biotechnology, the spectrum of progress is vast and diverse.

The relentless pursuit of excellence in research, engineering, and exploration has yielded remarkable achievements across numerous disciplines. For instance, the field of materials science has witnessed the emergence of novel materials with unprecedented properties, paving the way for transformative applications in electronics, healthcare, and energy. Breakthroughs in biotechnology have unlocked the potential of genetic engineering, personalized medicine, and sustainable agriculture, revolutionizing the way we approach healthcare and environmental conservation.

Advancements in information technology continue to redefine the possibilities of connectivity, computation, and data analytics, driving innovation in sectors ranging from telecommunications to cybersecurity. Simultaneously, progress in energy and sustainability endeavors seeks to address pressing global challenges, offering cleaner energy solutions and promoting eco-friendly practices for a more sustainable future.

Moreover, the frontiers of healthcare and medicine are continuously expanding, with groundbreaking research leading to improved treatments, diagnostic tools, and healthcare delivery systems. Meanwhile, space exploration and aerospace technologies push the boundaries of human endeavor, propelling us toward new frontiers of discovery beyond Earth's atmosphere.

In this dynamic landscape of progress, it is crucial to recognize the interconnectedness of scientific and technological advancements and their profound implications for society. By understanding the forms and content of these advancements, we can better appreciate the collective effort driving human ingenuity forward and anticipate the transformative possibilities that lie ahead.

The issue of researching its variability.

Utilizing the advances in current science and technology, ongoing procedures are carried out with the aid of techniques for organizing, producing, and managing cocktails as well as for developing and enhancing the technological processes of cocktail instruments and items.

Analyses and Results.

Forms and content of technological and scientific advancement

Technological and scientific advancements can take various forms and encompass a wide range of content. Here are some common forms and content of technological and scientific advancement:

Forms:

Innovative Technologies: Advancements often manifest in the form of new technologies or improvements to existing ones. This could include breakthroughs in materials science, electronics, software development, robotics, renewable energy, etc.

Research Discoveries: Scientific advancements frequently come in the form of new discoveries or insights gained through research. This could involve uncovering fundamental principles of nature, identifying new compounds or materials, or understanding complex biological processes.

Engineering Solutions: Advancements in engineering involve the application of scientific principles to solve practical problems. This could include designing more

efficient structures, developing new transportation systems, improving manufacturing processes, or creating innovative medical devices.

Process Improvements: Advancements can also involve refining existing processes to make them more efficient, cost-effective, or environmentally friendly. This could include streamlining manufacturing processes, optimizing supply chains, or developing new methods for waste management.

Policy and Regulation: Advancements can occur in the realm of policy and regulation, leading to new laws, standards, or guidelines aimed at promoting safety, sustainability, or ethical practices in technology and science.

Content:

Materials Science: Advancements in materials science involve the development of new materials with novel properties or improved performance. This could include materials for use in electronics, construction, healthcare, transportation, and more.

Biotechnology: Advances in biotechnology involve the manipulation of biological systems for various purposes, such as healthcare, agriculture, environmental remediation, and industrial processes. This could include breakthroughs in gene editing, drug development, tissue engineering, and bioinformatics.

Information Technology: Advancements in information technology encompass developments in computing, telecommunications, data storage, and networking. This could include improvements in hardware design, software algorithms, cybersecurity measures, and data analytics techniques.

Energy and Sustainability: Advancements in energy and sustainability focus on developing cleaner, more efficient energy sources and reducing environmental impact. This could include advancements in renewable energy technologies, energy storage systems, smart grid infrastructure, and sustainable manufacturing practices.

Healthcare and Medicine: Advances in healthcare and medicine involve developments in medical treatments, diagnostic tools, preventive care, and healthcare delivery systems. This could include breakthroughs in pharmaceuticals, medical devices, telemedicine, personalized medicine, and public health interventions.

Space Exploration and Aerospace: Advancements in space exploration and aerospace involve developments in spacecraft design, propulsion systems, satellite technology, and planetary exploration. This could include advancements in rocket technology, space habitats, space tourism, and satellite imaging capabilities.

These forms and content areas represent just a few examples of the multifaceted nature of technological and scientific advancement, which continues to drive progress and innovation across diverse fields and industries.

In the term of "technical progress" describes the advancement of modern science and technology in the creation and enhancement of continuous processes, cocktail tools and products, technological processes, organization, production, and management techniques. It encompasses the following: the dissemination of scientific and research work and the widespread application of its findings; the development and application of new machinery, tools, equipment, materials, and energy sources in production; the modification of the material production structure in accordance with technological advancements; the creation of new social distribution systems for food; the

optimization of labor force placement; employee skill development; and the enhancement of working conditions.

The content, form, direction and pace of science-technological development are determined primarily by the method of development. The progress of science and technology in its historical development takes two forms, i.e. evolutionary and revolutionary. In the evolutionary form, the change and development of technology is slow, while in the revolutionary development, there is a leap in quality based on the new achievements of science. In the revolutionary form of scientific and technical development, the connection between science and production is second-guessed, in which the quality of scientific work and project development is improved, the duration is accelerated, and the result is quickly introduced into mass or serial production, discoveries based on the fundamental foundations of science are carried out in scientific research and experimental construction work. gives high results. The modern stage of scientific and technical development in mechanical engineering is crucially dependent on the correct solution of economic issues, planning of new equipment, predicting its effect, economic justification of technical development, justification of the price of product production, material incentives, as well as the introduction of new equipment.

Anticipation of science and technology development is the identification of resources and organizational measures required to achieve them by estimating the ways and results of the possible development of science and technology. In order to solve the issues related to the advance planning of science and technology development, it is considered: to identify and evaluate the future of science and technology development, to show the features and laws of the development of the main branches of the national economy.

Identifying the main directions of the development of science and technology, identifying the economic and technical goals in the development of science and technology, identifying and determining the future directions of scientific research and development work. The difference between the plan and the scientific and technical forecast is that the forecast encourages the development of science and technology and ensures the sequence of scientific, technical and organizational activities, in particular the formation of a set of options, while the plan takes into account the existing limitations based on the evaluation of the options and takes into account the technical and economic basis of the decision. reflects If forecasting identifies the known variants of the development of science and technology in this or that direction, then the plan, in terms of accepted measurements, the final result, the period of execution, the necessary volume of work, the provision of funds, the sources, the executors, and it has a description of the future.

Making a scientific prediction does not increase or decrease the importance of the plan. It helps to choose a scientifically-based option by providing support for the main parts of the plan. In the scientific prediction-plan system, two parts are organically connected with each other, but the plan has decisive importance. There are various methods and methods in the theory and practice of predicting scientific and technical development. All different scientific and technical forecasting methods can be divided into three

classes: extrapolation, expertise and modeling. Each class includes several types and descriptive groups of scientific and technical forecasting.

Extrapolation methods are based on the study of the relationship between the quantitative and qualitative indicators of the problem under study, applying the change of the tradition of data found for a number of years to the forecast period. Here, various factors affecting the dynamics of the indicators are taken into account. Extrapolation methods provide an opportunity to determine the changes in the main indicators of the planned processes with the accuracy that can be used in practice. These methods are widely used in scientific and technical forecasting and are the basis of short-term forecasting and long-term forecasting. The expert method of forecasting is the gathering of expert specialists to analyze the problem and develop a general decision on it.

Scientific forecasting is based on individual or group expert evaluations. The essence of problems is estimated in the direct exchange of opinions between experts in the method of group work. When studying the development of a problem, it is necessary to use the opinions of experts in closely related fields of science and technology.

One way is to get the opinions of experts through a question-and-answer questionnaire. The content of the question paper is studied and the solution of the problem is worked out using appropriate mathematical and logical methods.

Modeling methods are based on the construction of informational and mathematical models of the problem.

Conclusions. In the realm of technological progress, the fusion of modern science and innovation has catalyzed the creation and refinement of myriad processes, tools, and products. This advancement extends across multiple domains, encompassing the optimization of production techniques, organizational methodologies, and management practices. At its core, technological progress entails the dissemination and application of scientific findings, alongside the continual integration of new machinery, materials, and energy sources into production systems.

The trajectory of scientific and technological development is shaped by two distinct yet interconnected forms: evolutionary and revolutionary. While evolutionary progress entails gradual changes over time, revolutionary leaps mark significant shifts propelled by groundbreaking scientific achievements. In the revolutionary paradigm, the synergy between science and production accelerates, leading to swift transitions from scientific discoveries to mass production.

Today, the trajectory of scientific and technical development within mechanical engineering hinges crucially on economic considerations, strategic planning, and the judicious deployment of new technologies. Anticipation of future developments necessitates meticulous forecasting, where identification of resources and organizational measures is paramount. Through methods such as extrapolation, expertise, and modeling, stakeholders endeavor to chart the course of technological evolution, balancing scientific rigor with practical feasibility.

The symbiotic relationship between scientific prediction and planning underscores the dynamism of progress, where foresight informs strategy and action. While scientific prediction illuminates potential pathways, planning provides the scaffolding for implementation and execution. Together, these elements form a cohesive

framework for navigating the complexities of scientific and technical advancement, driving innovation and shaping the future of mechanical engineering and beyond.

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UDC: 514.18 +756

VIRTUAL REPRESENTATION OF MUSEUM EXHIBITS BASED ON THE CREATION OF A MODEL AND ALGORITHM OF INTERSECTION OF CLASSIFIED GEOMETRIC SHAPES

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Annotatsiya. Raqamli asrda virtual muhit orqali madaniy merosga kirishning ahamiyati tobora ortib bormoqda. Muzey eksponatlarining sifatli raqamli taqdimotini yaratishning asosiy jihatlaridan biri ularning jismoniy atributlarini yuqori darajadagi tafsilotlar bilan modellashtirishdir. Ushbu maqolada turli geometrik shakllarni kesib o‘tish algoritmlari asosida 3D modellarni yaratish orqali muzey eksponatlarini virtual taqdim etish usulini ishlab chiqishni tavsiflaydi. Biz eksponatlarning tipik geometrik shakllarini tasnifladik va ularning o‘zaro ta‘sirini aniq modellashtirish uchun algoritmlarni ishlab chiqdik. Bu virtual makonda eksponatlarni aniqroq va aniqroq tasavvur qilish imkonini beradi va shu bilan raqamli texnologiyalar orqali foydalanuvchilarning madaniy meros bilan o‘zaro munosabatlarini yaxshilaydi. Ushbu

yondashuvni qo‘llash muzey kollektsiyalariga kirishni kengaytirishga yordam beradi va ta’lim va tadqiqot uchun yangi imkoniyatlar ochadi.

Kalit so‘zlar. Virtual modellashtirish, 3D vizualizatsiya, muzey eksponatlari, geometrik algoritmlar, shakllarning kesishishi, obyektlar tasnifi, real tasvir, raqamli meros.

Аннотация. В эпоху цифровых технологий значимость доступа к культурному наследию через виртуальные среды все более возрастает. Одним из ключевых аспектов создания качественного цифрового представления музейных экспонатов является моделирование их физических атрибутов с высокой степенью детализации. Эта статья описывает разработку метода виртуального представления музейных экспонатов путем создания трехмерных моделей на основе алгоритмов пересечения различных геометрических форм. Мы классифицировали типичные геометрические формы экспонатов и разработали алгоритмы для точного моделирования их взаимодействий. Это позволяет более точно и реалистично визуализировать экспонаты в виртуальном пространстве, улучшая тем самым взаимодействие пользователей с культурным наследием через цифровые технологии. Применение этого подхода способствует расширению доступа к музейным коллекциям и открывает новые возможности для образования и исследований.

Ключевые слова. Виртуальное моделирование, трехмерная визуализация, музейные экспонаты, геометрические алгоритмы, пересечение форм, классификация объектов, реалистичное представление, цифровое наследие.

Abstract. In the digital age, the importance of access to cultural heritage through virtual environments is increasing. One of the key aspects of creating a high-quality digital representation of museum exhibits is modeling their physical attributes with a high degree of detail. This work describes the development of a method for the virtual representation of museum exhibits by creating three-dimensional models based on algorithms for the intersection of various geometric shapes. We have classified the typical geometric shapes of the exhibits and developed algorithms to accurately simulate their interactions. This allows for more accurate and realistic visualization of exhibits in virtual space, thereby improving user interaction with cultural heritage through digital technologies. The application of this approach helps to expand access to museum collections and opens up new opportunities for education and research

Keywords. Virtual modeling, three-dimensional visualization, museum exhibits, geometric algorithms, intersection of shapes, classification of objects, realistic representation, digital heritage.

Introduction. In the modern world, the digitalization of museum collections is becoming increasingly important for both scientists and researchers, as well as for the general public. Virtual technologies provide unique opportunities for the preservation of cultural heritage, education and access to art and history without geographical restrictions. A key element of these technologies is the ability to accurately and realistically recreate physical objects in three-dimensional space, which requires a complex combination of mathematical modeling and computer graphics.

The central task of this research is to develop a model and algorithm that allow you to create accurate virtual representations of museum exhibits based on the

intersection operations between various classified geometric shapes. Through the analysis and classification of typical shapes and structures found among museum objects, we strive to improve the modeling of such complex artifacts as statues, decorations and even architectural elements.

This introduction is aimed at outlining the goals and objectives of our research, describing the principles and methods of modeling, as well as a preliminary overview of the potential contribution of this approach to expanding the possibilities of digital cultural heritage. Based on the latest advances in computer vision and graphics, our work makes a significant contribution to the field of virtual museology and educational technologies.

Literature review. The advent of digital technologies in the preservation and presentation of cultural heritage has sparked considerable research into the development of virtual museum exhibits. The scholarly landscape is rich with multidisciplinary studies converging on the intersection of computational geometry, computer graphics, digital curatorship, and cultural preservation. Computational Geometry and Geometric Modelling: Extensive literature exists in the field of computational geometry that discusses the mathematical principles and algorithms for modelling and rendering three-dimensional shapes. The works by Piegl and Tiller on NURBS for curve and surface representation have provided a foundational framework for geometric modelling that is highly relevant to representing complex museum objects digitally. Computer Graphics and Rendering Techniques: The advancements in real-time rendering and visualization techniques, as thoroughly reviewed by Kajiya and more recently by Haines and Akenine-Moller, are directly applicable to the creation of realistic virtual museum environments. Techniques such as photorealistic rendering and texture mapping play a significant role in enhancing the viewer's experience. Virtual Museums and Digital Exhibitions: Studies such as those conducted by Schweibenz and Styliani et al. have shed light on the evolution and significance of virtual museums. These works have examined user engagement and the pedagogical potential that virtual museums offer. Research by Sylaiou et al. underlines the importance of interactive technologies in enhancing the educational value and accessibility of museum content. Cultural Heritage Preservation: Fernie et al. and Cameron and Kenderdine explore the role of digital technologies in cultural heritage preservation. Realism in Virtual Artefacts: Realism in virtual artefacts is closely tied to the precision with which geometric intersections and boundaries are represented. Research led by Dorsey et al. on procedural modelling and realistic material characteristics provides insights into the accuracy needed for a believable virtual representation of physical objects. Algorithm Design for Geometric Intersections: The core of this research lies in the algorithmic treatment of geometric intersections. A seminal paper by Mark de Berg et al. on computational geometry algorithms outlines methods for detecting and computing intersections between different geometric entities, which is essential for modelling artefacts comprising multiple geometric forms. In summary, the literature underscores the necessity for an interdisciplinary approach that melds advanced computational methods with a thorough understanding of cultural context. The intersectionality of algorithms for geometric intersection, computer graphics techniques for rendering, and humanities-based insights for cultural

significance culminate in the creation of immersive and educational virtual museum experiences.

After the independence of the Republic of Uzbekistan, a lot of work is being done to promote the rich spiritual and cultural heritage of our nation to the world. In this regard, according to the decree of the President of the Republic of Uzbekistan " On the radical improvement and improvement of the activities of museums"[1], through extensive exhibition activities in Uzbekistan and abroad, the rich history of our country, today's achievements will be introduced to the world public, and the unique exhibits stored in museums will be promoted on a global scale. tasks are presented. After all, the features that make a nation known to the world are its spirituality and culture. In the work of the first President of the Republic of Uzbekistan, I.A. Karimov, "Yuksak ma'naviyat – yengilmas kuch ", the concept of spirituality is broadly defined: "spirituality is the spiritual purification of a person, which invites him to grow from the heart, the inner world of a person, strong will, "The incomparable power that completes his faith and awakens his conscience is the criterion of all his views" [2].

The idea of three-dimensional description of objects of national cultural heritage, museum collections and electronic documents is related to the extremely rapid development of real and abstract structures based on the sciences of engineering geometry and computer graphics of information technologies, and the museum is ahead of the field of digital modeling of objects. work, historical monuments, archeology and even purely humanitarian and other fields, aims to solve such issues as virtual existence.

3D model is a unique feature of this model - a continuous representation of the three-dimensional environment by elements, in which many different objects, including different modeling methods, are used together . Thus, this model is a representation of a continuous sequence of real-world objects in the form of a set of discrete images of equal size on the plane, as a rule, in a square shape - pixels (depicting any simple polygonal shape), or in space - cube - consists of voxels (volume pixels). One cell of the model contains one value of the average characteristic of the elemental surface area (2D) or volume of free space (3D) of the object.[3]

The level of detail (accuracy) of the model compared to the original is determined by the size of voxels and ultimately their number. If the resolution of the voxel model is high enough, then when the model is displayed on the screen, there may be a situation where the voxel size is equal to or smaller than the display pixel size, and in turn, they are indistinguishable in the final image. In this case, the model is perceived as smooth, visible, that is, more realistic. Image enhancement techniques completely hide the underlying cuboidal structure of the voxel model, but similarly, these processes hide the structure of the polygonal surface model.

Research Methodology. We express the analytical view of the geometric model in the form of a third-order polynomial of the $Y(x) = y_i(x)$ function in each section [xi-1, xi] (i=1,2,…,N):

$$y_i(x) = a_i + b_i(x - x_i) + c_i(x - x_i)^2 + d_i(x - x_i)^3 \qquad (1)$$

$$x_{i-1} \leq x \leq x_i \ , (i=0,1,2,\ldots,N)$$

where a, b, c, d are coefficients.

Given the following points (1, 2), (2, 3), (4, 2.5). (7.4).

We interpolate through these points using formula (1). We write down the formulas for the three-part polynomial

$$\begin{cases} y_0 = a_0 + b_0(x - x_0) + c_0(x - x_0)^2 + d_0(x - x_0)^3 \\ y_1 = a_1 + b_1(x - x_1) + c_1(x - x_1)^2 + d_1(x - x_1)^3 \\ y_2 = a_2 + b_2(x - x_2) + c_2(x - x_2)^2 + d_2(x - x_2)^3 \end{cases}$$

In order for a polynomial line passing through each point to be smooth, the attempts to enter and exit the curve must overlap. for this

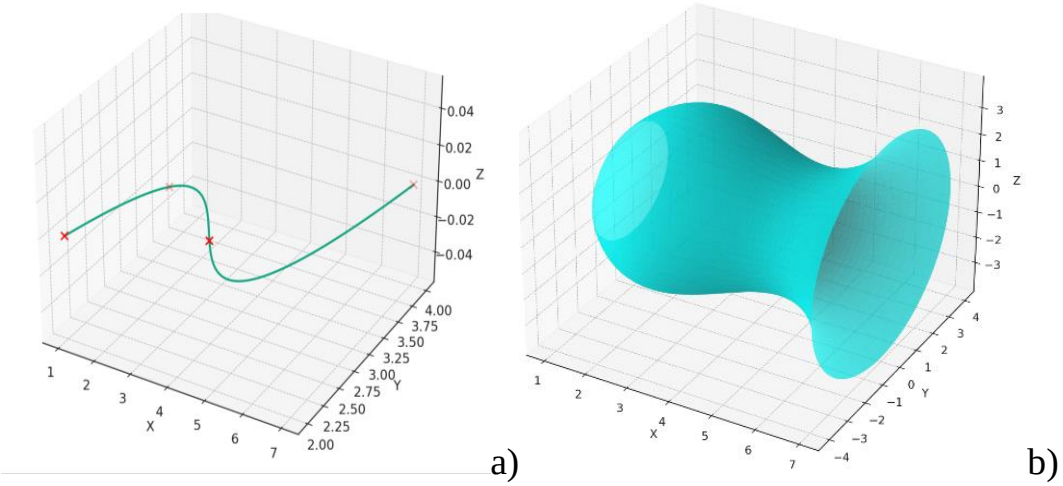
$$y_0' = y_1', y_0'' = y_1'' , y_1' = y_2' , y_1'' = y_2'' \qquad (2)$$

We determine the property of polynomials at the initial and final points. We give zero curvature to polynomials.

$$y_0'' = 0,\ y_2'' = 0,\ x_0=1,\ y_0=2,\ x_3=7,\ y_3=4 \qquad (3)$$

We calculate the values of the function with a step of 0.1 by replacing the coefficients in table 4-b-c-d to the functions in formula (2) defined for each segment.

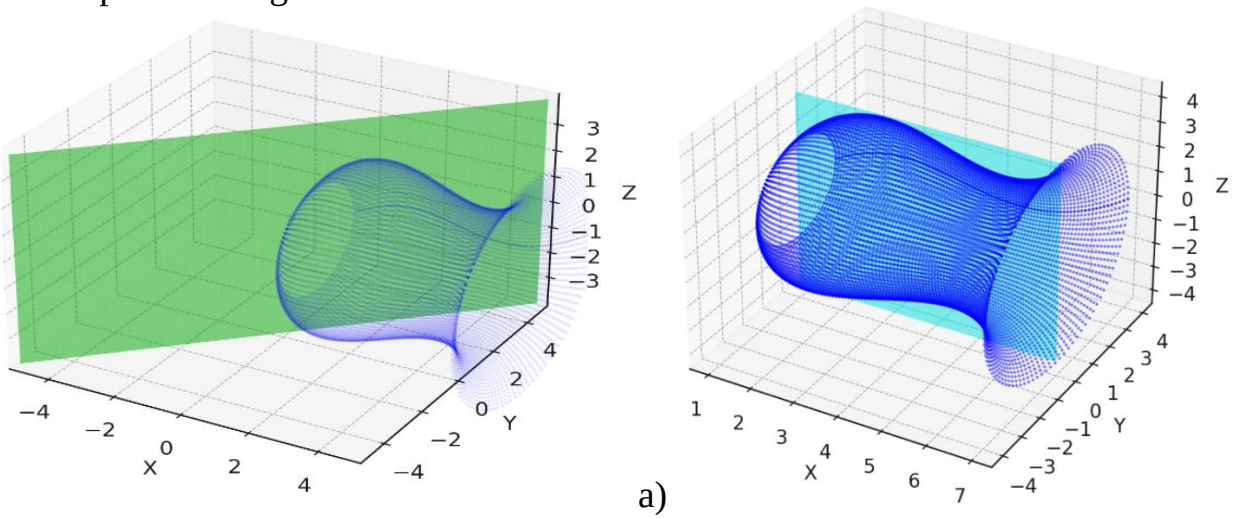
Using formula (1), (3), (4), we draw a curve on the surface of the object



a) b)

Figure 1. a) A curve drawn on the surface of the object using formulas (1), (2), (3). b) A model generated by a 3rd degree polynomial represented by the given points above.

Turn the curve 360 degrees around the x-axis and fill the trajectory with points (Fig. 1b). The intersection of the resulting object (Fig. 1b) with the plane y =x and y = 0 is depicted in Fig. 2.



a) b)

Figure 2. Graph of intersection of the object in Fig. 1b with planes a) y = x b) y = 0

After rotating the given points (1,2,0), (2,3,0), (4,2.5,0), (7,4,0) around the X-axis of the object generated using a polynomial To find an analytical solution for the part where y > 0, we first consider the mathematical expression of this object. In this case, we need the exact cubic spline function and its expression after rotation about the X-axis.

Polynomial function $Y(x)=a_i+b_i(x-x_i)+c_i(x-x_i)^2+d_i(x-x_i)^3$

Rotate around the X axis

After rotating around the x-axis, the new y' and z' coordinates are:

$$y' = y\cos(\alpha)-z\sin(\alpha),\ z' = y\sin(\alpha)+z\cos(\alpha)$$

But since z=0, it looks like below: $y' = y\cos(\alpha)$, $y' = y\sin(\alpha)$

Cutting the object

We use the condition $y'>0$ for cutting. Based on this condition, we need to consider the part of the cubic spline function y(t) where y>0. For values of y=y(t), $y'=y(t)\cos(a)>0$, which holds for all a for which cos(a)>0.

Solution

To write the analytical solution directly, we need an exact representation of the function y(t), but use the given points to calculate the coefficients ai, bi, ci, and di of the polynomial. Based on the given points, it is possible to calculate these coefficients and then analytically express the cut section based on the condition $y'>0$, but since the calculated values are a large amount of data, its program code is presented and the result is illustrated in Figure 3:

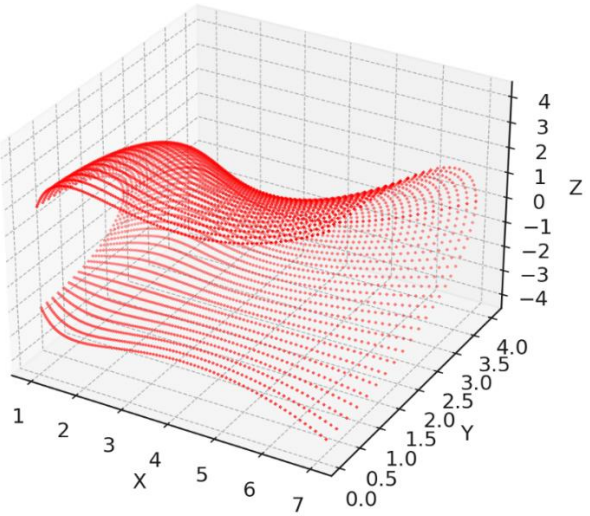


Figure 3. The model created by intersecting the created model with the y = 0 plane.

Conclusion. The virtual representation of museum exhibits based on the creation of a model and algorithm of intersection of classified geometric shapes offers a promising approach to preserving and showcasing cultural artifacts. By utilizing advanced modeling and intersection algorithms, this method allows for the precise recreation of historical objects and artworks in a virtual environment. This not only enables broader access to these exhibits but also provides an opportunity for interactive and immersive experiences, enhancing engagement and understanding among audiences. As museums continue to explore digital strategies for collection

preservation and public engagement, the development of virtual representation through geometric modeling and algorithmic techniques holds great potential for the future of museum experiences.

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UDK 519.71

EDUCATIONAL PLATFORM BASED ON ARTIFICIAL INTELLIGENCE

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Annotatsiya: Hozirgi kunda onlayn ta’lim platformalaridan talabalar keng foydalanmoqda. Ushbu platformalar talabalar uchun juda ko‘p qulay xususiyatlarga ega. So‘ngi yillarda mashinani o‘rgatish algoritmlari onlayn ta’lim platformasida qo‘llanila boshlandi. Mashina o‘rgatish bu sun’iy intellektning tarkibiy qismi hisoblanadi. Mashinani o‘rgatish yordamida yaratilgan platformalar an’anaviy platformalarga nisbatan funksional imkoniyatini oshirganligini kuzatishimiz mumkin. Bu talabalarning ta’lim jarayonida ba’zi muammolarni hal qilishda yordam beradi. Ushbu maqolada sun’iy intellektning yordamida qurilgan ta’lim platformasini ko‘rib chiqamiz.

Kalit so‘zlar: sun’iy intellekt, mashinani o‘rgatish, ta’lim ma’lumotlarini qazib olish, vektorni qo‘llab-quvvatlash mashinasi, soda Bayes, qaror qabul qilish daraxti, sun’iy neyron tarmoq.

Аннотация: В настоящее время платформы онлайн-обучения широко используются студентами. Эти платформы имеют множество удобных функций для студентов. В последние годы алгоритмы машинного обучения начали использоваться на платформах онлайн-обучения. Машинное обучение является компонентом искусственного интеллекта. Мы можем наблюдать, что платформы, созданные с помощью машинного обучения, обладают повышенной функциональностью по сравнению с традиционными платформами. Это поможет студентам решить некоторые проблемы во время обучения. В этой статье мы рассмотрим образовательную платформу, построенную с помощью искусственного интеллекта.

Ключевые слова: искусственный интеллект, машинное обучение, интеллектуальный анализ образовательных данных, машина опорных векторов, наивный Байес, дерево решений, искусственная нейронная сеть.

Abstract: Nowadays, online learning platforms are widely used by students. These platforms have many convenient features for students. In recent years, machine learning algorithms have begun to be used in online learning platforms. Machine learning is a subpart of artificial intelligence. We can observe the platforms built with machine learning have increased functionality compared to traditional platforms. This will help students solve some problems during their studies. In this article we will overview the educational platform built using artificial intelligence.

Key words: artificial intelligence, machine learning, educational data mining, support vector machine, naïve bayes, decision tree, artificial neural network.

Introduction. Nowadays, there are a lot of problems in the education [1]. Some problems are given below: a lack of funding for education, a lack of teachers, a lack of classrooms in educational organizations, a lack of learning materials, the exclusion of children with disabilities and so on. A lot of the existing educational methods and techniques can work effectively in certain condition. However, these methods are inefficient in order to solve the above problems [2]. In this case, it is correct to use a tool that solves as a lot of educational problems as possible.

Educational Data Mining (EDM) is a field of research associated with the application of data mining, machine learning and statistics to information produced by educational institutions. Such analysis attempts to extract patterns from the data generated during the training process, such as, for example, attendance, academic performance or data from distance learning systems. EDM is subpart of Artificial intelligence (AI). AI is actively used in many areas of human life, including in the field of education. Today, people around the world have the opportunity to use modern technologies in the educational process to improve its quality and effectively master the necessary professional skills.

The paper illustrates the educational platform based on artificial intelligence. The educational platform is based on machine learning (ML) [4]. The platform is composed of two subparts: first subpart is server side and the second one is user side. In the next sections, we will overview in detail [5].

Methodology. In this section, we will overview machine learning algorithms for the architecture. First of all, it will be necessary to check the psychological condition of the student who accesses the platform. In this scenario, we use the support vector machine (SVM) machine learning algorithm.

SVM is one of the most popular Supervised Learning algorithms. SVM is used for classification as well as regression problems. However, primarily, it is used for classification problems in ML. In this case, the algorithm could be used as a classification i.e., it determines the psychological condition of the student whether he can use the platform or not.

Linear SVM [7] uses to determine the student's psychological condition who would access the platform of the architecture. In this scenario, the student is given psychological test questions in order to determine the student's psychological condition. Each test question has two answers, the first answer determines that the psychological condition of the student is positive, the second one determines that is negative. Class A illustrates the positive answers of psychological test questions. Class B illustrates the negative answers of questions.

The equation of a hyperplane is $w * x + b = 0$ where w is a vector normal to hyperplane and b is an offset.

To classify a point as negative or positive we need to define a decision rule according to formula 1. We can define decision rule as:

$\vec{X} * \vec{w} - c \geq 0$ putting $-c$ as b, we get $\vec{X} * \vec{w} - b \geq 0$

Hence $y = \begin{cases} +1 \ \ if \ \vec{X} * \vec{w} + b \geq 0 \\ -1 \ \ if \ \vec{X} * \vec{w} + b \leq 0 \end{cases}$ (1)

If the value of $w * x + b > 0$ then we can say it is a positive point otherwise it is a negative point [8]. Now we need (w, b) such that the margin has a maximum distance. This distance is d.

The next machine learning algorithms in the architecture is naive Bayes classifier. Naïve Bayes is built from supervised learning. Despite the unrealistic assumption of feature independence, naive Bayes have proven themselves well in solving many practical problems. An additional advantage of the method is the small number of examples needed for training. In our case, naïve Bayes is used to classify to classes student's knowledge of each subject. The classes are poor, average, good and excellent.

In essence, the Bayesian classifier [9] is a probabilistic model. Let a set of observations be given, each of which is represented by a feature vector $x = (x_1, x_2, .., x_n)$. The model assigns to each observation a probability $p(C_k|x_1, x_2, .., x_n), C_k$-class. We can write using Bayes' theorem:

$$p(C_k|x) = \frac{p(C_k)p(x|C_k)}{p(x)} \qquad (2)$$

In this formula, only the numerator is of interest from the point of view of classification, since the denominator does not depend on the class symbol and is constant. It can be shown that the characters are independent

$$p(C_k|x_1, x_2, .., x_n) = p(C_k)p(x_1|C_k)p(x_2|C_k) \dots p(x_n|C_k)$$
$$= \prod_n p(x_i|C_k) \qquad (3)$$

Then a simple Bayesian classifier can be considered as a function that assigns a class label to each output value of the model, i.e., $y = C_k$ as follows

$$y = arg_k max_{1\dots k} \prod_n p(x_i|C_k) \qquad (4)$$

Thus, class C_k is chosen, thus, class a is chosen, which maximizes the likelihood function, which is the product of the conditional probabilities of the values of the attribute x_i for each class C_k.

The probabilistic classifier predicts the class with the largest conditional probability for a given feature vector x.

As for the application of the algorithm to the platform, the Platform has a set of subjects assigned to each group, and the set contains the scores of students in the group from each subject. When evaluating the student's knowledge level for each subject, the scores are poor, average, good and excellent. Naïve Bayes classifies a student's knowledge into poor, average, good and excellent classes. Using this dataset, it is possible to determine to what extent a newly joined student is mastering subjects using the naïve Bayes classification algorithm. A dataset of students' grades in each subject is given. Firstly, we calculate the number of each score in the dataset. Then, the ratio of the total number of subjects to the number of each score is calculate [10] ($p(C_k)$ in formula(3)). After that, the probability of each score (poor, average, good and excellent) for each subject in the dataset is calculated (($p(x_1|C_k)p(x_2|C_k) \dots p(x_n|C_k)$

in formula 4). We calculate y the probability of each estimate using the formula (3). Using the formula (4), with the highest probability score among the scores is calculated. This score is the student's score.

The third machine learning algorithm of the architecture is Decision tree algorithm. Decision tree is one of the most effective tools for data mining and predictive analytics that allow you to solve classification and regression problems.

Actually, the decision tree itself is a method of representing decision rules in a hierarchical structure consisting of two types of elements — nodes and leaves. The decision rules are located in the nodes and the examples are checked for compliance with this rule by some attribute of the training set.

In the simplest case, as a result of the check, the set of examples that fall into the node is divided into two subsets, one of which contains examples that satisfy the rule, and the other does not.

Popular algorithms used to train decision trees [11] are based on the principle of "divide and conquer". Define a common set S containing:

- n examples, each of which has a class label $C_i (i = 1..k)$;
- m attributes $A_j (j = 1..m)$, which determine whether an object belongs to a particular class.

Then three cases are possible:

- The examples of the set S have the same label C_i, therefore, all the training examples belong to the same class. In this case, training does not make sense, because all the examples in the model will be of the same class, which will "learn" to recognize the model. The tree itself will look like one large leaf associated with the C_i class. Then its use will not make sense, because all new objects will belong to the same class.
- The set S is an empty set without examples. A sheet will be formed for it, the class of which will be selected from another set. For example, the most common of the parent set is the class.
- The set S consists of training examples of all classes C_k. In this case, the set is divided into subsets in accordance with the classes. To do this, one of the attributes A_j of the set S is selected, consisting of two or more unique values: $a_1, a_2, \dots, a_p$, where p is the number of unique values of the attribute. The set S is divided into p subsets $(S_1, S_2, \dots, S_p)$ consisting of examples with the corresponding attribute value.
- The partitioning process continues, but with the next attribute. It will be repeated until all examples in the resulting subsets are of the same class.

The third is used in most of the algorithms used to build decision trees. This technique forms a tree from top to bottom, that is, from the root node to the leaves.

Today there are many learning algorithms: ID3, CART, C4.5, C5.0, NewId, ITrule, CHAID, CN2 and others.

Figure 3 illustrates using Decision tree algorithm in the architecture [12]. The algorithm helps to determine that whether a student could pass next level or not.

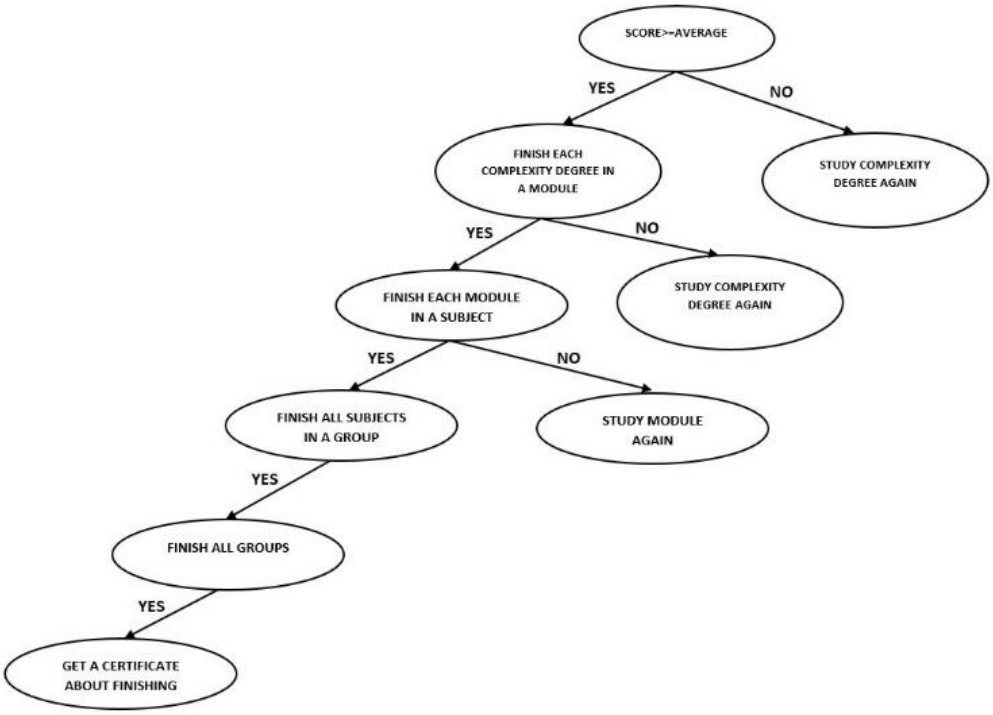

Fig 3. Decision tree

The last algorithm of the architecture is artificial neural network (ANN). ANN is a computational architecture for processing complex data using multiple interconnected processors and computational paths. Artificial neural networks, created by analogy with the human brain, are able to train and analyze large and complex data sets that are extremely difficult to process using more linear algorithms.

The principle of operation of an artificial neural network is to form connections between many different processing elements, each of which serves as an analogue of one neuron in the brain of a biological being. Neurons can be physically reproduced or simulated using a digital computer. Each neuron receives a set of input signals, and then, taking into account the internal system of weight coefficients, generates one output signal, which, as a rule, serves as input for another neuron [6].

Neurons are closely interconnected with each other and are organized into several different levels. The input layer receives the input data, and the output layer generates the final result. Typically, there are one or more hidden levels between these two levels. In such a structure, it is impossible to predict or know exactly how data is transmitted. ANN illustrates in the Figure 4.

After passing the psychological test, the student could be chosen a subject from the grade appropriate to his/her age. The student is given a test in the chosen subject.

Where $x_i, i = 1..n$ - the number of questions of different complexity for groups which is chosen by the student.

Class A- the grade that corresponding to the level of the pupil's knowledge in the chosen subject;

Class B- the module in the selected subject that corresponding to the level of the student's knowledge;

Class C- a complexity level of the module;

Results. Figure 5 illustrates the architecture of educational platform based on machine learning algorithms that is component of artificial intelligence.

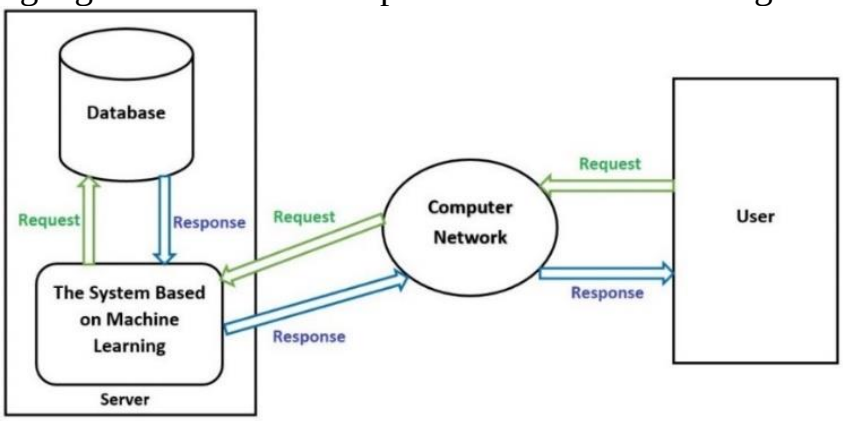

Fig 5. The architecture of the educational platform

The architecture is composed of user side, computer network and server side. The server side has two subparts: the system based on machine learning and database. In this section we consider the server side in detail. Figure 6 depicts database part of architecture. The database consists of four tables as shown in Figure 6, namely list of groups, number of subjects in each group, number of modules in a subject and complexity degree of task in the module. Groups are arranged in sequence, for instance, course 1, course 2 or grade 8, grade 9, grade 10.

The second part of server is called as the system based on machine learning algorithms. This part is core of the architecture. The system is created using machine learning algorithms. Support vector machine, naïve Bayes, Decision tree and Artificial neural network.

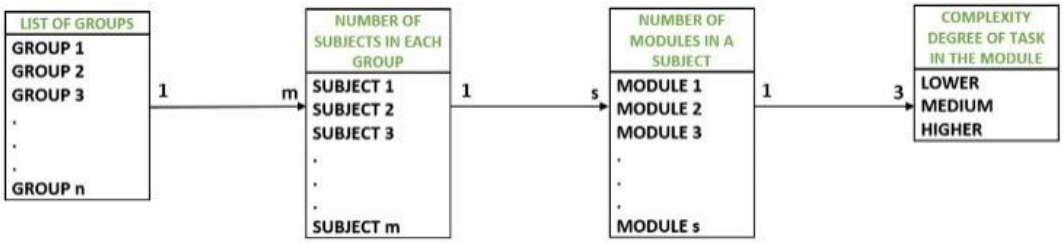

Fig 6. Database part of the architecture

The system based on machine learning performs the following tasks: determining the psychological condition of student who accesses to the platform based on the architecture, determining the student's knowledge degree from the subject that has chosen by the student and providing the student with appropriate educational materials, assessing the student's knowledge at the end of each module of the subject, passing the student to the next module, completing each subject in the grade, passing of the student from the grade to the next grade and completion of the full course.

We overview each algorithm in detail. As mentioned above, SVM can be used to check the psychological condition of the student i.e., SVM can be used for the case the student can be accessed the platform. Moreover, SVM [3] will be able to use when the student's score of the subject decreases after accessing the platform.

Naïve Bayes carries out in order to classify student's level of knowledge into the classes (poor, average, good and excellent).

Decion tree algorithm performs moving the next level in each stage of the architecture according to student's score.

ANN classifies student's knowledge into classes for the subject that chosen by the student i.e., it determines the student's knowledge level.

Discussion. The educational platform is created using the architecture presented in the article has several advantages in comparison with the traditional educational platform. We will overview each advantage.

- The student can study subjects on the platform at a convenient place and time. The platform can be used for 24 hours in a day.
- The student is allowed to repeat the subjects on the platform. If the student does not well understand any topic in the platform, the student can study the topic again.
- The platform has an individual approach for each student, that is, provides educational materials according to each student's knowledge level. As we know that people have different intellectual levels. Some students can learn a subject, some students can learn slowly. The platform is able to educate each student depends on their intellectual level.
- Each exam of the student is evaluated by a system based on artificial intelligence, which increases the accuracy in determining and evaluating the student's knowledge level. The system created on the basis of artificial intelligence evaluates the student's knowledge level in each subject without the human factor. This increases the accuracy of the assessment given to each student.
- Lack of teachers. It is known that not all children in the world have chance to learn from high qualification teachers. The platform has the ability to provide high-qualification teaching for each subject.
- Inexpensive. Due to the fact that the teacher is not paid monthly for the subjects taught on the platform, the amount of payment for each course will be several times cheaper than the courses taught in the offline mode.

This educational platform [13] is the beginning of new era of educational platforms that is based on artificial intelligence.

Conclusion. The educational platform created on the based the architecture in the previous section has a flexible feature. It can be applied for each level of education. The main difference between this platform and other platforms is that the student's knowledge is predicted and divided into classes based on machine learning algorithms. we consider the advantages of an educational platform created on the basis of architecture. Many countries in the world cannot pay enough attention to the education system due to economic problems. They cannot allocate funds for the construction of schools, necessary equipment for studying, teaching materials and salaries for teachers. The platform based on the architecture helps to solve these problems. In addition, there may not be enough teachers in all regions of the country. This situation is not related to funds. In this case, the missing teachers can be replaced by the platform.

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UDC: 323.1

PATRIOTISM AND NATIONAL PRIDE ARE THE REFLECTION OF HISTORICAL MEMORY IN THE ACTIVITIES OF MILITARY PERSONNEL (SOCIO-PHILOSOPHICAL APPROACH)

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Annotatsiya. Ushbu maqolada milliy g‘urur va tarixiy xotiraning harbiy xodimlar faoliyatida aks etishi xususiyatlari ochib beriladi. Harbiy xodimlar faoliyati vatan himoyasi, askariy bilim va mahorat, mardlik, fidoiylik bilan bog‘liqligi ko‘rsatiladi.

Tayanch so‘zlar: harbiy xodimlar, harbiy bilim, askariy mahorat, mardlik, vatan himoyasi, vatanparvarlik, milliy g‘urur, tarixiy xotira, ideal, ibrat.

Аннотация. В данной статье расскрываются особенности деятельност военнослужащих, их связи о национальной гордостью и исторической памятью. В ней подчеркивается связи деятельности военнослужащих с такими кечествами таких как защита родины, военное знание и мастерства, отвага, самопожертвования.

Ключевые слова: военные кадры, военное знание, военное мастерство, отвага, защита родины, патриотизм, национальная гордость, историческая память, идеал образец.

Abstract. This article reveals the features of the reflection of national pride and historical memory in the activities of military personnel. It is shown that the activities of military personnel are related to the defense of the homeland, military knowledge and skills, bravery, and selflessness.

Key words: military personnel, military knowledge, military skill, bravery, homeland defense, patriotism, national pride, historical memory, ideal example.

As stated by our head of state, we should give more importance to educating our youth in the spirit of military patriotism, increasing their love and loyalty to the motherland. National pride expresses the feeling of pride that belongs to a nation.

If a citizen or person realizes that they are a representative of this or that nationality, they understand the instructive, noble and beautiful qualities of that nation. These qualities seem to them to be an ideal example of imitation, a maturity that helps to form a life goal. It is known that any ideal has a model, an imagination, a thought and a far-reaching goal. The social ideal is based on social existence and implies the improvement of social existence. This prospective goal is formed in the imagination and mind of people in the form of “image, model, fantasy, imagination, goals”. However, a certain socio-cultural environment and tradition are manifested in the historical process. As a person is formed not in an abstract place, but in a space with its own historical and cultural paradigms, the social ideal of a person also has the influence of this historical and social space. This requires looking at the social ideal in

connection with the historical and cultural environment, national characteristics, family, neighborhood, mentality, traditional lifestyle, etc. If we pay attention to the factor of pride from the ideal in national pride, we will notice that national pride is associated with the search for the ideal. A citizen is someone who seeks an ideal quality, image, or artifact that represents their nation. Once they have found this ideal, they take pride in their nation, work to preserve and protect its noble qualities, and strive to multiply them.

Patriotism, national pride, bravery and courage are central to the profession of military personnel. Without them, military personnel are no different from ordinary citizens. Historical memory plays an important role in the formation of these qualities. It is impossible to connect all the above qualities with historical memory. Therefore, at this point, in the article, we will limit ourselves to the harmonious influence of national pride and historical memory on the activities of military personnel. Military personnel also need a social ideal. Those who left an important mark in the history of our nation, who defended the honor, interests, and homeland of the nation, fulfill their ideal role. Shiroq, Tumaris, Najmiddin Kubro, Jalaloliddin Manguberdi, Babur, our brave and patriotic forefathers are examples and ideal characters for military personnel. The past of national pride cannot be formed without a past, it is obviously based on historical memory.

Historical memory is the re-reflection, recollection and appreciation of material and spiritual wealth created by ancestors in the minds and daily practical activities of people; social memory is the re-manifestation, recall, and appreciation of the social feelings, hypotheses, theories, moods, ideas and views, habits and traditions of ancestors in the minds and activities of generations.

So, national pride, the search for a vital ideal presupposes historical memory. It is characteristic of humans and society to seek the object of ideal and pride from the past, from history. This national historical factor applies to both ordinary citizens and military personnel.

In military personnel, the appeal to national pride and historical memory is the leading place in their professionogram. Military patriotism, military duty and skill, self-sacrifice, altruism, characteristic of military personnel, are components of their activities. That is why the phrase “building courage and bravery in military personnel” is surprising. In fact, courage and bravery should be a necessary quality of military personnel. Patriotism, as the basis of this quality, requires military knowledge and skills, obeying discipline, protecting the homeland, tranquility, the people, and the interests of the nation by sacrificing one’s life when necessary. These qualities may not be part of the daily activities and qualities of ordinary citizens and individuals, but the work of military personnel should be permanently added to these qualities.

National pride and historical memory are dialectically manifested in military personnel through the following qualities;

- homeland defense;
- to put the interests of the people, the nation above everything, even the soul;
- boldness, courage and strength;
- altruism, self-sacrifice;
- modern military knowledge and military skills;

- following the principles of humanism.

In the general military regulations of the Armed Forces of the Republic of Uzbekistan, it is noted that the formation of moral and spiritual spirituality in the protection of the motherland in soldiers is one of the main tasks. Defense of the homeland is an expression of national pride. Only people with national pride and patriotism consider the defense of the homeland as their sacred duty. The doctor of philosophy, professor, academician E.Yusupov told that “Patriotism can become a decisive factor of development only if it is manifested not in words, but in practical actions, in defense of the homeland”. Various stages of historical, socio-political, spiritual progress bring new facets of patriotism, love for the motherland. Consequently, the formation of the concept of the motherland in each individual is associated with its spiritual maturation and the development of society. At the same time, E.Yusupov emphasizes that patriotism comes in the form of a “general idea”. Therefore, protection of the homeland, patriotism as an expression of practical activity is reflected in human life actions. This principle and requirement protects homeland defense and patriotism from becoming scholasticism and nonsense, and gives a clear essence and social character to the activities of military personnel. True, no feeling and idea is formed without the influence of a subjective factor. However, the subjective factor in military personnel must always come in the form of a clear appearance and type of behavior.

Putting the interests of the people and the nation above everything, even their lives, is a common requirement for military personnel. Without it, national pride will be nothing. And the historical memory shows people who served the interests of the people and the nation, who spent their lives and everything for the national goal, as ideals and examples. The dialectical connection between them is visible in the way of applying the historical fact, i.e., the ideal image that left a significant mark in the socio-historical life, to the existing existence. Sometimes we may not even notice the dialectical connection between them, because practice and behavior are the priority in every employee’s activity. However, it is difficult to deny that serving the interests of the people and the nation stems from a socio-historical fact and an ideal image of the way of life. In any case, we cannot ignore the fact that serving the interests of the people and the nation is a legacy left by our ancestors. An objective knowledge of the history of the Motherland, together with a correct understanding of the past, protects the experience of ancestors, opens the way to find new opportunities for independent development, and leads to love the Motherland with deeper faith.

When military personnel turn to historical memory, they look for a motive that will be a strong motivation for their work. These motivations are varied, but they are based on real life requirements, military doctrine and missions. Our special observations are these motives:

- spiritual and moral;
- psychological-spiritual;
- social status image;
- to demonstrate identity, military training;
-qualification, military skill improvement, etc. These motives appear in various forms in ordinary sailors and soldiers, sergeants, commanders, starshinas, officers. For

example, sergeants and officers want a military rank and an increase in status. They dream of graduating from military school. This pattern appears differently in commanders. That is, they strive to get the rank of major, lieutenant colonel as soon as possible. This is a natural necessity. But this desire is related to the fulfillment of a certain duty at a high level. It is not enough to show that you have enough money. So, you can think and write about this for a long time. In our opinion, achieving a military position is desirable if it happens through the performance of military duty.

Military service does not reject humanism. If the order, law, duty has a humanistic nature, if it is focused on glorifying and protecting human dignity, then it has fulfilled its noble task. Defense of the homeland, military service, military skills cannot be opposed to humanism.

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UDC: 323.1

ETHICAL INTEGRATION OF INTERCULTURAL COMMUNICATION IN GLOBALIZATION

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Annotasiya: XXI asrda globallashuv jarayonlari yanada kuchayib, hayot sur’atlarining jadal rivojlanib borishi kuzatilmoqda. Dunyoda ro‘y berayotgan ijtimoiy, iqtisodiy, siyosiy voqyealar insoniyatning hayot faoliyatiga o‘zining ijobiy yoki salbiy ta’sirini o‘tkazmoqda. Shu bois bugun madaniyatlararo muloqot munosabatlari, millatlararo totuvlik masalalari global o‘zgarishlar davrida asosiy e’tibor qaratish lozim bo‘lgan vazifalardan biriga aylanib bormoqda.

Kalit so‘zlar: Globallashuv, ijtimoiy, siyosiy, iqtisodiy, mustaqillik, milliy, din, etnik, muloqot, axloq, odob, farosat, demokratiya, huquq, ong, uzluksiz, axborot, tabiiy, tenglik, adolat, huquq, siyosat, davlat, milliy, urf-odat, an’ana, qadiryat, millat.

Аннотация: В XXI веке процессы глобализации усиливаются, темп жизни стремительно развивается. Социальные, экономические и политические события, происходящие в мире, оказывают положительное или отрицательное влияние на жизнедеятельность человечества. Поэтому сегодня вопросы межкультурного диалога и межэтнического согласия становятся одной из

главных задач, на которые следует обратить внимание в эпоху глобальных изменений.

Ключевые слова: Глобализация, социальная, политическая, экономическая, независимость, национальная, религия, этническая, коммуникация, мораль, нравы, мудрость, демократия, закон, сознание, преемственность, информация, естественное, равенство, справедливость, закон, политика, государство, национальный, традиция, обычай , традиция, ценность, нация.

Abstract: In the 21st century, the processes of globalization are intensifying, and the pace of life is rapidly developing. The social, economic, and political events taking place in the world have a positive or negative effect on the life activities of mankind. Therefore, today the issues of intercultural dialogue and interethnic harmony are becoming one of the main tasks that should be paid attention to in the era of global changes.

Keywords: Globalization, social, political, economic, independence, national, religion, ethnic, communication, morality, manners, wisdom, democracy, law, consciousness, continuity, information, natural, equality, justice, law, politics, state, national, tradition custom, tradition, value, nation.

Introduction. Intercultural communication and moral integration are global in nature and are becoming one of the important processes of every era. This topic includes complex aspects and logical processes related to cultural, social, political, and economic consequences. With the development of cultural ties and mutual trust between independent countries of the world, the role of integration of relations between people and communication is expanding. This, in turn, fosters intercultural communication and is one of the most important foundations of moral processes, opening the way for the integration of people with national, religious, and ethnic aspects. The process of communication among people living in the world is not only information transfer, but the joint development of some newly received information is observed on this basis. According to M.S. Kagan, “communication is the process of developing new information that is common to people and to be born into their society (or to raise the level of this society)”[1; 149-b.]. It helps to form the processes of mutual integration between people and thus helps to form a culture of communication and establish relations between people.

Literature analysis: The moral and philosophical roots of communication culture and the development of intercultural communication in the years of independence from the scientists of our republic G. Mirzayev, I. Saifnazarov, N.B. Abdullayeva, E. Kadirov, A. Ochildiyev, R.H. Murtazayeva, O.P. Musayev, C.H. Yusupova, A. Hasanov, B.R. Karimov, S. Karimov I. Karimov, E. Karimova, T. Makhmudov, A. S. Ochildiyev, S. O. Otamuratov, V. Kochkarov, Z. R. Kadirova, U. Saidov, J. Tolanov, Kh. Kh. Khanazarov, Z. Khusniddinov, Kh. Yunusova , E. Yusupova studied. In this process, he discovered that it is possible to strive towards the goal set as a result of the establishment of modern trends of international relations based on equality, mutual respect, friendship and cooperation. D. Locke, J. J. Russo, R. Mullerson, K. Popper, B. Spinoza. As D.Truman wrote, he explained that

maintaining society from decline, preservation and stability is the only criterion of an open society, which is connected with intercultural communication and tolerance.

Research methodology. The methods of comparative analysis, analysis and synthesis, comparison of conceptual theories, field ethnographic work, historicity, logic, succession, and systematicity were used in this study.

Analysis and results. Intercultural communication and moral integration is a process of changing views, values, and impressions between people. This can be done through globalization, foreign relations, diplomatic relations, economic cooperation and intercultural exchange, along with the processes of expansion of international relations. This is, first of all, an approach to intercultural relations aimed at accepting mutual differences, working with questions between values and impressions. Secondly, an important part of communication between people is acceptance and appreciation of values and impressions. For example, S. Otamurodov says: “In the process of creating, mastering and developing spiritual culture, society progresses, labor productivity increases, production forces develop, people's moral image is formed, morals, taste and intelligence are formed, aesthetic pleasure, creative power and values develop, the state is governed based on the principles of justice”[2; 22-b.].

Intercultural identity is used to define an individual's ability to transcend one’s own culture, adapt to a new culture, and in the process acquire alternative understandings of both cultures. Communication is defined as the promotion of transfer from one culture to another. Intercultural communication is crucial for cultural adaptation. It provides humans with a primary means of understanding the new environment in which they live, and among the many forms of human communication, interpersonal communication and media consumption are the most important. Aspects of cultural adaptation are considered the brightest form of the educational process. At the same time, they have built their theories around the concept of “alien” and extended this concept to people from different groups that are not well understood by us, while in real life they include everyone in the field of globalization. At the same time, today’s globalization, along with intercultural communication, S.L. Serebryakov identified individual freedoms, pluralism in society and democratic legal consciousness as the main civic values. [3; 74-80-b.].

Communication culture as a special communicative process is of high social importance, because, among other tasks, it provides information to all types of social practice. The information side of communication is expressed in the existence of a continuous process of production and movement of social information, its translation, reception and storage. Information distributed in the form of knowledge, values, stereotypes feeds all social processes. Information exchange occurs when there is a significant difference in the information potential of the participating parties and an objective need for their mutual enrichment and relative equalization in order to organize collective activities to solve emerging problems.

Cultural adaptation occurs not only in immigrants, but also in the host culture and society, because cultural adaptation is a natural process of adjustment when individuals socialized in one culture move to another culture. This process not only adapts individuals to the new culture, but also changes the new culture by bringing some aspects of the old culture into the new culture. Over time, the diversity of foreign

cultures has made the host culture different. The immigrants then acquire a new host cultural environment that has changed and is constantly changing after their arrival. Recognizing its cross-cultural identity, the community has become more mature than ever in dealing with immigrants, expatriates and international business people. These push and pull forces allow people and the host cultural environment to continuously evolve without abandoning the previous culture.

This intercultural communication along with spiritual and moral values, S.N. Drozjin emphasizes that the community is good, which consists in understanding the priority of state values based on cooperation for the common good of all subjects of society; equality and justice are perceived as equal distribution of the burden of problems among all citizens; pluralism; patriotism; truthfulness[4; 36-46-b.]. In addition, S.N.Drozhin justifies the order as a certain Russian citizenship value. The concept of "order" allows law, politics, state bodies to create a social-public system aimed at protecting and helping the subjects of society. [5; 45-b.]. The reason for this is that the stable development of our country, the effective implementation of reforms in all spheres of society is explained by the necessary social space opportunities to respect the communication culture, art, national customs, traditions and values of society members.

Today's globalization process requires the study of the problem of intercultural communication, making specific proposals for solutions to the problem. Our opinion is confirmed by the fact that since mankind began to communicate in different languages, it has been separated according to the level of culture, the color of the skin, and the culture of behavior. After all, the more nationalities there are in the country, the more diversity there is. One of the positive features of the globalization process is that intercultural communication, exchange of information occurs simultaneously with the exchange of cultures within or between countries. However, as American scientist S. Huntington said, this aspect should be based on mutual respect, regardless of the number of nations, and not at the expense of the larger nations and cultures swallowing weaker nations and cultures.

According to statistics, many Uzbeks currently live in countries other than the Republic of Uzbekistan. For example, in our neighboring countries, 24.4% of the population of Tajikistan, 13.8% of the population of Kyrgyzstan, 9.0% of the population of Turkmenistan, and 2.5% of the population of Kazakhstan are Uzbeks. That is why Uzbekistan is a supporter of permanent, all-round mutual relations and strong security in the region among the independent states of Central Asia. The positive results of integration will help the communication between nations and regional security[6; 81-b.]. The declaration "On the Culture of Peace" was adopted at the 53rd session of the UN General Assembly. The culture of peace should be understood as a global school that analyzes how to live together in peace and harmony, inculcate the protection of the world into the minds of young people, non-violence, and the establishment of justice and democracy. Education of qualities such as tolerance, communication culture without violence and conflicts, listening and drawing conclusions, arguing with the opponent, and not turning him into an enemy should be organized from childhood" [7.]. This has an impact on the interaction of people living

in different countries. It is not difficult to understand that such wide-scale relations undoubtedly affect the interaction between different nations.

One of the main principles of ensuring inter-ethnic relations among people in society is the development of inter-ethnic communication culture. The culture of inter-ethnic dialogue is the culture of peoples and nations in the process of interaction, and it is created on the basis of their rapprochement and development in the process of social activity. This means equality of peoples in economic, social, political and cultural development, mutual support between them, taking into account each other's interests and national characteristics.

Conclusions. To sum up, one of the main problems waiting to be solved in the modern world is related to ensuring relations between nations. The reason is that these issues are mentioned a lot in scientific sources by theoretical scientists and experts. Ensuring security in the 21st century, building intercultural dialogue, and solving national-ethnic issues in multinational countries depend on the development of positive trends. Therefore, preserving the national identity of ethnic groups and ensuring the internal integrity of the country, harmonizing the mutual relations of different ethnic groups serves to provide a solution to the problem.

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UDC: 796.01

FACTORS OF FORMATION OF SCIENTIFIC OUTLOOK IN THE HERITAGE OF EASTERN THINKERS

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Annotatsiya: Fan va ilmiy tafakkurning rivojlanishi turli omillar ta'sirida bo'lgan murakkab jarayondir. Ushbu maqolada Sharq mutafakkirlari merosida ilmiy dunyoqarashning shakllanishiga xizmat qilgan omillarni o‘rganamiz. Sharq faylasuflari va olimlari turli fan sohalariga katta hissa qo‘shgan. Ushbu maqolada Sharq ilmiy tafakkurini shakllantirgan madaniy, falsafiy va tarixiy omillar va uning kengroq ilmiy jamoatchilikka ta’siri ko‘rib chiqiladi.

Kalit so'zlar; Ilmiy qarashlar, Sharq mutafakkirlari, madaniy omillar, falsafiy omillar, tarixiy omillar, yaxlit dunyoqarash, fanda an’analar, gnoseologik qarashlar, muvozanat va uyg‘unlik.

Аннотация: Развитие науки и научного мышления представляет собой сложный процесс, находящийся под влиянием множества факторов. В данной статье мы исследуем факторы, которые способствовали формированию научного мировоззрения в наследии восточных мыслителей. Восточные философы и ученые внесли значительный вклад в различные области науки. В этой статье рассматриваются культурные, философские и исторические факторы, которые сформировали восточное научное мышление и его влияние на более широкое научное сообщество.

Ключевые слова; Научное мировоззрение, восточные мыслители, культурные факторы, философские факторы, исторические факторы, целостное мировоззрение, традиция в науке, эпистемологические перспективы, баланс и гармония

Abstract: The development of science and scientific thinking is a complex process influenced by a variety of factors. In this article, we explore the factors that have contributed to the formation of a scientific outlook in the heritage of Eastern thinkers. Eastern philosophers and scholars have made significant contributions to various. This article examines the cultural, philosophical, and historical factors that have shaped the Eastern scientific mindset and its impact on the broader scientific community.

Key words; Scientific Outlook, Eastern Thinkers, Cultural Factors, Philosophical Factors, Historical Factors, Holistic Worldview, Tradition in Science, Epistemological Perspectives, Balance and Harmony

Introduction: The formation and evolution of scientific outlooks are dynamic processes that are deeply influenced by cultural, philosophical, and historical contexts. While Western scientific thought has often taken center stage in the global narrative, it is crucial to acknowledge and appreciate the contributions of Eastern thinkers to the development of scientific knowledge and methodologies. This article embarks on a journey to explore the multifaceted factors that have shaped the scientific outlook in the heritage of Eastern thinkers. The rich history of Eastern philosophy, science, and

culture has not only nurtured scientific traditions in the East but has also left a lasting imprint on the broader scientific community.

Eastern thinkers, spanning across cultures such as India, China, the Middle East, and other regions, have made significant strides in various scientific fields. Their unique perspectives, rooted in the profound philosophical traditions of their respective cultures, have enriched the global scientific landscape. By investigating the cultural, philosophical, and historical factors that have contributed to the formation of a scientific mindset in the East, this article aims to shed light on the depth and diversity of Eastern scientific heritage. These insights not only broaden our understanding of the history of science but also facilitate a more holistic appreciation of the interconnectedness of human intellectual achievements across different civilizations.

Cultural Factors:

Holistic Worldview:

Eastern cultures have long embraced a holistic worldview that views the universe as an interconnected and interdependent system. In contrast to reductionist approaches, this perspective recognizes that everything is intertwined, and actions have consequences throughout the web of existence. Philosophical traditions such as Daoism in China and Vedanta in India emphasize this interconnectedness. This holistic outlook has had a profound impact on scientific thinking by promoting the study of systems, relationships, and the consideration of multifaceted interactions in scientific research. Eastern scientists often seek to understand the interplay between elements, which can be observed in fields like traditional Chinese medicine, where balance and harmony are central to the healing process.

Respect for Tradition:

Eastern cultures have a deep-rooted respect for tradition and ancestral knowledge. This reverence for the wisdom of the past has resulted in the preservation and accumulation of scientific knowledge over generations. Eastern scholars have built upon the work of their predecessors, adding their insights and discoveries to an ever-growing repository of wisdom. This tradition of knowledge preservation and transmission has been a cornerstone in the development of Eastern scientific thought. The continuity and stability of this knowledge base have provided fertile ground for the advancement of various scientific disciplines.

Spiritual and Ethical Foundations:

Eastern cultures often incorporate spiritual and ethical considerations into their scientific endeavors. In India, for example, the concept of "Dharma" underlies the ethical dimension of scientific inquiry, encouraging scientists to pursue knowledge for the greater good of society. This ethical underpinning ensures that scientific advancements are guided by a moral compass, striving to benefit humanity rather than merely for the sake of knowledge itself. Such ethical considerations have influenced the directions and applications of scientific research, leading to a more harmonious integration of science within the cultural fabric.

Interdisciplinary Approaches:

Many Eastern cultures traditionally foster interdisciplinary approaches to understanding the world. In fields like traditional Chinese medicine or Vedic sciences, the synthesis of knowledge from various disciplines, including astronomy, philosophy,

and biology, is common. This cross-pollination of ideas and practices encourages a more comprehensive understanding of complex phenomena. Interdisciplinary approaches have been instrumental in addressing multifaceted scientific challenges and continue to play a significant role in the Eastern scientific tradition.

The cultural factors outlined above have been instrumental in shaping the scientific outlook in the heritage of Eastern thinkers. They have not only influenced the approach to scientific research but have also left an enduring mark on the philosophical and ethical foundations of science in the East. These cultural factors are integral to understanding the unique contributions of Eastern thinkers to the broader scientific discourse, illustrating the dynamic interplay between culture and scientific thought in shaping our understanding of the world.

Philosophical Factors:

Epistemological Perspectives:

Eastern philosophical traditions have provided distinctive epistemological perspectives that have deeply influenced the development of scientific thought. For instance, Indian philosophies, including Nyaya and Vaisheshika, explore the nature of perception, inference, and testimony, which has important implications for the philosophy of science. These philosophical systems have laid the groundwork for understanding how knowledge is acquired and validated, which is essential for the scientific method.

Balance and Harmony:

Many Eastern philosophies, such as Taoism and Buddhism, place a strong emphasis on balance and harmony within oneself and with the external world. These philosophical principles have had a profound influence on various scientific disciplines, particularly in fields related to health and well-being. Traditional Chinese medicine, for example, aims to restore balance within the body's vital energy (Qi) and its elements (Yin and Yang). Ayurveda, an ancient Indian system of medicine, similarly focuses on achieving harmony within the body, mind, and spirit.

The importance of balance and harmony in Eastern philosophies has led to the development of holistic approaches to health and well-being, which have been incorporated into complementary and alternative medicine practices. This emphasis on balance and harmony has impacted the scientific methods employed in these fields, encouraging a more integrated and holistic understanding of health and disease.

Concepts of Causality:

Eastern philosophies often offer unique perspectives on causality and the interconnectedness of events. For instance, the concept of Karma in Indian philosophy suggests that every action has consequences, which can be viewed as a precursor to the modern understanding of cause and effect in science. Similarly, the Chinese concept of "Wu Wei" in Taoism, often translated as "effortless action," implies that the right actions will naturally lead to desired outcomes, which aligns with certain aspects of systems theory in science.

Similarly, India had its own periods of scientific excellence during the Gupta and Mauryan empires, with achievements in mathematics, astronomy, and metallurgy. The Chinese civilization experienced its own golden ages with notable advances in fields such as mathematics, astronomy, and papermaking.

Cultural Patronage and Institutions:

The establishment of centers of learning, libraries, and institutions by Eastern rulers and patrons played a crucial role in the advancement of science. The House of Wisdom in Baghdad, for instance, was a major center for translation, research, and scholarship during the Islamic Golden Age. The Nalanda University in India and the libraries of the Silk Road served as hubs for intellectual exchange, research, and the preservation of scientific manuscripts.

The support of these institutions allowed scientists and scholars to engage in research, collaborate with their peers, and exchange knowledge. This historical support for learning and research laid the groundwork for the development of scientific thinking and methodologies in the East.

Innovative Technological Advancements:

Eastern civilizations have a rich history of innovative technological advancements that significantly influenced scientific progress. For example, ancient Chinese inventors developed the compass, papermaking, and gunpowder, which had profound effects on navigation, communication, and warfare. These inventions not only advanced scientific knowledge but also facilitated further research and exploration.

Conclusion: The formation of a scientific outlook in the heritage of Eastern thinkers is a multifaceted journey deeply influenced by cultural, philosophical, and historical factors. The rich tapestry of Eastern thought, spanning across diverse cultures and regions, has made substantial contributions to the development of scientific knowledge and methodologies. By examining these factors, we gain a more profound understanding of the Eastern scientific heritage and its lasting impact on the global scientific community.

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UDK: 9(069)

PROSPECTS OF ETHNOECOLOGICAL TOURISM IN JIZZAK REGION

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Abstrakt. Tog‘ yonbag‘irlarida tabiiy boyliklari ko‘p, shifobaxsh iqlimi va suviga ega bo‘lgan viloyatdagi qishloqlar orasida Turkiston tog‘ tizmasi etagida joylashgan Baxmal va Zomin, Nurota tog‘lari, mevali va dorivor o‘simliklar o‘sadi. va o'zlarining mahalliy aholisiga ega. Farish tumanlari kiradi.

Kalit so'zlar. Etnoekologik turizm, nomoddiy meros, moddiy meros, oilaviy mehmon uylari, etnik xalqlar, tabiiy yashash joylari, ekoturizm, etnik turizm, ziyorat turizmi, urf-odatlar, milliy qadriyatlar, turistik qishloq.

Абстракт. Бахмаль и Зомин, расположенные у подножия Туркестанского хребта, и Нуратинский горный массив, среди сел области, которые имеют много природных богатств на склонах гор, имеют целебный климат и растут воды, фруктовые и лекарственные растения. и иметь свое коренное население. Включены Фаришские районы.

Ключевые слова. Этноэкологический туризм, нематериальное наследие, материальное наследие, семейные гостевые дома, этнические народы, естественная среда обитания, экотуризм, этнический туризм, паломнический туризм, обычаи, национальные ценности, туристическая деревня.

Abstract. Bakhmal and Zomin, located at the foot of the Turkestan mountain range, and Nurota mountain range, among the villages in the province, which have a lot of natural wealth on the mountain slopes, have a healing climate and water, fruit and medicinal plants grow and have their own native population. Farish districts are included.

Keywords. Ethnoecological tourism, intangible heritage, tangible heritage, family guest houses, ethnic peoples, natural habitats, ecotourism, ethnic tourism, pilgrimage tourism, customs, national values, tourism village.

Introduction. "It is known that the tourism sector is one of the fastest growing and promising sectors of the world economy. Globalization processes have opened wide opportunities for free movement of people around the world," said the President of the Republic of Uzbekistan Shavkat Mirziyoyev in his speech at the 25th session of the General Assembly of the World Tourism Organization. He also emphasizes that in recent years, the World Tourism Organization has become a reliable and long-term strategic partner in the full realization of the tourism potential of New Uzbekistan [5]. This means that we need to develop all types of tourism in our Republic and present it to the world tourism market. It is an urgent issue to bring tourism directions, such as

ecological and ethnic tourism, which entered at the end of the 20th century, to new stages of economic and social development of our Republic.

Ethno-ecological tourism is a complex interdisciplinary field that includes the scientific approaches of tourism, ethnic ecology and ethnic geography. The combination of "ethno" and "eco" indicates a close relationship between the ethnic group and the natural-geographical environment, which is considered by ethnologists as a "life-supporting environment" [1].

Various environmental and climatic conditions have always influenced the economy of peoples and their social development to one degree or another. Local ethnic groups live in the existing ecological environment based on the formation of a complex of material and spiritual culture. That is, with the help of ethnic culture, people unite into ecological communities and become a part of the ecological system. Therefore, there is an integrated approach in ethno-ecological tourism, in which ecological and ethnographic aspects are combined and formed together for a long time [6].

Ecotourist mainly travels to natural habitats, i.e. nature reserves, national parks, forestry lands. At the same time, they will get acquainted with the lifestyle, traditions, customs, performances of folklore groups of the people living in the areas where ecotourism routes are organized. They see with their own eyes that the level of use of the natural resources around the houses, gastronomy, and surroundings of the population are directly connected with the surrounding nature, climate changes, and frequent natural disasters [1,2].

Purpose and mission. Analysis of ethnic structure of Jizzakh region; Studying the lifestyle of indigenous people in the recreational areas of the region from an ethnic point of view; study of ethnological activities on ecotourism routes in the region; to assess the region's ethno-ecological tourism potential; development of proposals for the further improvement of ethno-ecological tourism of the region.

Level of learning. Due to the fact that ethno-ecological tourism is a relatively new direction for our country, we will first dwell on the scientific research works of Russian scientists. A. Yu. Aleksandrova's textbook called "География туризма" suggests adding rural tourism to a branch of ecological tourism [4]. V.V. Khrabovchenko's educational manual called "Экологический туризм" focuses on the organization of rural tourism along with ecological tourism [5]. A.B. Kosolapov conducted research on the theoretical issue of organizing ecological and rural tourism in the textbook called "Теория и практика экологического туризма"[6]. Similarly, among the scientists of our country, Z.I. The main directions of Usmanova's research are aimed at the development of tourism and recreation services in Uzbekistan, in which she explained the lack of development of recreational and health tourism in Samarkand, Kashkadarya and Surkhandarya regions due to the small number of institutions. It should be noted that at present there is no single understanding among many authors regarding the development, formation and introduction of innovations in the field of ethno-ecological tourism infrastructure. In our opinion, the scope of the research that needs to be conducted in this regard is wide, and we should take into account the well-known international experiences in order to ensure the proportional development of the sectors in the formation of local tourism infrastructure.

Research methodology. In the research, the methodology of taking into account the changes expected in the coming years and studying the development of tourism as a whole infrastructure is used in determining the development of the ethno-ecological tourism infrastructure. Observation, comparison, empirical research, comparative analysis and expert opinion are studied in this regard. a method of determining the development directions of infrastructure components through methods such as evaluation is proposed.

Analysis and results. Ecotourism is natural tourism, which involves creating and understanding the natural environment. Its management is carried out in such a way that the resulting activity is ecologically, socially and culturally sustainable, and includes the "natural environment", cultural contents, "ecological sustainability" adequate income for the local population and the long-term protection of the resources used. Ecotourism, like any other type of tourism, should be ecologically sustainable, provide pleasure to tourists and bring income to local residents. In addition, it should "fit in" with the natural and cultural environment. The meaning of the word "fit" is that the style, size and variety of this activity must correspond to the scale and character of the landscape, and the customs of the local population**.**

In the organization of ecotourism in the region, it is envisaged to provide services to ecotourists not only unilaterally, but also multilaterally.

- according to one or another purpose, ecotourists can travel to enjoy nature;
- they can expand and grow their scientific knowledge;
- they can get to know the culture, traditions and rituals of the indigenous people living in the area and participate directly;
- they can eat the national dishes of indigenous people living in the area and, if they wish, participate in the preparation process themselves.

All of the above-mentioned activities are related to ethnotourism and serve to increase the enrichment and attractiveness of ecotourism routes in our region.

For example, an ecotourist visiting the Nurota mountain range can see the mountain landscapes, unique fauna and flora, the Seversov sheep store established under the Nurota state reserve, the thousand-year-old Mojurum fir (Biota tree), ancient houses, mosques, stone inscriptions. can reach They can also go boating on the Aydar-Arnasoy lake and ride horses and camels along the expanses of Kyzylkum, have a rest in the national pasture, and stay in family guest houses organized by the indigenous people of the mountains.

The area of Forish district, located in the Nurota mountain range, is 9.56 thousand square kilometers (956 thousand 476 hectares). The length of the border is 583 km. The population is 95.6 thousand people. National composition: Uzbeks (87.2%). Tajiks (6.1%), Kazakhs (5.0%), Russians (0.6%), Tatars (0.2%), Kyrgyz (0.1%) and representatives of other nationalities (0.8%). The economy of the district is specialized in the fields of fruit and vegetable, animal husbandry, horticulture, deep processing of agricultural and agricultural products, food and construction materials. Therefore, tourists who visit this area get acquainted with the Uzbek and Tajik culture, lifestyle and traditions of the mountain villages.

In Forish District, several dozen houses are currently hosting foreign tourists as family guest houses. In the decisions and orders issued on the establishment of family

guest houses and ethnotourism villages, it is envisaged to equip such guest houses with equipment reflecting the history and culture, ethnography of the region, and to invite local folklore groups to organize entertainment events [3,4,5]. Tourists who visit such a family guest house, watch the baking of bread in the oven and the preparation of food in the village kitchen, and they themselves participate in this process. They are also guests at family traditions and wedding ceremonies. Folkloric ensembles and solo singers from among the indigenous population will sing folk songs to tourists around the evening bonfire. Also, tourists are interested in the role of the father in the family, the fact that the daughter-in-law and grandchildren live together in the big yard, and the neighbor-neighbor relationship. They experience the mutual respect and love of such families, living in the sacred traditions of the family, which are our ancient values, as a part of this family.

Figure 1. National farms and family guest houses in Jizzakh region

Bakhmal and Zomin, located at the foot of the Turkestan mountain range, are among the villages with their own indigenous population, with a lot of natural wealth on the mountain slopes of the region, with a healing climate and water, a lot of fruit and medicinal plants. districts are also included. If we consider their population and social situation, the population is mostly Uzbeks (92.4%), as well as representatives of Russian, Kazakh, Tajik, Kyrgyz and other nationalities. On average, there are 10 to 25 people per 1 km2. There are paddy farmers and mechanized forestry in the district. There are gardens, vineyards, orchards and forests, mainly grain and cattle breeding. The inhabitants of Zomin district are mainly Uzbeks, and representatives of Kyrgyz, Russian, Tatar, Tajik and other nationalities also live in this district. There are 42 people per 1 km2.

The current task is to study these regions from the point of view of special types of tourism and to develop routes for pilgrimage tourism, agro tourism, rural tourism, ecological tourism, recreational tourism, sports health tourism and ethno-ecological tourism, and to present them to the global tourism market. Although the currently established infrastructures have attracted local tourists and routes have been made for foreign ecotourists, the existing ethno-ecological tourism potential of the region has not been fully utilized.

According to the plan of the tourist village "Duoba" in Zomin district, there will be a number of recreation centers, new exhibition facilities for tourists, centers of national cuisine prepared by local residents, examples of national crafts and ethnotourism, and most importantly, folk medicine, It is planned to introduce

beekeeping centers. For information, it is worth mentioning that in accordance with the Decree of the President of the Republic of Uzbekistan No. PF-5781 of August 13, 2019, citizens who have been granted the status of "Tourism Neighborhood", "Tourism Village" or "Tourism Park" since 2020 The collections will be included in the state programs "A prosperous village" and "A prosperous neighborhood" in the first place.

In the guest house "Orazboy teacher" in Zomin district, the processing processes of Zomin boilers and dairy products are shown. However, it is not included in the routes to show tourists the handicrafts of the indigenous people of the region, many horsemanship performances and wedding ceremonies. Tourists who visit Peshagor village of Zomin district mainly come to see the Peshagor cave located at the foot of Molguzar mountain. However, there are no family guesthouses in this village. Tourists do not have a one-day itinerary that reflects the lifestyle, crafts and history of the ethnic population of Peshagor. However, more than 3,000 exhibits in the historical ethnographic museum, which was built by the people at the Khojai Serob pilgrimage site, provide information about the history and enography of this place.

The ethno-ecotourism potential of Bakhmal district is also very high, ancient crafts, animal husbandry and horticulture are widely developed in this place. For example, in the village of Novka there are chest makers, cradle makers and saddle makers of several generations who still have their own workshops and apprentices. In particular, they prepare saddles for famous horsemen of Kazakhstan, Kyrgyzstan, and Tajikistan with the "Novka red saddle" ancient red saddle unofficial brand. Also, horticulture and animal husbandry are widely developed in Bakhmal district, orchards, walnut groves and strawberry groves have been established on large areas.

Conclusion and suggestions

- Crossing the corners of nature;
- Creating favorable conditions for the visit of our people in competent natural objects;
- Creation of road infrastructures to natural objects; Improving the culture of the population in dealing with tourists;
- Increase the potential of personnel in the field of ecotourism;
- Development of new ethnoecological tourism routes;
- Wide promotion of ecological objects and routes; close cooperation with representatives of local authorities in attracting potential investors to the sector.

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UDC: 86.5

THE ESSENCE AND SIGNIFICANCE OF ALISHER NAVOI'S ETHICAL PHILOSOPHY

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Annotatsiya Maqolada Alisher Navoiyning ijtimoiy-axloqiy, estetik va antropologik qarashlari, axloqiy ta'limotini real hayotda amalga oshirishga qaratilgan мезонлар, inson va jamiyat o‘rtasidagi узвий боғлиқлик ижтимоий -фалсафий таҳлил қилинган.

Tayanch so'zlar: axloq, estetika, antropologiя, taraqqiyot, маънавият, онг, ta'lim, sinergetika, жамият, инсон.

Аннотатция. В статье социально-философски анализируются социально-этические, эстетические и антропологические взгляды Алишера Навои, критерии реализации его нравственного учения в реальной жизни, неразрывная связь человека и общества.

Ключевые слова: этика, эстетика, антропология, развитие, духовность, сознание, образование, синергетика, общество, человек.

Abstract. The article socio-philosophically analyzes the socio-ethical, aesthetic and anthropological views of Alisher Navoi, the criteria for the implementation of his moral teachings in real life, the inextricable connection between man and society.

Key words: ethics, aesthetics, anthropology, development, spirituality, consciousness, education, synergetics, society, man.

Introduction. The social and ethical views of Alisher Navoi covered almost the entire spiritual heritage of the poet. The practical activity of the thinker was one way or another aimed at implementing his ethical doctrine in real life. In his works, Navoi pointed out the inextricable connection between man and society as a common link in the unbroken chain of world development. Navoi's vision of human development was based on the then existing views on man and society. In this concept of the relationship between man and society, the priority was the rational, creative development of the individual. The cultivation of truly human qualities in an individual implied the development of his inner self, the spiritual world as a guarantee of improving the social environment. Man and society in development overcome various stages, which involve an ascent from lower forms to higher ones, from ignorance to perfection, denying evil as a vice and striving for a good beginning. This dialectical struggle between opposites represents the essence of human life and the development of society, determines the level of self-knowledge of the individual as the owner of reason. This approach as an idealistic concept took place in the era when Navoi lived. Today, of course, we are fully aware that without the formation of moral qualities in a person, the development of society is impossible; without them, society will degrade and will come to its destruction.

The moral perception of reality began to form among people in the early stages of the development of society. People formed an idea of the world through the prism of the categories of good and evil, which allowed them to evaluate certain events of human existence.

The concept of good and evil comes from the depths of thousands of years, when at the dawn of human development people built their relationships with the surrounding reality from the angle of benevolence or unfriendliness, their view of the world was perceived by dividing it into the world of good and evil spirits who acted in actions similar to those of humans. From these ideas about good and evil, religious assessments of good and evil gradually developed, which in turn were performed by evil and good deities [1].

Thus, according to researcher E. Taylor, from time immemorial human thoughts about good and evil have had their place in the development of society. Primitive people gradually formed dualistic views about pleasures or pains, benefits and disadvantages that befell a particular individual or his family, relatives[2].

With the development of society, ideas about good and evil gradually go beyond the hedonistic perception of the world, losing all sensuality. Plato, in his views, noted that goodness is proof of the spiritual essence of existence and its constancy, identifying goodness with the divine essence. His teaching refutes the hedonistic approach to understanding goodness; he calls for clearing goodness from various

material and sensory shells. Good, according to Plato, is the subject of all human activity [3]

The ancient beliefs of the peoples of Central Asia had their own ideas about good and evil, according to which they were considered as an eternal struggle between two principles - light and dark. This idea of a dialectical struggle between two opposites was reflected in the beliefs of the ancient Zoroastrians, which was expressed in the struggle between Ahura Mazda and Ahriman. The further development of the human community was represented in Zoroastrianism as an inexorable victory of the forces of light over the forces of darkness[4].

Manichaeism in its doctrine proceeded from a dualistic concept, according to which God was presented as the primary source of good, the primary light, and the kingdom of darkness is the source of evil and destructive forces. Manichaeism considered the further development of the world and ethical virtues as a process of incessant struggle between these two principles[5].

It should be noted that the initial ideas about the eternal confrontation between two principles were the desire of people in this way to explain the inferiority of human life. The dualistic idea of the contradictory nature of the surrounding world - the presence of darkness and light, heat and cold, life and death - gradually transformed and entered the social sphere of human existence. The polar ideas of primitive people and their fantasies were reflected in folklore and the way of life of peoples, which was also expressed in the culture of the peoples of Central Asia.

In the history of the development of the human community, the concepts of good and evil have had different interpretations and approaches, and have been subject to transformations based on changes in the social structure of peoples. Although basically the essence of good was understood as necessity, compliance with the requirements of human interests. Everything that conflicted with good was considered evil [6]

Analysis of the relevant literature. At the beginning of the 17th century. Georgian poet Tsitsishvili, French scientist A. d'Herbelot, Sylvester de Sacy conducted a number of studies to study the work of the thinker. Although the initial work on studying the spiritual heritage of Alisher Navoi began during the life of the poet himself, a systematic analysis of his works began in the 19th century. At this point, it is worth saying that research on this topic can be divided into three groups:

First group. This group includes foreign scientists who have studied the life and work of Alisher Navoi on a global scale. Since the first half of the 19th century, interest in the publication and research of Alisher Navoi’s works has increased in European countries. Many European scientists began to study the spiritual heritage of the thinker with particular interest. Among such scientists, the studies of Cartmer, Pave de Courteil, Ogah Siri Levend, I. N. Berezin, M. Nikitsky, V. V. Vilyaminov-Zernov, E. E. Bertels should be highlighted.

Second group. Scientists from the Commonwealth of Independent States also made a great contribution to the development of the field of Navigation Studies. In particular, the works of Russian scientists A. Krymsky, V. V. Bartold, A. A. Semenov, L. Klimovich, A. N. Borovkov, E. E. Bertels, as well as Azerbaijani scientists S. A. Mamedov, works of A. .AND. Agayeva, L.A. Aliyeva, J. Nagiyeva are inextricably linked with the poetry of the East and Central Asia. The creative heritage of Alisher

Navoi, his advanced ideas became the goal of research by many scientists, among whom it is necessary to especially note the Russian orientalist E.E. Bertels. When studying the creative heritage of E.E. Bertels, it is necessary to point out that his works provide a thorough study of the creativity of Alisher Navoi. The scientist, following his method of comparative analysis of primary sources, comes to the conclusion that the Uzbek poet is not an imitator of other poets, but he himself is "a great artist, the author of a word, capable of creating an original work from given material."

Research methodology. Comparative analysis, expert evaluation, dynamic series, analytical comparison, logical reasoning and grouping methods are widely used in this research. Also, the researches of foreign and local scientists on this topic were analyzed. Official statistics were used in the analysis.

Analysis and discussion of results. In Navoi's understanding, goodness is manifested in good deeds, which consist in protecting the people in every possible way from suffering, need and tyranny. And from this perspective, it acts as a broad social category, which is designed to characterize the behavior of rulers and those in power and is expressed in compliance with the principle of justice, generosity, generosity, nobility. In interpersonal relationships, Navoi sees goodness in the manifestation of honesty, truthfulness, love and mutual respect, cooperation and mutual assistance, in sympathy for the grief of one's neighbor, in honest and noble work. All this taken together contradicts evil. Navoi's rational approach to issues of good and evil is that he sees them as certain human actions that have a relationship with the interests of others. According to Navoi, evil is the source of all troubles and suffering of people. And therefore he calls on each and every one to sow the seeds of goodness, trying to abstain from evil and bad deeds. After all, as Navoi says, what a man sows, he will also reap. In the poem "The Wall of Iskander" Navoi writes that the one who sows the seeds of barley will never reap the seeds of wheat. And there are noble and base deeds, and the one who performs noble deeds will certainly receive good. The one who shows evil will receive nothing less than evil in return.

In general, the traditional idea of the struggle between good and evil, light and darkness in the ethical views of the thinker is expressed in specific phenomena and acts as a kind of conflict of a social nature. In the poems "Beloved of Hearts" and "Confusion of the Righteous," Navoi in bright colors indicates that goodness lies in justice and correct legislation.

The great social evil for Navoi is injustice and oppression of the people. Exposing evil deeds, the thinker castigates the vices, inhumanity of those in power, exposes the ungodly actions of oppressors, who are shown in the form of an unjust ruler, judge, greedy priest, ignorant teacher and mentor in a madrasah. Having stood up for the defense of the oppressed and disadvantaged, Navoi exposes the true face of those in power, their depravity and hypocrisy, hypocrisy and deceit. Navoi writes that such people chose the path of the devil and the customs of evil spirits. Their manners are tricks and malice, their justice is expressed in suspicion and deceit, their honesty is expressed in treachery and cunning.

The Shah is called upon to select worthy and respected people for important government posts, because his state policy directly depends on the activities of his officials. The poet points out the personal responsibility of the ruler for the actions of

those whom he appointed to government positions. The one who surrounds himself with those who sow this evil is responsible for evil. From this we can conclude that the mistakes of rulers can be regarded as a crime against the people.

Navoi's ideal of life is not arrogant and idle nobles, nor corrupt and greedy judges, nor idle ordinary people. The ideal for a thinker is a simple person, who has moral purity and has a formed active civic position. Navoi despises those people who do not care about the welfare of their people. He claims that only the person who is pure in thoughts and looks at the world with honest eyes is worthy of the honorary title. This principle is the cornerstone of Alisher Navoi's philosophy.

Conclusions and suggestions. As a result of the socio-philosophical study and analysis of the spiritual heritage of Alisher Navoi, the following conclusions were made:

1. The study of the creative and life path of the great medieval thinker, statesman and public figure Alisher Navoi is an important task of our time, since the solution to many problems of our time is reflected in his spiritual heritage. The spiritual heritage of Alisher Navoi is relevant and in demand today.

2. The era within which the formation of Alisher Navoi’s worldview took place was full of difficulties and was of a contradictory nature. The characteristic features of this era were the relative development of statehood, the development of economic relations, the result of which was the flourishing of culture and spirituality of peoples. Politically, there was an increasing desire for decentralization and separatist tendencies in the country. All this affected the development of Alisher Navoi’s views on the challenges of that time.

3. The work of many scientists, starting with his contemporaries, Western researchers, who drew energy from his work to improve humanistic concepts and further develop the social and philosophical thought of the medieval East, was devoted to the study and analysis of the spiritual heritage of Alisher Navoi.

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UDK: 1.740.11

COMPARATIVE ANALYSIS OF THE SUFI VIEWS OF ABU ALI IBN SINA (USING THE EXAMPLE OF THE TREATISES "AN-NAJAT", "AL-ISHARAT WA-T-TANBIHAT")

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Annotatsiya: Maqolada Abu Ali Ibn Sinoning tasavvufiy qarashlari qiyosiy tahlili keltirilgan. Muallif "An-Najat", "Al-Isharat wa-t-tanbihat" allegorik asrlaridagi tasavvufiy kategoriyalarning mohiyati va metodologik xususiyatini ochib bergan. Ibn Sinoning irfoniy qarashlari, sufiyning ruhiy kechinmalari misolida ochib berilgan.

Tayanch so‘zlar: so'fiy, tasavvuf, falsafa, tasavvuf, irfon, fano, An-Najat, Al-Isharat wa-t-tanbihat**.**

Аннотация: В статье представлен сопоставительный анализ мистических взглядов Абу Али Ибн Сины. Автор раскрыл сущность и методологический характер мистических категорий в аллегорических произведениях" Ан-Нажат"," Аль-Ишарат ва-т-танбихат". Мифологические взгляды Ибн Сины раскрываются на примере духовных переживаний суфия.

Ключевые слова: суфий, мистицизм, философия, тасаввуф, ирфан, фана, An-Najat, Al-Isharat wa-t-tanbihat**.**

Abstract: The article presents a comparative analysis of the mystical views of Abu Ali Ibn Sina. The author revealed the essence and methodological character of mystical categories in the allegorical works "An-Najat", "Al-Isharat wa-T-tanbihat". The mythological views of Ibn Sina are revealed by the example of the spiritual experiences of a Sufi.

Key words: Sufi, mysticism, philosophy, tasawwuf, irfan, fana, An-Najat, Al-Isharat wa-t-tanbihat.

Introduction. Ibn Sina was the encyclopedist and the spirit of early philosophy. Among his major works, "An-Najat", "The Book of Healing", "Al-Isharat wa-t-tanbihat", stand out as masterpieces. The text significantly played an instrumental role in the progress of Islamic philosophy and thought. Tasawwuf or Sufism, key metaphysical ideas and practices such as the soul and body relation, knowledge of God, and the suffering of the innocent, have a close similarity with the views of Ibn Sina. Tasawwuf is the Islamic teaching by which Muslims are urged to recognize the truth and serve it by the use of reason. The main focus of this paper will be Sina's metaphysical ideas, such as the soul and body relation. Besides this, the paper will also try to highlight the influence of Greek philosophers such as Plato and Aristotle on Ibn Sina's work.

Main part. The essence of truth according to the teaching of Tasawwuf is as follows: It is necessary to know about God, His existence, and His unity, His essence and His attributes. It will result in love and certainty. However, it should be noted that there is an intellectual manipulation which is based on Greek philosopher Plato's idea

of the soul. Throughout life, according to Plato, the soul can be polluted by the sufferings of the body and knowledge can be gained through purification. Such knowledge, when we have it, is the knowledge of an eternal and changeless state. Events or actions will be taken by concern and mind for the knowledge. This knowledge is called wisdom. By knowing at the same time, you will understand the underlying essences of that knowledge. For example, when you view a particular object, your mind will help you to have a perception of the object, that is the essence, which is not altering and that is what it is. Only the body or the visible surface of the e.g. the painting will change, not the principle of the knowledge. Such knowledge of reality is so called the knowledge of truth. And the soul, as a result, will enjoy an unalterable and eternal happiness. It has been suggested that the phrase "knowledge of truth" was translated wrongly from Arabic, in which it should mean the truth of knowledge, a close similarity to Ibn Sina's "knowledge by presence" as what we will discuss in this paper. In "knowledge by presence," such knowledge of a thing intrinsically, it fills the mind and that certainty does not require to put attention to the thing. As such, it is immediate. Only by reaching such a state, a further understanding of that intellectual and spiritual will take place.

Thinker in his metaphysical views outlined in the previous section, Ibn Sino's interpretation of Tasawwuf takes on a more coherent and nuanced form. Ibn Sino's interpretation of Sufism as a healing process for the soul and its importance is seen in his definition of existence and the first cause - God - and how these two causes can affect human souls. Ibn Sino, in his book "Divine Knowledge," describes the first existential cause that manifested the first intelligence that, in turn, through a soul, manifests the body. This has been interpreted as medical intervention for a successful soul healing progress in the different stages of Sufi practices. He explains his definition of existence through the concept of the first cause.

While the Aristotelian understanding suggests a world of separations and changes, Sino describes the metaphysical reality where everything comes from an immaterial and necessary being, a being that follows nothing else, a being that eternity is its attribute. Therefore, this definition of existence reinforces the Sufi concept of life being only an illusion and eternal life lies in "the true world." He also defines this world, the physical world where our souls are trapped, as a world which is not true existence and just a shadow of an existence, a world where depends on matters and life will cease once the matter are perished. These views have influenced the Sufi concepts of "fana," which means destroy ourselves in God and begin to live the real life. Moreover, both the soul and the body are bound by the matter in this world as Sino's interpretation of the relationship between soul and the body. Nevertheless, under Ibn Sino interpretation, humankind has a choice in which we do not have to listen to our body, the desire, which makes our soul go into corruption. In other words, people can choose to live life in the Sufi way, disconnect from the physical world, and begin to understand the truth of our own existence. Ibn Sino explains the importance of the second cause, human opinions or desire in our soul, and its medical intervention planning for our soul, which is the most important part in the Tasawwuf practices and Sufi scholars.

God is the first cause according to Ibn Sino, and he creates the eternal constant first energy that gives the human soul its life and the ability of the functions, and in turn, this energy is used to maintain the soul which connects the body and the soul as well as the spirit within the body. For Sino, God has the knowledge, the will, the power, and the life itself - the four attributes of the first cause, so as to heal our soul to connect us back to the live of the true world. Ibn Sino author 'Philosophical Theology' all discuss in some detail about how metaphysical views based on God and the above-mentioned opinions are interrelated to the soul's healing progress, which has become evidence that passions and life are eternal life in the first cause in his definition of existence. Such a period of time, when souls are reconnected to the first cause by leaving the body and going to the true world, is interpreted by Sufis as the crown of the Sufi practices - the speed of the soul's perfection after receiving the divine knowledge in the stage of 'fana'. These kinds of objective explanations on Sufi practices and the intimate connection between the practices and the soul's medical progress, from the first cause to the second cause in 'Divine Knowledge', strengthen the historical Sufi claims over centuries that Sufism is both knowledge and practices for a soul's healing and knowledge over God's work.

Ibn Sino's metaphysical views, it is clear that he has contributed much to the development of Islamic mysticism, particularly in the areas of spiritual purification and asceticism. One of the most significant ways in which his metaphysics impacted Tasawwuf lies in the sphere of "tazkiyah al-nafs" or the purgation of the soul. In his famous work, "The Canon of Medicine", Ibn Sino elaborated on the concept of "radical therapy", which was an approach to healing that not only addressed the body, but the soul of the patient as well. As previously mentioned, the practice of spiritual purification is central to Sufism. The term for spiritual purification is "tazkiya" or "tasfiya." The purpose of tasfiya is to eliminate the influence of the lower self or ego, allowing the spiritual heart, or "qalb," to awaken and become aware of the divine presence. According to the Sufi master and philosopher Ibn Juzayy, "purification of the lower self is achieved by eliminating blameworthy traits and adorning it with praiseworthy traits."

Ibn Sina was a Muslim polymath who is largely known for his philosophy and medicine. Also, he is a well-known figure in Tasawwuf literature. On the other hand, traditional Islamic scholars mostly criticized his approach to metaphysics and Sufism. One of the main criticisms against him has been his claim to prophecy. Because, according to Islam, the final of the prophets is Muhammad the Quran testify. So, for any Muslim thinker or spiritual guide cannot recognize himself as a prophet. However, in his famous work in metaphysics, "Al-Isharat", Ibn Sina argued that there is a hierarchical order for human beings as well as their intellects. And he stated that his special kind of intellectual capacity allowed him to reach the nature of the God even to its ultimate level. But classical scholars' point of view was different from that. In response to that kind of criticism, particularly in his other work, "An-Najat", he tried to have expressed his thoughts in an indirect way than the "Al-Isharat". However, another debate between him and the traditional scholars has been on free will. Because his understanding of the issue led to the determinism, which classical scholars did not hesitate to show their disapprovals and rejections. Also, some leading figures of the

first type of Sufism like 'Ibn Arabi' criticized Ibn Sino's approach to metaphysics. He argued that Ibn Sino tried to explain practice of Sufism as a kind of intellectual matter. On the other hand, he firmly stated that the essence of Sufism is to find the knowledge of God in a way depending on spiritual experiences and practicing. But it is clear that recent studies on Ibn Sino defended him by saying that as much as he respects to the classical elements and methods of Sufism, he also presented a new kind of Sufism that adopts to rigor of the mental practices. On this point, it is clear that his combination of metaphysics and Sufism had a profound impact on both fields for the centuries. Notably, he was revered not only by the eastern philosophical society but also by medieval western scholars, as of which his name turned into Latinized form, "Avicenna".

Conclusion. In conclusion, it is evident that the metaphysical views of Ibn Sina as discussed in this essay have far-reaching implications in the field of Tasawwuf. His ontological and cosmological ideas are evident in the contemporaneous philosophy and mysticism, and have continued to shape the spiritual practices and theoretical discussions in these fields for centuries. It is notable that despite being a scientist and a physician, Ibn Sina seems to embrace mysticism in a wider perspective. However, as reflected in this article he maintained a critical approach in understanding the ways in which theoretical claims in metaphysics friends with the practices found in the mysticism of his days. As a result, nowadays Tasawwuf is understood within the wider landscape of the philosophy, and it depends solely on the metaphysical aspects of scholars like Ibn Sina who have greatly shaped the nature of mysticism. Also, based on his findings, it would be inaccurate to conclude that metaphysics and mysticism are two friendless entities in the field. But rather, he opined that once the inner meaning of the metaphysical claims has been discovered, then the methods that are found in metaphysics, logic and in the mysticism practices become wholly different. This clearly indicates that metaphysics and spiritual practices have indeed indulged in an unbreakable bond over the years, and understanding the metaphysical ground of the practices in mysticism is what brings then closeness between the two and it is what that brings about the relevant criticism and harmony. His idea of different levels of existence, which influences the Sufis to emphasize the divine love rather than the divine knowledge, greatly impacts the teachings of the Sufis and the ways in which they relate to God. His thoughts of rationality and belief, possibility and necessity as well as the human perfection provide the theoretical framework of the ways in which the teachings, recitations, hymns, and the group rituals are instructed and performed in the Sufi practices.

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UDK:371.13-340.11

LEGAL CONDUCT AND LEGAL WILL

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Annotatsiya: Ushbu maqolada, huquq fenomenining subyektiv voqelik ekani unga taalluqli bo'lgan voqeliklarni ham subyektiv tahlil qilish imkonini berishi va huquqiy ong, huquqiy bilim, huquqiy tafakkur, huquqiy dunyoqarash kabi subyektiv voqeliklar huquqiy iroda (aslida obyektiv voqelik yoki huquqning subyektiv tomonlarini inson xatti-harakatlari va faoliyatida obyektivlashgani, dolzarblashgani)ni ham subyektiv voqeliklardan biri sifatida qarashga undash kabi masalalar tahlil etiladi.

Kalit so'zlar: Huquqiy iroda, obyektiv, pragmatik xususiyat, huquq fenomeni, sivilizatsion taraqqiyot, huquqiy ong, huquqiy bilim, huquqiy tafakkur, huquqiy dunyoqarash, obyektiv voqelik.

Аннотация: В данной статье тот факт, что феномен права является субъективной реальностью, позволяет провести субъективный анализ реалий, которые к нему относятся, и таких субъективных реалий, как правосознание, правознание, правомышление, юридическое мировоззрение, правовая воля (фактически, объективная реальность или субъективные аспекты права - это действия человека, и анализируются такие вопросы, как поощрение смотреть на субъективную реальность как на одну из субъективных реальностей.

Ключевые слова: Правовая воля, цель, прагматический признак, правовое явление, цивилизационное развитие, правосознание, правовое знание, правопонимание, правовое мировоззрение, объективная реальность.

Abstract: In this article, the fact that the phenomenon of law is a subjective reality allows a subjective analysis of the realities that apply to it, and subjective realities such as legal consciousness, legal knowledge, legal thinking, legal worldview, legal will (in fact, the objective reality or the subjective aspects of law are human

actions and issues such as encouraging to look at the subjective reality as one of the subjective realities are analyzed.

Key words: Legal will, objective, pragmatic feature, legal phenomenon, civilizational development, legal consciousness, legal knowledge, legal thinking, legal outlook, objective reality.

Introduction. First of all, we should say that the concept of "legal will" used in the legal literature is often analyzed by a person's self-control, performing one or another behavior, especially actions related to criminalistics. A person without will cannot be the object of rights and punishment, such a person is mentally or physically ill. Legal problems related to human will and the processes of its expression often go back to the field of criminology. Therefore, concepts and realities such as "will and voluntarism", "will and freedom", "will and motivation", "will and regulation", "illegal will", "unwillingness" are analyzed in criminalistics and civil law, their legal aspects will be revealed. But we consider the will in the system of legal culture reality.

Main part. The phenomenon of law and the legal culture of society is reflected in real realities such as certain worldviews, actions, self-expression, social activities and fulfillment of duties of people. If the phenomenon of law, legal culture of society, legal consciousness, legal knowledge, legal worldview are considered subjective realities, then legal behavior is their expression in social existence and human activity. These two subjective and objective realities are combined in the legal behavior and legal will of people. Jurists do not argue about the question of which of them is primary, because for them legal behavior is the first priority. No one doubts the pragmatic aspect of jurisprudence, serving social and practical purposes, the very existence of a person in the socio-legal space determines his actions. Legal anthropology interprets the formation of a person's legal behavior as the most important aspect, the final result of all institutions related to the phenomenon of law. Yes, a person's legal behavior is an expression of a legal (legal) worldview, but it is also a manifestation of a person's will. From this point of view, the legal outlook and legal will should be understood as the foundations of behavior. It is one of the problems that are studied in philosophy and human actions, activities, relations to the world are considered as an expression of will. Therefore, at this point, we know that it is necessary to dwell on the topic of will, or rather, the reality of legal will, which, unfortunately, is not analyzed in legal literature.

Certain views and opinions about the reality of will have been expressed in philosophy since ancient times. For example, according to I. Kant, human aspirations are "actions of the will." If a person gives up his will for another, it means that he "subjugates his will to another will. If he keeps doing this, he will turn himself into a slave." I. Kant connects his ideas about will and freedom with civil society and the phenomenon of law, and emphasizes that relations between individuals, individuals and society are organized according to "moral imperatives", order and requirements. His views on the moral imperative are very close to the principles of legal behavior. However, the view of will as a separate reality, the meaning and essence of human actions and activities began with Arthur Schopenhauer's (1788-1860) great work "The World as Will and Imagination". Like all serious philosophical works, the book "The World of Will and Imagination" did not receive attention in its time, at least according to A. Schopenhauer. The philosopher accuses readers of honoring and glorifying

Hegel's "false, bad, and ultimately absurd and irrelevant" works. He complains that he did not pay enough attention to his book. The point is that Schopenhauer believes that a person's knowledge of the world requires a special will, which in a divine way prompts a person to run and run. In the philosopher's interpretation, work, activity or action "for its own sake" is the only tool necessary for society, development and finding the ideal. The type of activity "for its own sake", reality does not stand outside of social processes, solving the problems of existence, but makes them effective, useful and in accordance with the criteria and requirements of reality. Activity, work that cannot be "for oneself" is for no one and for nothing. It is unlikely to be effective in such conditions. The fact that free will is aimed at knowing, understanding and changing the world, without these actions it is difficult to perceive the power of will. Therefore, the awareness of the body as a priori, the reception, makes it necessary to also understand the aspirations that go back to the will. While thinking about the processes of objectification of will, Schopenhauer emphasizes that whatever the human body does, whatever it strives for is a reflection and result of its will. The act of the will and the movement of the body are not separate realities, they are related to each other. Body movement is nothing but the appearance and expression of will. "An act of the will is at the same time an act of the body itself." Legal will can be considered as a manifestation of these aspirations. Based on this premise, the legal will can be divided into the following forms:

to perceive body movement (human life, biological existence) as an objective need;

creating the necessary objective environment and mechanisms for body movement (health, psychophysiological development);

ensuring general human will (positive will).

resisting deviant behavior;

formation of national legal will.

The fact that the phenomenon of law is a subjective reality allows subjective analysis of the realities related to it. Subjective realities such as legal consciousness, legal knowledge, legal thinking, legal worldview encourage us to consider legal will (in fact, the objective reality or the objectification and actualization of the subjective aspects of law in human actions and activities) as one of the subjective realities. But this does not deny the primacy of the objective, pragmatic character of the legal will. Will, as A. Schopenhauer said, is a reflection of bodily behavior, and it is always considered a reality with an objective, pragmatic nature. Therefore, the directions given above allow us to consider the legal will as a subjective reality. Such an approach, in our opinion, is related to the connection of our research with philosophy of a subjective nature and allows us to know more clearly the scientific-philosophical aspects and immanent features of the legal will. Yes, we must admit that there is an effect of a speculative approach here, but this approach also allows us to fully understand the epistemological problems of the legal will.Perception of body movement as an objective expression of biological needs goes back to the understanding of human life, aliveness, and relationships with the world. A person is a living being. Its existence, its existence as a biological species, in legal terms, the supreme value of human life, is guaranteed by the state and society with certain socionorms and legal mechanisms. Life

is the most cherished value for legal realities and institutions, and it is a crime to encroach on a person's life while he is alive. Human life, which is at the center of the legal will, is an absolute value, it shows what anthropological goals the phenomenon of law serves. The person, from the point of view of legal anthropology, is the "eternal object" of the legal phenomenon or the subject of its constant research. The history of civilization is the history of connections, dialogues, even conflicts between the individual and the phenomenon of law and the processes related to their resolution. Human civilization is valued for its efforts to protect the life of an individual and his biological existence. Doctor of legal sciences, professor N.I. Novikov said that human life, its existence as a biological species is mainly provided by the phenomenon of law. At the same time, the phenomenon of law itself has improved and turned towards anthropology due to various and sometimes conflicting aspects of civilizational development and increasing responsibility of man to preserve biological life.

Conclusion. Today, the anthropology of the legal field is becoming a social reality, an expression of processes related to the development of humanitarian law and the increasing importance of ensuring human rights and freedoms. By the 21st century, human civilization has reached the level of self-destruction. The turbulent world today has turned danger into a global reality, and there are countless people predicting the third world war. The humanitarian rights and legal requirements that have been used until now are openly denied by some Western countries claiming hegemony, and it has become clear that liberal democratic values are a yellow card for them. In such a time of conflict, it is very difficult to preserve human life, to guarantee its survival as a biological species. Because, as the doctor of philosophy, professor V. Alimasov wrote, "war has already become an integral part of human life... It is difficult to stop the war with empty appeals and admonitions. The opposing party must be stronger, more powerful, even more evil than the aggressor.

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UDK: 1(09)

THE ROLE OF ALISHER NAVOI'S LEGACY IN THE SPIRITUAL REVIVAL OF THE UZBEK PEOPLE

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Annotatsiya. Ushbu maqola Alisher Navoiy ma'naviy merosining o'zbek xalqining ma'naviy tiklanishiga ta'siri tahliliga bag'ishlangan. Mutafakkir ma'naviy merosidagi yuksak g'oyalarning komil shaxs shakllanishi va yosh avlodning ma'naviy kamolotiga ta'siri ko'rsatilgan.

Kalit so'zlar: ma'naviy meros, o'zbek xalqi, ma'naviy tiklanish, Uyg'onish davri, insonparvarlik, komil shaxs

Аннотация. Данная статья посвящена анализу влияния духовного наследия Алишера Навои на духовное возрождение узбекского народа. Показано влияние высоких идеалов в духовном наследии мыслителя на формирование совершенной личности и духовный рост молодого поколения.

Ключевые слова: духовное наследие, узбекский народ, духовное возрождение, ренессанс, гуманизм, совершенная личность

Annotation. This article is devoted to the analysis of the influence of the spiritual heritage of Alisher Navoi on the spiritual revival of the Uzbek people. The influence of high ideals in the spiritual heritage of the thinker on the formation of a perfect personality and the spiritual growth of the younger generation is shown.

Key words: spiritual heritage, Uzbek people, spiritual revival, Renaissance, humanism, perfect personality

Introduction. The spiritual heritage of Alisher Navoi is the spiritual heritage of the entire human community. Today our people have entered a new stage of development, which is based on the principle "From national revival to national progress," through which the foundation is laid for the third Renaissance, where the spiritual heritage of Alisher Navoi is especially important. The spiritual heritage of Alisher Navoi is undoubtedly important for the further development of the Uzbek language, culture, and moral values of the Uzbek people. The legacy of Alisher Navoi absorbed all the best that was available in that era from the world treasury of culture. And therefore, by joining the great heritage of Alisher Navoi, we become involved in the great spiritual heritage of human civilization.

In his works, Alisher Navoi in every possible way promoted the ideas of a comprehensively developed personality, peace, progress, religious tolerance, which had to be formed in society for its further prosperity and progress.

Analysis of the relevant literature. Navoi saw social relations as the basis for economic growth and development. Navoi saw the basis of social order in the presence

of political institutions, institutions and the state, which were to be governed by worthy people. The thinker imagined society as a place of events, pointing out that no one can be outside society, independent of it. Navoi does not see a person outside the social environment, which, according to the thinker, shapes his character and habits. Moreover, in the process of socialization, a person, according to Navoi, is not free in his choice in the process of borrowing habits; he is strongly influenced by public opinion. The will of a person is drowned out by the general flow of social events, and the personal life of each person is an integral element of these events. The individual becomes drawn into the orbit of social interaction. Moreover, Navoi calls on a person to be together with society, to be useful to society:

“O man! Become a protection, a support for those around you,
Bring benefits to people, be blessed by the people” [7; 332].

Often an individual becomes blind and depends on the will, desires, goals, and behavior of other people. And sometimes people like thieves and drunkards reduce their actions to the detriment of themselves and the people around them, thereby not striving for useful deeds, reasonable good, which are necessary for human happiness:

“The torment of people is their only concern.
The prophet said about them: “Eradicate the evil ones!” [1,3]

Alisher Navoi believes that although a person is influenced by the social environment, he is still not a puppet, and he should not care what is happening around him. In his works, Navoi emphasizes the importance of the social environment, pointing out the need for human creative activity, the ability for active mental activity, and awareness of what is good and what is evil. According to Navoi, a real person should strive for the most noble deeds, protesting against violence and lawlessness.

Research methodology. In this study, such methods and means of scientific knowledge were used as analysis and synthesis, complex and systemic analysis, hermeneutic approach and existential method of knowledge, comparison of conceptual theories.

Analysis and discussion of results. The hero of Navoi Farhad is a man with a powerful mind, a desire for heroic deeds, and capable of creative work. Another hero with ideal character traits is Iskander, who also resists dark and destructive forces, giving people joy, turning deserts into gardens of Eden.

Through the images of Farhad and Iskander, Navoi wanted to show the powerful mind of man, his creative ability. Iskander, characterizing himself, pointed out that God endowed him with the ability to create everything, and his first step upon ascending the throne was to introduce into practice the rule of nationwide reception in order to study the needs of the people:

“By your will I accepted power and honor,
And I know that there are countless offended people.
But let anyone who is oppressed by the yoke
He will come to me for justice.
And an equal in me, and not a king,
Let everyone speak to me." [3; 32]

With these human traits, Navoi sought to instill in members of society a conscious attitude to the surrounding reality, to the events of social life, to the influence

of the social environment, calling for getting rid of vicious habits and preserving humanity in a person [6; 312].

From the above it follows that a person is not only susceptible to influence from the outside, but is also able to change the social environment around him and therefore he must be vigilant in order to be outside the influence of bad habits. And if the social environment does not meet the requirements of human life, then it is necessary to try to change the environment for the better, get rid of harmful rulers, and discipline them from harmful passions and habits. The social environment should be a source of a happy life and humanism. And since the era educates people, Navoi demands that people study, understand and use it well.

The progressive thoughts of Alisher Navoi were important; in many ways they anticipated the views of French enlightenment philosophers. Navoi attached great importance to human interests, thereby determining the development of society. In the poem “Farhad and Shirin” Navoi noted that human actions are not carried out without reason, which we see in the poem “The Wall of Iskandar”.

Navoi especially draws attention to the fact that people, for the sake of their own benefit, perform certain actions or activities, that is, they unite to satisfy their needs. And in these thoughts, Navoi is very close to the English thinker John Locke, who noted that the essence of the state is the interests of the people [5].

At the heart of the actions and behavioral attitudes of people, Navoi sees two determining factors, which are material interest and reason. Moreover, material interest stands above human rationality, regulating people’s actions. The exception in this case is learned people.

Navoi, in amazement at the statement of this fact, tries to explain the superiority of the material over the spiritual. And if reason stands higher than material interests, then a person, according to Navoi, will act in order to improve people’s lives. But if interest takes precedence over reason, then this leads to greed, greed, profit, and therefore a person must re-educate himself, directing his actions in a different direction. Having realized his mistakes, a person must necessarily reach repentance:

“He who has been endowed with grace from God at least once,
Even if he is once desecrated by an unworthy deed,
In the end he will understand the mistake and let him find amends for the sin
And again he will go along the road that he walked at first” [4; 48].

Analyzing various problems, facts, socially significant events, Alisher Navoi considered them from the standpoint of what moral benefits they bring to people and human upbringing. Dwelling on issues of moral education and training of children, he highlighted internal and external aspects. The first concerned the knowledge of the spiritual world, the elevation of one’s intellectual abilities, and the eradication of moral illnesses. Moreover, it was very important to take into account the natural properties of the human mind.

Alisher Navoi called on people to be generous, wise, strive to do good and good, and be patient with representatives of other religions. And an important place in the development of such qualities in people is occupied by the family, the power of the personal example of parents. And if the actions of parents are an example for a child, then for members of society the personal example of the ruler is important, through

whose rule justice should be carried out and the law in the country should be enforced. Navoi sees a person's self-esteem in combination with real harmony with soul and body. And this harmony is interconnected with social conditions, the ability of the ruler to implement the principles of justice in society. The spiritual heritage of Alisher Navoi comes from the active life position of a person who is one with God, but at the same time does not forget about socially useful work, the ideas of which are evidence of the deep impact on the entire work and life path of the thinker of the ideas of the Naqshbandiy order.

In general, the legacy of Alisher Navoi is designed to activate the social nature of man, which is aimed at making all members of society happy. In his works, Alisher Navoi promotes the active life position of a person in society, which is manifested in his choice of moral activity in social reality. Ethical standards are intended to become a determinant of human actions, requiring freedom from the individual in the implementation of ethical standards, which ultimately forms a person's ability for self-analysis and self-government. And that is precisely why moral and ethical principles involve setting requirements for a person, which encourages a person to take action, expand ethical opportunities and choices [11]. In general, the spiritual heritage of Alisher Navoi reflects such a great virtue as humanism, which is expressed in love not only for one's people, but for all humanity. Love for people is a special property of the human soul:

"Love is a diamond; and your hearts
The container is a box for it.
Call your heart the zodiac
When, like the sun, the light of love is bright..." [10].

The cornerstone of his philosophy is the education of a harmoniously developed personality who has such qualities as tolerance, friendship, good neighborly relations based on universal human values and high morality [7, 8]. In the preface to his "Arbain", Alisher Navoi emphasizes that the main purpose of writing this work was to familiarize the Turkic-speaking peoples with the poetic presentation of hadiths that were among the truthful. Moreover, the very first hadith as presented by Alisher Navoi states the golden rule of morality, which is that a true person should wish for his neighbor what he considers good for himself:

"But those to whom you bring good by loving,
They will always pray for you.
Your nickname: "The best of people,"
Justify him with your whole life.
The more benefit you bring to people,
The more benefit you will find in it" [9].

Through this statement, Alisher Navoi encourages people to be open to others, to be honest and prudent, tolerant and virtuous.

Conclusions and suggestions. Navoi, based on the requirements of Islam, calls on people to be pious and not harm their loved ones in word and deed. Navoi calls on people, and among them rulers, to ensure that they provide a decent life for their people, provide them with prosperity and a peaceful life [9]. Navoi instructs a person to be free from stinginess and vicious actions. Navoi compares a person with a stingy heart to a

world without light. The Thinker calls on people to be generous and from their generosity to give to those who are in need.

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