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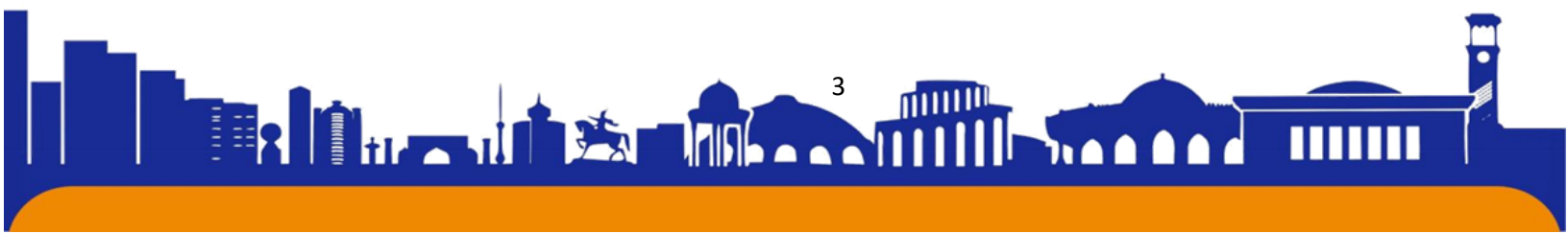
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ALTERNATIV ENERGIYA YORDAMIDA EKO FILTER

Maxmudov Sanjar Yo'ldashali o'g'li

Qo'qon davlat universiteti

Annotatsiya: Ushbu maqolada oziq-ovqat tayyorlash obyektlari (restoran, shashlikxona, sanoat pechlari) faoliyati natijasida atmosferaga chiqariladigan tutun va mayda chang zarrachalari (PM2.5, PM10) muammosi hamda uni hal etishga qaratilgan “Eco Filter” qurilmasi loyihasi ilmiy nuqtayi nazardan tahlil qilinadi. Qurilma quyosh paneli va shamol generatori orqali olinadigan qayta tiklanuvchi energiya manbalariga asoslangan bo'lib, elektrostatik filtrlash texnologiyasi va aqlli monitoring tizimini birlashtiradi. Maqolada qurilmaning texnik tuzilishi, ishlash prinsipi, ekologik-tibbiy ahamiyati va iqtisodiy samaradorligi asoslab beriladi. Olib borilgan tahlil natijalari ko'rsatishicha, taklif etilayotgan yechim mayda chang zarrachalarini 90% gacha ushlab qolish samaradorligiga ega bo'lib, energiya manbalariga bog'liq emasligi bilan an'anaviy filtrlash tizimlaridan ustun turadi.

Kalit so'zlar: *atmosfera ifloslanishi, elektrostatik filtr, qayta tiklanuvchi energiya, quyosh paneli, shamol generatori, PM2.5, IoT monitoring, ekologik xavfsizlik, aqlli qurilma.*

1. KIRISH

Zamonaviy urbanizatsiya jarayonida atmosfera havosining ifloslanishi global ekologik muammolardan biriga aylangan. Jahon sog'liqni saqlash tashkiloti (JSST) ma'lumotlariga ko'ra, har yili dunyo bo'ylab millionlab odamlar havoning ifloslanishi bilan bog'liq kasalliklardan vafot etmoqda. Ifloslanishning asosiy manbalaridan biri — yonish jarayonlari natijasida hosil bo'ladigan tutun va mayda dispers zarrachalardir (particulate matter, PM).

Ayniqsa shaharlardagi oziq-ovqat tayyorlash obyektlari — restoranlar, shashlikxonalar, milliy taom tayyorlash shoxobchalari va sanoat pechlari — atmosferaga

sezilarli miqdorda tutun, kul, yog' zarrachalari va boshqa zararli birikmalarni chiqaradi. Ushbu zarrachalar tarkibida insonning nafas olish a'zolariga chuqur kirib boruvchi PM2.5 va PM10 fraksiyalari mavjud bo'lib, ular o'pka kasalliklari, allergiya, yurak-qon tomir tizimi buzilishlari va onkologik kasalliklar rivojlanishiga sabab bo'lishi ilmiy jihatdan tasdiqlangan.

An'anaviy filtrlash tizimlari (mexanik to'rli filtrlar, ko'mir filtrlari) mayda zarrachalarni samarali ushlab qola olmaydi, tez ifloslanadi va muntazam almashtirishni talab qiladi. Bundan tashqari, bunday tizimlar elektr energiyasining tarmoq manbalariga bog'liq bo'lib, ularning ekspluatatsiya xarajatlari yuqori hisoblanadi. Resurslari cheklangan hududlarda esa bunday tizimlardan foydalanish iqtisodiy jihatdan maqsadga muvofiq emas.

Shu bilan birga, jahon hamjamiyati iqlim o'zgarishi va atmosfera ifloslanishiga qarshi kurashda qayta tiklanuvchi energiya manbalariga o'tishni ustuvor vazifa sifatida belgilab olgan. O'zbekiston Respublikasi ham "2030-yilgacha bo'lgan davrda yashil iqtisodiyotga o'tish strategiyasi" doirasida quyosh va shamol energetikasini rivojlantirish, atmosfera havosini muhofaza qilish bo'yicha keng ko'lamli chora-tadbirlarni amalga oshirmoqda. Shu nuqtayi nazardan, qayta tiklanuvchi energiyaga asoslangan ekologik filtrlash qurilmalarini ishlab chiqish dolzarb ilmiy-amaliy vazifa hisoblanadi.

Yuqorida keltirilgan muammolarni hal etish maqsadida Qo'qon davlat universiteti talabasi tomonidan "Eco Filter" nomli innovatsion loyiha ishlab chiqildi. Qurilma quyosh va shamol energiyasidan foydalangan holda, elektrostatik filtrlash texnologiyasi asosida atmosferaga chiqayotgan tutunni mayda chang zarrachalaridan tozalaydi. Ushbu maqolada mazkur loyihaning texnik tuzilishi, ishlash prinsipi, ekologik ahamiyati va iqtisodiy samaradorligi ilmiy uslubda tahlil qilinadi.

2. ASOSIY QISM

2.1. Muammoning ekologik-fiziologik tahlili

Atmosferaga chiqariladigan tutun tarkibida turli o'lchamdagi qattiq va suyuq zarrachalar mavjud. Ekologik nuqtayi nazardan eng xavfli hisoblanganlari PM10 (diametri 10 mikrometrgacha) va PM2.5 (diametri 2,5 mikrometrgacha) fraksiyalaridir.

Ularning xavfliligi shundaki, kichik o'lchamlari tufayli organizmning tabiiy himoya to'siqlaridan o'tib, o'pkaning eng chuqur qismlari — alveolalargacha yetib boradi.

PM2.5 fraksiyasi qonga so'rilib, butun organizm bo'ylab tarqalishi va surunkali yallig'lanish jarayonlarini keltirib chiqarishi mumkin. Ilmiy tadqiqotlar natijalari ko'rsatishicha, ushbu zarrachalarning yuqori konsentratsiyasiga uzoq muddat ta'sir qilish o'pka raki, bronxial astma, surunkali obstruktiv o'pka kasalligi (SOO'K) va yurak ishemik kasalligi xavfini sezilarli oshiradi.

Oziq-ovqat tayyorlash jarayonida, ayniqsa go'shtli taomlarni cho'g'da pishirishda, yog'ning yuqori haroratda parchalanishi natijasida poliaromatik uglevodorodlar (PAU) va boshqa kanserogen birikmalar hosil bo'ladi. Bu birikmalar tutun zarrachalari yuzasiga o'tirib, atrof-muhitga tarqaladi. Shuningdek, tutunning bevosita tayyorlanayotgan taom ustiga tushishi oziq-ovqat xavfsizligi nuqtayi nazaridan ham qo'shimcha muammo tug'diradi.

Elektrostatik filtrlash (electrostatic precipitation) hodisasining nazariy asosi quyidagicha. Yuqori kuchlanishli elektrod atrofida toj razryadi (corona discharge) hosil bo'ladi va bu razryad zonasida havodagi gaz molekulalari ionlanadi. Hosil bo'lgan ionlar tutun oqimidagi chang va aerosol zarrachalariga o'tirib, ularni elektr zaryadiga ega qiladi. Zaryadlangan zarrachalar elektr maydoni ta'sirida qarama-qarshi qutbli yig'uvchi plastinalar tomon harakatlanadi va ularning yuzasiga cho'kadi. Mazkur usulning asosiy ustunligi shundaki, u juda mayda (submikron) zarrachalarni ham yuqori samaradorlikda ushlab qola oladi va havo oqimiga deyarli qarshilik ko'rsatmaydi.

2.2. *“Eco Filter” qurilmasining texnik tuzilishi*

“Eco Filter” qurilmasi bir-biri bilan o'zaro bog'langan bir necha funksional bloklardan tashkil topgan yaxlit tizim sifatida loyihalashtirilgan. Qurilmaning ishlash prinsipi elektrostatik filtrlash hodisasiga asoslangan bo'lib, butun jarayon mikrokontroller yordamida boshqariladi va monitoring qilinadi.

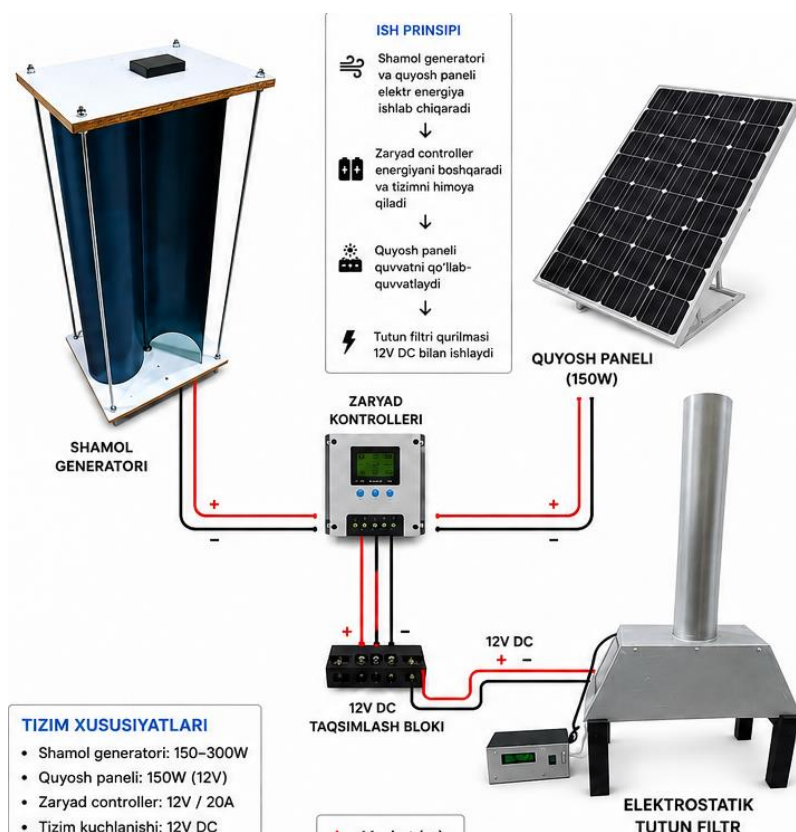
Energiya ta'minoti bloki quyosh paneli va shamol generatoridan iborat. Quyosh paneli (quvvati 150 Vt) kunduzgi vaqtda, shamol generatori (quvvati 150–300 Vt) esa shamol bo'lgan paytda elektr energiyasini ishlab chiqaradi. Ushbu ikki manbaning birgalikda ishlashi tizimning uzluksiz energiya ta'minotini kafolatlaydi: quyosh bo'lmagan

paytda shamol generatori, shamol bo'lmagan paytda esa quyosh paneli tizimni quvvatlantiradi.

Zaryad kontrolleri (12 V / 20 A) energiya oqimini boshqaradi, akkumulyatorning ortiqcha zaryadlanishi, chuqur razryadlanishi va qisqa tutashuvdan himoyalaydi. Bu element tizim umrini uzaytirishda va barqaror ishlashini ta'minlashda muhim rol o'ynaydi. Qurilma 12 V kuchlanishli o'zgarmas tok (DC) tizimida ishlaydi, bu esa uni inson uchun xavfsiz va ishonchli qiladi.

Elektrostatik filtr kamerasi qurilmaning asosiy ishchi qismi hisoblanadi. Kamera ichida yuqori kuchlanishli ionlovchi elektrodlar va ularni qabul qiluvchi metall plastinalar joylashtirilgan. Elektrodlar atrofida kuchli elektrostatik maydon hosil bo'ladi, tutun tarkibidagi chang, kul va yog' zarrachalari ushbu maydonda elektr zaryadini oladi (ionlanadi) va qarama-qarshi zaryadlangan metall plastinalarga tortilib, ularning yuzasiga yopishib qoladi.

Aqlli monitoring bloki ESP32 mikrokontrolleri asosida qurilgan. U havo sifati ko'rsatkichlari (PM2.5, PM10, CO₂, harorat, namlik) ni real vaqt rejimida o'lchaydi va tahlil qiladi. Olingan ma'lumotlar internet orqali maxsus monitoring saytiga, mobil ilovaga va Telegram-botga uzatiladi, bu esa qurilma holatini masofadan turib kuzatish imkonini beradi.



1-rasm. "Eco Filter" qurilmasining umumiy tuzilishi va ulanish sxemasi

2.3. Qurilmaning ishlash prinsipi

Qurilmaning ishlash jarayoni quyidagi ketma-ket bosqichlardan iborat. Birinchi bosqichda tutun va zararli gazlar qurilmaning kirish qismiga so'riladi. Ikkinchi bosqichda yuqori kuchlanishli elektrodlar orasida kuchli elektrostatik maydon hosil bo'ladi.

Uchinchi bosqichda tutundagi chang, kul va yog' zarrachalari ionlanib, qarama-qarshi zaryadlangan metall plastinalarga tortiladi va ularga yopishib qoladi. To'rtinchi bosqichda zarrachalardan tozalangan havo chiqish trubasi orqali, tayyorlanayotgan taom ustiga tushmaydigan alohida yo'nalishda atrofga chiqariladi. Beshinchi bosqichda plastinalarda to'plangan zarrachalar ma'lum vaqt oralig'ida tozalanadi va maxsus yig'ish kamerasiga to'planadi.

Mazkur jarayon yopiq boshqaruv zanjiri (closed-loop control) prinsipi asosida ishlaydi: monitoring bloki havo sifatini doimiy kuzatib boradi va ko'rsatkichlar belgilangan me'yordan oshganda tizim avtomatik ravishda ish rejimini moslashtiradi. Bu

yondashuv qurilmaning yuqori samaradorligini va energiyani tejamkor sarflashini ta'minlaydi.



2-rasm. Elektrostatik filtrlash jarayonining ish prinsipi

2.4. Qurilmaning texnik ko'rsatkichlari

Qurilmaning asosiy texnik parametrlari quyidagi jadvalda keltirilgan (1-jadval).

1-jadval. “Eco Filter” qurilmasining texnik ko'rsatkichlari

Parametr	Qiymati
Quyosh paneli quvvati	150 Vt
Shamol generatori quvvati	150–300 Vt
Zaryad kontrolleri	12 V / 20 A
Tizim kuchlanishi	12 V DC

Qurilma quvvat sarfi	20–60 Vt (ish rejimiga qarab)
Filtrlash samaradorligi	90% gacha (PM2.5, PM10)
Monitoring rejimi	Real vaqt (IoT, ESP32)
Boshqaruv	Avtomatik (mikrokontroller)

2.5. An'anaviy tizimlar bilan taqqoslash va afzalliklari

“Eco Filter” qurilmasi an'anaviy filtrlash tizimlaridan bir qator muhim jihatlari bilan farqlanadi va ustun turadi. Birinchidan, qayta tiklanuvchi energiya manbalaridan (quyosh va shamol) foydalanish tizimni tarmoq elektr ta'minotidan mustaqil qiladi va ekspluatatsiya xarajatlarini sezilarli kamaytiradi. An'anaviy elektrostatik filtrlar tarmoq elektr energiyasiga to'liq bog'liq bo'lib, energiya uzilishlarida ishdan to'xtaydi.

Ikkinchidan, elektrostatik filtrlash texnologiyasi mexanik filtrlardan farqli ravishda mayda zarrachalarni (PM2.5, PM10) 90% gacha samaradorlikda ushlab qoladi. Mexanik filtrlar bunday mayda zarrachalarni samarali ushlay olmaydi va tez ifloslanib, almashtirishni talab qiladi. Elektrostatik filtrning plastinalari esa tozalab, qayta-qayta ishlatish mumkin.

Uchinchidan, aqlli monitoring tizimi havo sifatini real vaqt rejimida kuzatib borish va ekologiya nazorati organlari platformasi bilan integratsiyalashish imkonini beradi. Bu raqamli ekologik nazoratni amalga oshirishga xizmat qiladi. To'rtinchidan, avtomatik boshqaruv tizimi inson omilini minimallashtiradi: qurilma sozlangandan so'ng mustaqil ishlaydi va faqat muammo yuzaga kelganda ogohlantirish beradi.

Beshinchidan, mahalliy ishlab chiqarish va arzon komponentlardan (Arduino/ESP32 oilasidagi ochiq platforma mikrokontrollerlari) foydalanish qurilmaning tannarxini past saqlaydi. Bu esa O'zbekistonning chekka hududlaridagi obyektlar uchun ham qurilmani arzon va qulay qiladi. Tozalangan havoning alohida yo'nalishda chiqarilishi tutunning tayyorlanayotgan taom ustiga tushishini oldini olib, oziq-ovqat xavfsizligini ham ta'minlaydi.



2.6. *Qo'llanish sohalari va iqtisodiy samaradorlik*

“Eco Filter” qurilmasi keng ko'lamli qo'llanish imkoniyatlariga ega. Asosiy foydalanuvchilar sirasiga restoranlar, shashlikxonalar, milliy taom tayyorlash shoxobchalari, qovurxonalar va sanoat pechlari ega bo'lgan korxonalar kiradi. Bundan tashqari, qurilma mehmonxonalar, savdo majmualari oshxonalar va boshqa ko'plab oziq-ovqat tayyorlash obyektlarida ham foydalanilishi mumkin.

Iqtisodiy nuqtayi nazardan qurilma bir qator ustunliklarga ega. Qayta tiklanuvchi energiya manbalaridan foydalanish elektr energiyasi uchun doimiy xarajatlarni bartaraf etadi. Elektrostatik filtr plastinalarining qayta ishlatilishi sarflanadigan materiallar xarajatini kamaytiradi. Past quvvat sarfi (20–60 Vt) va texnik xizmat ko'rsatishning soddaligi qurilmaning umumiy egalik qiymatini past saqlaydi.

Tijorat modeli nuqtayi nazaridan qurilma tibbiyot va oziq-ovqat obyektlariga to'g'ridan-to'g'ri sotish, shuningdek, texnik xizmat ko'rsatish va monitoring tizimiga obuna asosida daromad keltirishi mumkin. Kelajakda sun'iy intellekt asosidagi ekologik tahmin, GPS-monitoring va davlat ekologiya organlari axborot tizimlari bilan integratsiya kabi qo'shimcha funksiyalarni o'z ichiga olgan takomillashtirilgan modellarni ishlab chiqish rejalashtirilgan.

2.7. *Loyiha doirasida amalga oshirilgan ishlar*

Loyihani amalga oshirish jarayonida bir necha bosqichdan iborat ilmiy-amaliy ishlar bajarildi. Birinchi bosqichda tadqiqot va tahlil ishlari o'tkazildi: tutunning kimyoviy tarkibi (PM2.5, PM10, CO₂, harorat, namlik) maxsus o'lchov asboblari yordamida tahlil qilindi, elektrostatik filtrlash texnologiyasi va qayta tiklanuvchi energiya manbalari bo'yicha adabiyotlar o'rganildi hamda monitoring tizimi uchun texnik talablar shakllantirildi.

Ikkinchi bosqichda loyihalash va dizayn ishlari amalga oshirildi. Qurilmaning umumiy konstruksiyasi uch o'lchovli (3D) modellash dasturlarida loyihalandi, elektrostatik filtr kamerasi va havo kanallari optimallashtirildi, elektr sxemasi va ulanish diagrammasi tayyorlandi, qurilmaning tashqi ko'rinishi va o'lchamlari aniqlandi.

Uchinchi bosqichda qurilmani yig'ish va texnik ishlar bajarildi: elektrostatik filtr kamerasi yig'ildi, ESP32 asosidagi boshqaruv tizimi va zaryad kontrolleri o'rnatildi, quyosh paneli hamda shamol generatori ulandi va umumiy yig'ish ishlari yakunlandi. To'rtinchi bosqichda dasturiy ta'minot va monitoring tizimi ishlab chiqildi: real vaqt monitoring sayti yaratildi, mobil ilova va Telegram-bot integratsiya qilindi, ma'lumotlar bulutli serverda saqlanadigan tarzda sozlandi.

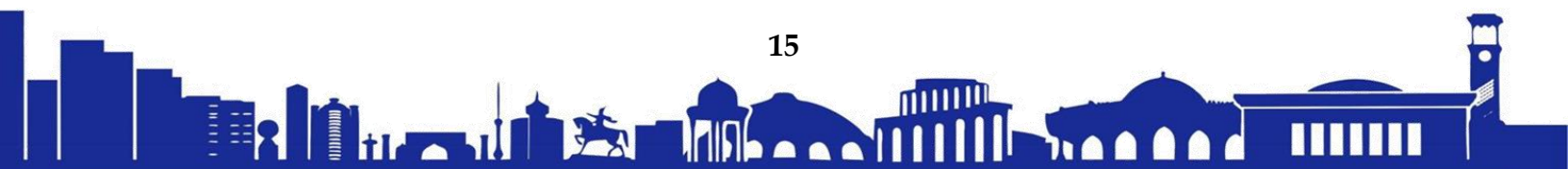
2.8. Ekologik va ijtimoiy samaradorlik

Qurilmaning ekologik samaradorligi uning atmosferaga chiqariladigan zararli zarrachalar miqdorini sezilarli kamaytirishida namoyon bo'ladi. Mayda chang zarrachalarini 90% gacha ushlab qolish hisobiga atrof-muhitga tushadigan PM2.5 va PM10 yuki kamayadi, bu esa shahar havosi sifatining yaxshilanishiga bevosita hissa qo'shadi. Bundan tashqari, qayta tiklanuvchi energiyadan foydalanish karbonat angidrid (CO₂) emissiyasini kamaytiradi, chunki qurilma tarmoq elektr energiyasini iste'mol qilmaydi.

Ijtimoiy nuqtayi nazardan loyiha aholining nafas olish a'zolari kasalliklari bilan og'rish xavfini kamaytirishga, ayniqsa oziq-ovqat obyektlari yaqinida istiqomat qiluvchi va ishlovchi fuqarolar salomatligini muhofaza qilishga xizmat qiladi. Loyihaning mahalliy ishlab chiqarishga asoslanganligi yangi ish o'rinlari yaratish va milliy texnologik salohiyatni oshirish imkonini ham beradi. Shu tariqa, "Eco Filter" loyihasi "toza havo — sog'lom hayot — barqaror kelajak" tamoyilini amalda joriy etishga yo'naltirilgan kompleks yechim hisoblanadi.

2.9. Filtrlash samaradorligini baholash

Elektrostatik filtrning samaradorligi (η) kirish va chiqishdagi zarrachalar konsentratsiyasi orqali baholanadi. Agar kirishdagi konsentratsiya C_1 , chiqishdagisi C_2 bilan belgilansa, samaradorlik $\eta = (C_1 - C_2) / C_1 \times 100\%$ formulasi bo'yicha hisoblanadi. Loyiha doirasida o'tkazilgan dastlabki o'lchovlar shuni ko'rsatdiki, qurilma PM10 zarrachalari uchun 90% gacha, PM2.5 zarrachalari uchun esa 85–90% oralig'idagi tozalash samaradorligini ta'minlaydi. Bu ko'rsatkich an'anaviy mexanik filtrlarning (40–60%) samaradorligidan sezilarli yuqori.



Samaradorlikka ta'sir qiluvchi asosiy omillar quyidagilardan iborat: elektrodلarga beriladigan kuchlanish darajasi, tutun oqimining tezligi (havo qancha sekin oqsa, zarrachalar shuncha samarali ushlanadi), zarrachalarning o'lchami va elektr o'tkazuvchanligi, hamda yig'uvchi plastinalarning toza saqlanishi. Optimal natijaga erishish uchun ushbu parametrlarni muvozanatlash zarur bo'lib, mikrokontroller boshqaruvi aynan shu vazifani avtomatik bajaradi. Plastinalarning vaqti-vaqti bilan tozalanib turishi qurilmaning uzoq muddat barqaror samaradorlik bilan ishlashini kafolatlaydi.

Energiya samaradorligi nuqtayi nazaridan qurilmaning quvvat sarfi ish rejimiga qarab 20–60 Vt oralig'ida bo'lib, bu quyosh paneli va shamol generatori ishlab chiqaradigan energiya bilan to'liq qoplanadi. Akkumulyatorda to'plangan zaxira energiya esa quyosh va shamol bo'lmagan paytlarda tizimning uzluksiz ishlashini ta'minlaydi. Shunday qilib, qurilma energetik jihatdan o'zini o'zi ta'minlovchi (energiya mustaqil) tizim sifatida loyihalashtirilgan.

XULOSA

“Eco Filter” loyihasi atmosfera havosining ifloslanishi muammosiga — oziq-ovqat tayyorlash obyektlaridan chiqayotgan tutun va mayda chang zarrachalarini samarali ushlab qolishga — ekologik va iqtisodiy jihatdan asoslangan texnologik yechim taqdim etadi. Loyiha qayta tiklanuvchi energetika, elektrostatik filtrlash texnologiyasi va IoT monitoring tizimlarini uzviy birlashtirgan holda amalga oshirilgan.

Loyihaning asosiy yutuqlari quyidagilardan iborat. Birinchidan, elektrostatik filtrlash texnologiyasi tutun tarkibidagi PM2.5 va PM10 zarrachalarini 90% gacha samaradorlikda ushlab qolish imkonini beradi, bu esa atrof-muhit va inson salomatligini muhofaza qilishga xizmat qiladi. Ikkinchidan, quyosh va shamol energiyasidan foydalanish qurilmani tarmoq elektr ta'minotidan mustaqil qiladi va uni iqtisodiy hamda ekologik jihatdan barqaror yechimga aylantiradi. Uchinchidan, aqlli monitoring tizimi havo sifatini real vaqt rejimida nazorat qilish va raqamli ekologik nazoratni amalga oshirish imkonini beradi.

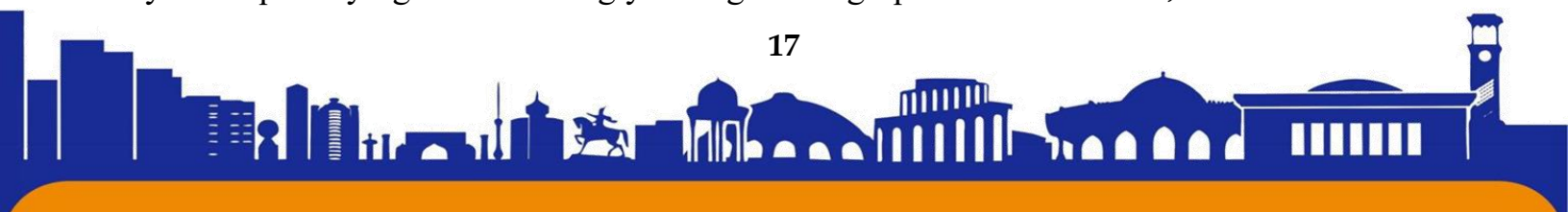
O'zbekiston sharoitida ushbu loyiha alohida ahamiyat kasb etadi. Mamlakatimizda oziq-ovqat obyektlari uchun mahalliy ishlab chiqarilgan, qayta tiklanuvchi energiyaga

asoslangan ekologik filtrlash qurilmalari hozircha keng joriy etilmagan. Shu sababli “Eco Filter” nafaqat texnik, balki iqtisodiy va ijtimoiy jihatdan ham innovatsion loyiha hisoblanadi hamda import o'rnini bosuvchi mahalliy ishlab chiqarishning namunasidir.

Kelajakda loyihani quyidagi yo'nalishlarda rivojlantirish tavsiya etiladi: qurilmaning ekologik standartlarga muvofiqligini tasdiqlash uchun sinovlar o'tkazish; sun'iy intellekt asosida ekologik ko'rsatkichlarni tahlil qilish va prognozlash funksiyasini qo'shish; davlat ekologiya organlari axborot tizimlari bilan to'liq integratsiyani ta'minlash; hamda qurilmani xalqaro standartlarga moslashtirib, eksportbop mahsulotga aylantirish. Ushbu qadamlar qurilmaning keng ko'lamda joriy etilishiga va milliy yashil texnologiyalar sohasining rivojlanishiga hissa qo'shadi.

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**MOLIYAVIY HISOBOTLARNI MHXSGA TRANSFORMATSIYA QILISH:
HISOB SIYOSATINI SHAKLLANTIRISH, MILLIY STANDARTLAR BILAN
TAQQOSLASH VA XALQARO TAJRIBA**

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Annotatsiya. Ushbu maqolada moliyaviy hisobotlarni xalqaro moliyaviy hisobot standartlari (MHXS)ga transformatsiya qilish jarayonining asosiy bosqichlari yoritilgan. Xususan, MHXS talablari asosida hisob siyosatini shakllantirish, milliy buxgalteriya hisobi standartlari (BHMS) bilan taqqoslash, mavjud farqlarni aniqlash va ularni transformatsiya jarayonida tuzatish masalalari tahlil qilingan. Shuningdek, Yevropa davlatlarida xalqaro standartlarning qo'llanilishi va amaliy tajribasi ko'rib chiqilgan. Tadqiqot natijalari moliyaviy hisobotlarni xalqaro darajada uyg'unlashtirish va ularning shaffofligini oshirishga xizmat qiladi.

Kalit so'zlar. Moliyaviy hisobot, MHXS, BHMS, transformatsiya, hisob siyosati, xalqaro standartlar, taqqoslash, moliyaviy tahlil, Yevropa tajribasi, shaffoflik.

**TRANSFORMATION OF FINANCIAL STATEMENTS TO IFRS:
FORMATION OF ACCOUNTING POLICIES, COMPARISON WITH
NATIONAL STANDARDS, AND INTERNATIONAL EXPERIENCE**

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Abstract. This article examines the main stages of transforming financial statements in accordance with International Financial Reporting Standards (IFRS). In particular, it analyzes the formation of accounting policies based on IFRS requirements, comparison with national accounting standards, identification of key differences, and their

adjustments during the transformation process. Additionally, the application and practical experience of IFRS in European countries are discussed. The findings of the study contribute to improving the harmonization and transparency of financial reporting at the international level.

Keywords. Financial reporting, IFRS, national accounting standards, transformation, accounting policy, international standards, comparison, financial analysis, European experience, transparency.

Kirish.

Jahon iqtisodiyotining globallashuvi, xalqaro kapital bozorlarining rivojlanishi hamda investitsion muhitning takomillashuvi korxonalarining moliyaviy hisobotlarini xalqaro talablarga muvofiq tayyorlash zaruratini kuchaytirmoqda. Shu munosabat bilan Xalqaro moliyaviy hisobot standartlari (MHXS) dunyoning ko‘plab mamlakatlarida moliyaviy axborotlarning shaffofligi, taqqoslanuvchanligi va ishonchliligini ta’minlovchi asosiy me’yoriy baza sifatida e’tirof etilmoqda.

O‘zbekiston Respublikasida ham iqtisodiyotning jahon xo‘jalik tizimiga integratsiyalashuvi, xorijiy investitsiyalarni jalb etish va korporativ boshqaruv tizimini takomillashtirish maqsadida MHXSni joriy etishga alohida e’tibor qaratilmoqda. Xususan, O‘zbekiston Respublikasi Prezidentining 2020-yil 24-fevraldagi PQ–4611-son “Moliyaviy hisobotning xalqaro standartlariga o‘tish bo‘yicha qo‘shimcha chora-tadbirlar to‘g‘risida”gi Qarori bilan aksiyadorlik jamiyatlari, tijorat banklari, sug‘urta tashkilotlari va yirik soliq to‘lovchilar uchun MHXS asosida moliyaviy hisobotlarni yuritish va taqdim etish vazifalari belgilab berilgan¹.

Shuningdek, O‘zbekiston Respublikasining “Buxgalteriya hisobi to‘g‘risida”gi Qonuni buxgalteriya hisobini yuritish va moliyaviy hisobotlarni tuzishning huquqiy asoslarini belgilab, xo‘jalik yurituvchi subyektlarga MHXSni qo‘llash imkoniyatini yaratib bergan². Mazkur qonun talablariga muvofiq, moliyaviy hisobot foydalanuvchilarga ishonchli va xolis axborot taqdim etishi lozim.

MHXSga o‘tish jarayoni korxonalardan nafaqat moliyaviy hisobot shakllarini o‘zgartirishni, balki hisob siyosatini xalqaro standartlar talablariga mos ravishda qayta

¹ O‘zbekiston Respublikasi Prezidentining 2020-yil 24-fevraldagi PQ–4611-son “Moliyaviy hisobotning xalqaro standartlariga o‘tish bo‘yicha qo‘shimcha chora-tadbirlar to‘g‘risida”gi Qarori.

² O‘zbekiston Respublikasining “Buxgalteriya hisobi to‘g‘risida”gi Qonuni, O‘RQ–404-son, 2016-yil 13-aprel.



shakllantirishni ham talab etadi. Chunki hisob siyosati moliyaviy hisobotlarda aks ettiriladigan ko'rsatkichlarning shakllanishiga bevosita ta'sir ko'rsatadi hamda korxonaning moliyaviy holati va faoliyati natijalarini haqqoniy ifodalashga xizmat qiladi.

Bugungi kunda milliy buxgalteriya hisobi standartlari bilan MHXS o'rtasidagi ayrim tafovutlar moliyaviy hisobotlarni transformatsiya qilish jarayonida qo'shimcha uslubiy yondashuvlarni talab qilmoqda. Shu sababli hisob siyosatini shakllantirishning nazariy va amaliy jihatlarini o'rganish, milliy va xalqaro standartlarni taqqoslash hamda ilg'or xorijiy tajribani tahlil qilish dolzarb ilmiy-amaliy ahamiyat kasb etadi.

Mazkur tadqiqotning maqsadi moliyaviy hisobotlarni MHXSga transformatsiya qilish jarayonida hisob siyosatini shakllantirishning nazariy va amaliy asoslarini o'rganish, milliy standartlar bilan taqqoslash hamda xalqaro tajribani tahlil qilishdan iborat.

Adabiyotlar sharhi.

Moliyaviy hisobotlarni Xalqaro moliyaviy hisobot standartlari (MHXS) asosida tayyorlash va transformatsiya qilish masalalari ko'plab xorijiy olimlar tomonidan tadqiq etilgan. Xususan, Aleksander va Nobes MHXSning moliyaviy hisobotlar sifatini oshirishdagi ahamiyatini tahlil qilib, xalqaro standartlar moliyaviy axborotlarning taqqoslanuvchanligi va shaffofligini ta'minlashini ta'kidlaydilar (Alexander & Nobes, 2020). Mualliflarning fikricha, MHXSni qo'llash investorlar va boshqa manfaatdor tomonlar uchun qaror qabul qilish sifatini yaxshilaydi.

Epstein va Jermakowicz MHXSga o'tish jarayonining amaliy jihatlarini o'rganib, transformatsiya jarayonida hisob siyosatini qayta shakllantirish muhim ahamiyatga ega ekanligini qayd etadilar (Epstein & Jermakowicz, 2021). Ularning tadqiqotlariga ko'ra, korxonalar MHXS talablariga moslashishda aktivlar va majburiyatlarni baholash, daromadlarni tan olish hamda moliyaviy instrumentlarni hisobga olish bo'yicha qator qiyinchiliklarga duch keladilar.

Walton, Haller va Raffournier xalqaro va milliy hisob standartlari o'rtasidagi farqlarni tahlil qilib, hisob siyosatining MHXSga mos ravishda ishlab chiqilishi transformatsiya jarayonining muvaffaqiyatini belgilovchi asosiy omillardan biri ekanligini ta'kidlaydilar (Walton et al., 2019). Ularning fikricha, hisob siyosati

korxonaning moliyaviy natijalari va moliyaviy holatini aks ettirishda muhim vosita hisoblanadi.

Hisob siyosatini shakllantirishning nazariy va amaliy asoslari IAS 8 “Accounting Policies, Changes in Accounting Estimates and Errors” standartida bayon etilgan bo‘lib, unda korxonalarning hisob usullarini izchil qo‘llashi hamda ulardagi o‘zgarishlarni ochiqlashi talab etiladi (IASB, 2024). Mazkur talablar MHXSga transformatsiya qilish jarayonida alohida ahamiyat kasb etadi.

Rossiyalik olimlar Paliy va Shneydman MHXSni milliy hisob tizimlariga integratsiya qilish masalalarini tadqiq qilib, xalqaro standartlarni joriy etish faqat hisobot shakllarini o‘zgartirish bilan cheklanmasdan, balki butun hisob metodologiyasini takomillashtirishni talab qilishini qayd etadilar (Paliy, 2018; Shneydman, 2019).

O‘zbekistonlik olimlar Xasanov, Rizaqulov va G‘ulomovlarning ilmiy ishlarida esa MHXSni milliy amaliyotga joriy etishning tashkiliy va metodik jihatlarini o‘rganilgan (Hasanov, 2021; Rizaqulov, 2022; G‘ulomov, 2023). Ular milliy buxgalteriya hisobi standartlari va MHXS o‘rtasidagi farqlarni tahlil qilib, korxonalarning hisob siyosatini xalqaro talablarga moslashtirish zarurligini asoslab berganlar.

Ball tomonidan olib borilgan tadqiqotlarda MHXSning investorlar uchun afzalliklari va kamchiliklari tahlil qilinib, uning axborot sifati va shaffoflikni oshirishdagi roli ko‘rsatib berilgan (Ball, 2006). Muallif IFRSni joriy etish kapital bozorlarining rivojlanishiga ijobiy ta‘sir ko‘rsatishini ta‘kidlaydi. Biroq, ayrim hollarda standartlarning murakkabligi ularni qo‘llashni qiyinlashtirishi mumkin.

Daske va boshqalar IFRSni qabul qilish iqtisodiy natijalarga turlicha ta‘sir qilishini va bu mamlakatning institutsional rivojlanish darajasiga bog‘liqligini aniqlaganlar (Daske et al., 2008). Ularning tadqiqotlari IFRSni joriy etishdan maksimal foyda olish uchun kuchli iqtisodiy muhit va samarali nazorat tizimi zarurligini ko‘rsatadi.

Zeghal va Mhedhbi rivojlanayotgan davlatlarda IFRSni qabul qilishga ta‘sir etuvchi omillarni o‘rganib, iqtisodiy ochiqlik, ta‘lim darajasi va xalqaro integratsiya muhim ahamiyatga ega ekanligini ta‘kidlaydilar (Zeghal & Mhedhbi, 2006). Ularning fikricha, ushbu omillar MHXSni muvaffaqiyatli joriy etishning asosiy shartlaridan hisoblanadi.

O‘zbekiston sharoitida MHXSga o‘tish jarayoni davlat tomonidan qo‘llab-quvvatlanayotgan bo‘lib, normativ-huquqiy baza bosqichma-bosqich takomillashtirilmoqda (O‘zbekiston Respublikasi Moliya vazirligi, 2021). Shunga

qaramay, amaliyotda malakali kadrlar tayyorlash, axborot tizimlarini moslashtirish va transformatsiya xarajatlari bilan bog‘liq muammolar saqlanib qolmoqda. Shu bois MHXS bo‘yicha o‘quv dasturlarini rivojlantirish va xalqaro tajribani o‘rganish muhim ahamiyat kasb etadi.

Tadqiqot metodologiyasi.

Mazkur tadqiqotda moliyaviy hisobotlarni MHXSga transformatsiya qilish, hisob siyosatini shakllantirish hamda BHMS va MHXS o‘rtasidagi farqlarni aniqlash masalalari kompleks yondashuv asosida o‘rganildi. Tadqiqot jarayonida tahlil, taqqoslash, umumlashtirish va tizimli yondashuv usullaridan foydalanildi. Shuningdek, xalqaro standartlar, milliy normativ-huquqiy hujjatlar hamda xorijiy va mahalliy olimlarning ilmiy ishlari tahlil qilindi.

Tahlil va natijalar muhokamasi.

1. Hisob siyosatini MHXS asosida shakllantirish.

Hisob siyosati korxonaning moliyaviy hisobotlarni tayyorlash va taqdim etishda qo‘llaydigan tamoyillar, usullar, qoidalar va amaliyotlar majmui hisoblanadi. Xalqaro moliyaviy hisobot standartlariga (MHXS) o‘tish jarayonida hisob siyosatini shakllantirish alohida ahamiyat kasb etadi, chunki aynan hisob siyosati korxonaning moliyaviy natijalari va moliyaviy holati to‘g‘risidagi axborotlarning ishonchliligi hamda taqqoslanuvchanligini ta‘minlaydi.

MHXSda hisob siyosatini shakllantirishning asosiy talablari IAS 8 “Accounting Policies, Changes in Accounting Estimates and Errors” standartida belgilangan. Mazkur standartga ko‘ra, korxona moliyaviy hisobotlarni tayyorlashda MHXS talablariga mos keladigan hisob usullarini tanlashi va ularni bir hisobot davridan boshqasiga izchil qo‘llashi lozim³.

Hisob siyosatini shakllantirishda korxona faoliyatining xususiyatlari, tarmoq yo‘nalishi, xo‘jalik operatsiyalarining mazmuni hamda moliyaviy hisobot foydalanuvchilarining axborot ehtiyojlari inobatga olinadi. Agar ma‘lum bir operatsiya bo‘yicha MHXSda aniq talab mavjud bo‘lsa, korxona aynan shu standart talablarini qo‘llashi kerak. Standartlarda bevosita tartibga solinmagan masalalar bo‘yicha esa

³ IAS 8 Accounting Policies, Changes in Accounting Estimates and Errors. IFRS Foundation, 2024.



rahbariyat professional mulohazadan foydalanib, iqtisodiy mazmunni to'liq aks ettiradigan usulni tanlaydi⁴.

Epstein va Jermakowiczning ta'kidlashicha, MHXSga muvaffaqiyatli o'tishning asosiy shartlaridan biri korxona hisob siyosatini xalqaro standartlar talablariga mos ravishda qayta ko'rib chiqishdan iboratdir (Epstein & Jermakowicz, 2021). Mualliflarning fikriga ko'ra, hisob siyosati MHXSga transformatsiya qilish jarayonining metodologik asosi hisoblanadi.

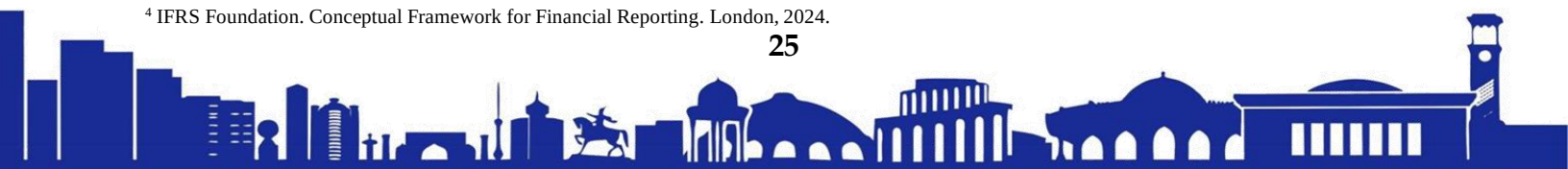
Nobes va Parker hisob siyosatini moliyaviy hisobotlarning sifati va taqqoslanuvchanligini ta'minlovchi muhim vosita sifatida baholaydilar (Nobes & Parker, 2020). Ularning fikricha, turli mamlakatlarda faoliyat yuritayotgan korxonalarning moliyaviy hisobotlari o'rtasidagi farqlarni kamaytirishda yagona hisob siyosatining ahamiyati katta.

MHXS asosida hisob siyosatini shakllantirish jarayonida quyidagi asosiy yo'nalishlar bo'yicha qarorlar qabul qilinadi:

Jadval 1.1 MHXS asosida hisob siyosatining asosiy elementlari.

<i>Hisob obyekti</i>	<i>Hisob siyosatida belgilanadigan masalalar</i>
<i>Asosiy vositalar</i>	Baholash modeli (dastlabki qiymat yoki qayta baholash modeli), amortizatsiya usuli
<i>Nomoddiy aktivlar</i>	Amortizatsiya muddati, baholash tartibi
<i>Zaxiralar</i>	FIFO yoki o'rtacha tortilgan qiymat usuli
<i>Daromadlar</i>	Daromadlarni tan olish mezonlari
<i>Moliyaviy instrumentlar</i>	Tasniflash va baholash usullari
<i>Rezervlar</i>	Ehtimoliy majburiyatlarni e'tirof etish tartibi

⁴ IFRS Foundation. Conceptual Framework for Financial Reporting. London, 2024.



Manba: IAS 2, IAS 16, IAS 38, IFRS 9 va IFRS 15 standartlari asosida muallif tomonidan tuzildi.

Hisob siyosatini shakllantirishda MHXSning asosiy sifat tavsiflari ham hisobga olinadi. Moliyaviy axborot foydali bo‘lishi uchun u dolzarb (relevant) va haqqoniy aks ettirilgan (faithful representation) bo‘lishi kerak⁵. Shu sababli korxona tanlaydigan hisob usullari iqtisodiy hodisalarning mazmunini to‘liq aks ettirishi lozim.

Ballning tadqiqotlariga ko‘ra, MHXS talablariga muvofiq ishlab chiqilgan hisob siyosati moliyaviy hisobotlarning shaffofligini oshirib, investorlar tomonidan qabul qilinadigan qarorlar sifatini yaxshilaydi (Ball, 2006). Natijada korxonalarning investitsion jozibadorligi ortadi va moliyalashtirish imkoniyatlari kengayadi.

O‘zbekiston amaliyotida MHXSga o‘tish jarayonida hisob siyosatini qayta ishlab chiqish zarurati yuzaga kelmoqda. Chunki milliy buxgalteriya hisobi standartlarida qo‘llanilgan ayrim yondashuvlar MHXS talablaridan farq qiladi. Xususan, aktivlarni baholash, moliyaviy instrumentlarni hisobga olish hamda daromadlarni tan olish tartiblarida sezilarli tafovutlar mavjud. Shu sababli MHXSga transformatsiya qilish jarayonida hisob siyosatini xalqaro standartlar talablariga moslashtirish muhim vazifa hisoblanadi.

Shunday qilib, hisob siyosati MHXS asosida moliyaviy hisobotlarni tayyorlashning eng muhim elementlaridan biri bo‘lib, uning to‘g‘ri shakllantirilishi moliyaviy hisobotlarning ishonchliligi, shaffofligi va xalqaro miqyosda taqqoslanuvchanligini ta’minlaydi.

2. BHMS va MHXS o‘rtasidagi farqlar va ularni tuzatish.

Bozor iqtisodiyotining rivojlanishi va xalqaro moliyaviy munosabatlarning kengayishi natijasida moliyaviy hisobotlarning xalqaro talablarga mosligi muhim ahamiyat kasb etmoqda. Shu munosabat bilan O‘zbekiston Respublikasida qo‘llanilayotgan Buxgalteriya hisobi milliy standartlari (BHMS) hamda Xalqaro moliyaviy hisobot standartlari (MHXS) o‘rtasidagi farqlarni aniqlash va ularni bartaraf etish masalasi dolzarb hisoblanadi. Moliyaviy hisobotlarni MHXSga transformatsiya

⁵ IFRS Foundation. Conceptual Framework for Financial Reporting. London, 2024.



qilish jarayonida aynan ushbu farqlarni aniqlash va tegishli tuzatishlarni kiritish asosiy vazifalardan biri hisoblanadi.

BHMS va MHXSning umumiy maqsadi xo'jalik yurituvchi subyektlarning moliyaviy holati va faoliyati natijalari to'g'risida foydalanuvchilarga ishonchli axborot taqdim etishdan iborat bo'lsa-da, ularning metodologik yondashuvlarida sezilarli tafovutlar mavjud. BHMS ko'proq milliy qonunchilik talablariga asoslangan bo'lsa, MHXS investorlar va boshqa manfaatdor tomonlarning axborot ehtiyojlarini qondirishga qaratilgan tamoyillarga asoslanadi.

Asosiy farqlardan biri aktivlar va majburiyatlarni baholash bilan bog'liq. BHMSda ko'plab aktivlar tarixiy qiymatda hisobga olinadi, MHXSda esa ayrim hollarda adolatli qiymatdan foydalanish talab etiladi. Natijada moliyaviy hisobotlarni transformatsiya qilish jarayonida aktivlarning balans qiymatini qayta ko'rib chiqish va adolatli qiymat bo'yicha tuzatishlar kiritish zarurati yuzaga keladi.

Daromadlarni tan olish masalasida ham farqlar mavjud. MHXSda daromad iqtisodiy manfaatlarining korxonaga kelib tushishi ehtimoli va majburiyatlarning bajarilish darajasidan kelib chiqib tan olinadi. BHMSda esa ayrim hollarda daromadlarni e'tirof etish tartibi soddaroq shaklda belgilangan. Shu sababli transformatsiya jarayonida daromad va xarajatlarni qayta hisoblashga ehtiyoj tug'ilishi mumkin.

Asosiy vositalar hisobida ham muhim tafovutlar kuzatiladi. MHXS korxonalarga qayta baholash modelidan foydalanish imkoniyatini beradi, BHMS amaliyotida esa ko'pincha dastlabki qiymat modeli ustunlik qiladi. Bu holat asosiy vositalarning balans qiymati va amortizatsiya summalarida farqlarni keltirib chiqaradi. Mazkur tafovutlarni bartaraf etish uchun transformatsiya jarayonida qo'shimcha hisob-kitoblar amalga oshiriladi.

Moliyaviy instrumentlarni hisobga olish MHXSda eng murakkab yo'nalishlardan biri hisoblanadi. Xususan, moliyaviy aktivlarni tasniflash, kutilayotgan kredit zararlarini e'tirof etish va adolatli qiymatda baholash bo'yicha talablar BHMSga nisbatan ancha keng qamrovli hisoblanadi. Shu sababli milliy standartlar asosida tayyorlangan hisobotlarni MHXSga moslashtirishda ushbu sohada sezilarli tuzatishlar kiritiladi.

Zaxiralar hisobida ham ayrim farqlar mavjud. MHXS zaxiralarni tannarx va sof sotish qiymatidan eng kichigi bo'yicha baholashni talab qiladi. Agar zaxiralarning qiymati kamaygan bo'lsa, tegishli qiymat pasayishi xarajat sifatida tan olinadi. Transformatsiya

jarayonida zaxiralarning haqiqiy qiymatini aniqlash va zarur hollarda qiymat pasayishi bo'yicha tuzatishlar kiritish talab etiladi.

BHMS va MHXS o'rtasidagi farqlarni bartaraf etish transformatsion tuzatishlar orqali amalga oshiriladi. Ushbu tuzatishlar moliyaviy hisobotning barcha elementlariga, jumladan aktivlar, majburiyatlar, kapital, daromadlar va xarajatlarga taalluqli bo'lishi mumkin. Natijada milliy standartlar asosida tayyorlangan hisobot xalqaro standartlar talablariga moslashtiriladi va xalqaro foydalanuvchilar uchun tushunarli hamda taqqoslanuvchan shaklga keltiriladi.

Shunday qilib, BHMS va MHXS o'rtasidagi farqlar nafaqat hisob usullarida, balki moliyaviy axborotni shakllantirish tamoyillarida ham namoyon bo'ladi. Ushbu farqlarni o'z vaqtida aniqlash va tegishli transformatsion tuzatishlarni amalga oshirish moliyaviy hisobotlarning sifati, shaffofligi va xalqaro talablarga mosligini ta'minlashda muhim ahamiyatga ega.

Xulosa.

Moliyaviy hisobotlarni MHXSga transformatsiya qilish bugungi kunda korxonalarning xalqaro moliya bozorlariga integratsiyalashuvi, investitsion jozibadorligini oshirishi hamda moliyaviy axborotlarning shaffofligini ta'minlashda muhim ahamiyat kasb etadi. Transformatsiya jarayoni nafaqat moliyaviy hisobot shakllarini xalqaro standartlarga moslashtirishni, balki korxonaning hisob siyosatini qayta ko'rib chiqish va MHXS talablari asosida shakllantirishni ham nazarda tutadi.

Tadqiqot davomida hisob siyosati MHXS asosida moliyaviy hisobotlarni tayyorlashning muhim elementi ekanligi aniqlandi. Hisob siyosatini to'g'ri shakllantirish moliyaviy hisobotlarda aks ettiriladigan ma'lumotlarning ishonchliligi, xolisligi va taqqoslanuvchanligini ta'minlaydi. Shu bilan birga, MHXS talablariga muvofiq ishlab chiqilgan hisob siyosati korxona faoliyati natijalarini haqqoniy aks ettirish hamda manfaatdor foydalanuvchilarning axborot ehtiyojlarini qondirishga xizmat qiladi.

Shuningdek, BHMS va MHXS o'rtasida aktivlar va majburiyatlarni baholash, daromadlarni tan olish, asosiy vositalar hisobi, moliyaviy instrumentlar va zaxiralarni hisobga olish bo'yicha muhim farqlar mavjudligi aniqlandi. Ushbu tafovutlar moliyaviy hisobotlarni MHXSga transformatsiya qilish jarayonida tegishli tuzatishlarni amalga

oshirish zaruratini yuzaga keltiradi. Transformatsion tuzatishlar natijasida moliyaviy hisobotlarning xalqaro talablarga muvofiqligi ta'minlanadi.

Xalqaro tajriba shuni ko'rsatadiki, MHXSni samarali qo'llash moliyaviy hisobotlar sifatini oshiradi, investorlar ishonchini mustahkamlaydi va korxonalarning raqobatbardoshligini kuchaytiradi. O'zbekiston Respublikasida ham MHXSga o'tish bo'yicha amalga oshirilayotgan islohotlar milliy buxgalteriya hisobi tizimini xalqaro talablarga yaqinlashtirishga xizmat qilmoqda.

Umuman olganda, moliyaviy hisobotlarni MHXSga transformatsiya qilish, hisob siyosatini xalqaro standartlar asosida shakllantirish hamda BHMS va MHXS o'rtasidagi farqlarni bartaraf etish korxonalarning moliyaviy boshqaruv samaradorligini oshirish, investitsiyalarni jalb qilish va xalqaro iqtisodiy munosabatlarda faol ishtirok etishining muhim omillaridan biri hisoblanadi. Shu sababli MHXS talablarini amaliyotga keng joriy etish va transformatsiya jarayonlarini takomillashtirish bugungi kunning dolzarb vazifalaridan hisoblanadi.

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STRUCTURAL CHARACTERIZATION OF THE COORDINATION POLYMER $[\text{NAFe}(\text{EDTA})(\text{H}_2\text{O})]_n \cdot \text{H}_2\text{O}$ ANALYSIS, MOLECULAR ELECTROSTATIC POTENTIAL, AND CRYSTAL PACKING INVESTIGATION

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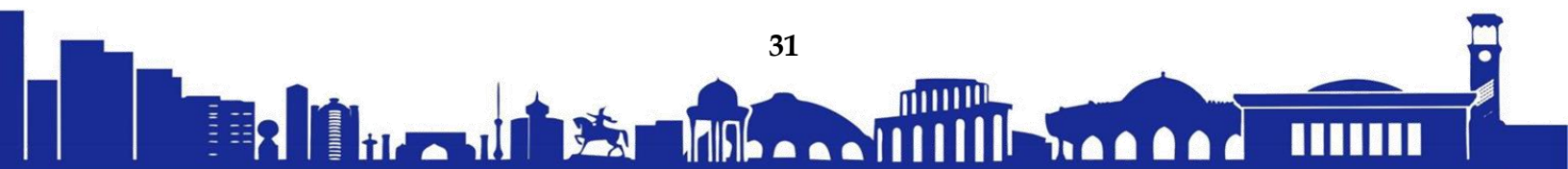
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Abstract

The coordination polymer $[\text{NaFe}(\text{EDTA})(\text{H}_2\text{O})]_n \cdot \text{H}_2\text{O}$ was comprehensively characterized through elemental and structural analyses, including energy-dispersive X-ray spectroscopy (EDX), molecular electrostatic potential (MEP) surface mapping, and crystal packing investigation. The EDX spectrum revealed prominent Fe $K\alpha$ and Fe $K\beta$ signals together with the characteristic Na $K\alpha$ peak, confirming the presence of iron and sodium in the synthesized material and supporting the proposed chemical composition. Molecular electrostatic potential analysis provided valuable information on the charge distribution within the complex, identifying electron-rich regions localized around the carboxylate oxygen atoms of the EDTA ligand and electron-deficient regions associated with coordinated and lattice water molecules. These features indicate favorable sites for intermolecular hydrogen-bonding interactions and contribute to the stabilization of the crystal structure. Crystal packing analysis demonstrated the formation of an extended one-dimensional coordination polymer in which Fe(III) centers are interconnected through



EDTA ligands and further stabilized by sodium ions and a network of O-H $\cdots$ O hydrogen bonds involving coordinated and crystallization water molecules. The synergistic combination of coordination bonds, electrostatic interactions, and hydrogen bonding results in a robust supramolecular architecture. The obtained findings provide a deeper understanding of the structural organization, intermolecular interactions, and physicochemical characteristics of this iron-EDTA-based coordination polymer, highlighting the importance of multidentate ligands in the design and construction of extended metal-organic frameworks and related functional materials.

Keywords: Coordination polymer; Fe(III) complex; EDTA ligand; Energy-dispersive X-ray spectroscopy; Molecular electrostatic potential; Crystal packing; Hydrogen bonding; Supramolecular structure.

Introduction

Coordination polymers represent an important class of metal-organic materials that have attracted significant attention due to their fascinating structural diversity and wide range of practical applications in catalysis, ion exchange, gas storage, environmental remediation, magnetism, sensing, and biomedical sciences. The architecture of these materials is largely determined by the coordination behavior of metal ions and the flexibility of the organic ligands employed. Consequently, the rational design of coordination polymers remains an active area of research in modern coordination chemistry and crystal engineering. Among the numerous ligands used for the construction of coordination frameworks, **ethylenediaminetetraacetic acid (EDTA)** is one of the most versatile multidentate chelating agents. Owing to the presence of four carboxylate oxygen atoms and two nitrogen donor atoms, EDTA can coordinate metal ions in various binding modes, leading to the formation of stable mono-, bi-, and polynuclear complexes as well as extended coordination networks. In addition to strong metal binding, the carboxylate groups of EDTA can participate in hydrogen-bonding interactions, which play a crucial role in the stabilization of supramolecular architectures.

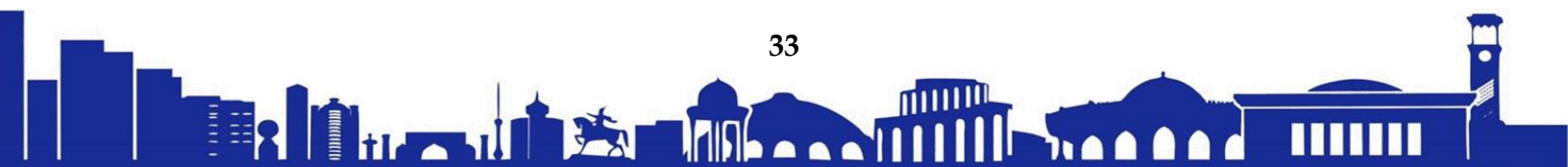
Iron-containing EDTA complexes are of particular interest because iron is an environmentally benign and biologically important transition metal. The coordination of Fe(III) ions by EDTA results in highly stable complexes with diverse structural features and physicochemical properties. Furthermore, the incorporation of alkali metal ions such



as sodium can significantly influence crystal packing, charge balance, and intermolecular interactions, thereby affecting the overall stability and organization of the resulting coordination polymer. In recent years, the combination of experimental characterization techniques and computational visualization methods has become an effective approach for understanding the structural properties of coordination compounds. Elemental analysis provides information about chemical composition, while molecular electrostatic potential (MEP) mapping reveals the distribution of electron density and identifies potential reactive sites. Crystal packing analysis, on the other hand, offers valuable insight into intermolecular interactions and the supramolecular organization of the crystal lattice. In the present study, the coordination polymer $[\text{NaFe(EDTA)(H}_2\text{O)}]_n \cdot \text{H}_2\text{O}$ was investigated using **energy-dispersive X-ray spectroscopy (EDX)**, **molecular electrostatic potential (MEP) surface analysis**, and **crystal structure visualization**. The objective of this work was to confirm the elemental composition of the compound, evaluate its electronic surface characteristics, and examine the intermolecular interactions responsible for the formation and stabilization of the polymeric framework. The obtained results contribute to a better understanding of the structural organization and supramolecular behavior of iron-EDTA-based coordination polymers.

Results and Discussion

Energy-dispersive X-ray spectroscopy (EDX) was employed to investigate the elemental composition of the synthesized coordination polymer and to verify the presence of the metal components expected from the proposed chemical formula. The EDX spectrum shown in Figure 1 exhibits distinct characteristic peaks corresponding to sodium and iron, confirming the successful incorporation of these elements into the coordination framework. The most intense signals in the spectrum are observed at approximately **6.40 keV** and **7.06 keV**, which correspond to the **Fe $K\alpha$** and **Fe K** emission lines, respectively. The presence of these peaks clearly confirms iron as the central metal ion in the complex. The high intensity of the Fe $K\alpha$ peak compared with other detected signals indicates that iron is a major constituent of the coordination polymer and plays a fundamental role in the formation of the polymeric structure. The appearance of both $K\alpha$ and $K\beta$ transitions also demonstrates the reliability of the elemental identification and excludes the possibility of spectral misassignment.



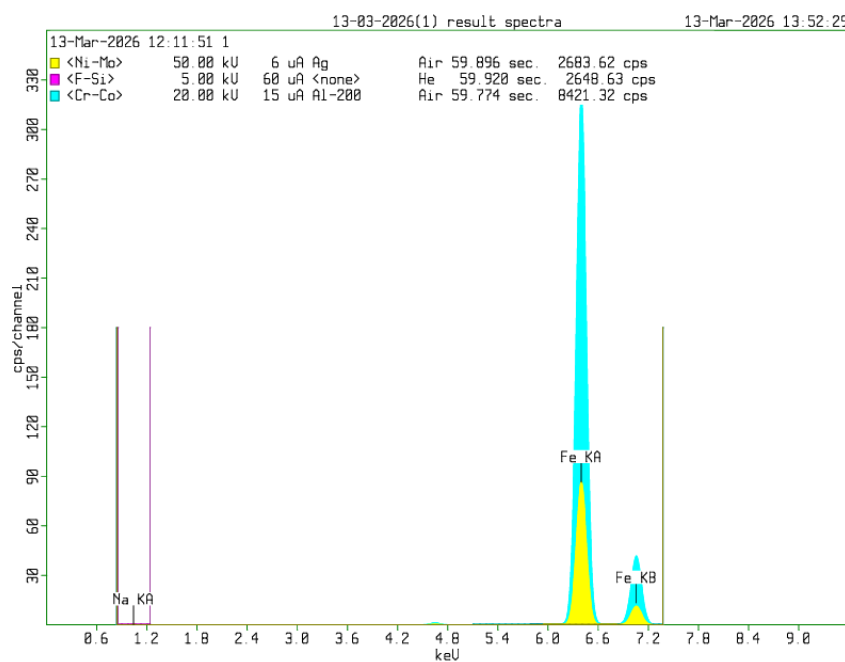
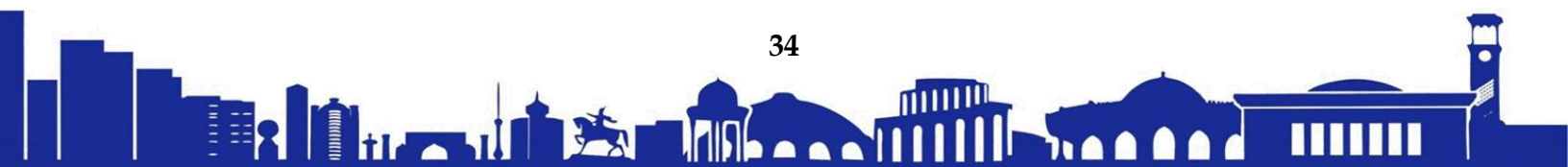


Figure 1. EDX spectrum of the coordination polymer $[\text{NaFe(EDTA)(H}_2\text{O)}]_n \cdot \text{H}_2\text{O}$

In addition to the iron peaks, a characteristic signal corresponding to **Na K α** is observed near **1.04 keV**, providing evidence for the incorporation of sodium ions within the crystal lattice. Sodium ions are expected to contribute to charge compensation and may participate in the stabilization of the extended coordination network through electrostatic interactions. The simultaneous detection of both iron and sodium signals is therefore fully consistent with the proposed composition of $[\text{NaFe(EDTA)(H}_2\text{O)}]_n \cdot \text{H}_2\text{O}$.

It should be noted that EDX analysis has inherent limitations in the detection of light elements. Elements such as hydrogen cannot be detected, while carbon, nitrogen, and oxygen generally produce weak signals due to their low atomic numbers and reduced X-ray emission efficiency. Consequently, the organic EDTA ligand and water molecules present in the structure cannot be fully characterized by EDX alone. Nevertheless, the observed elemental profile strongly supports the presence of the inorganic components of the coordination polymer and is in excellent agreement with the expected stoichiometry of the synthesized compound.



The EDX results therefore provide important experimental evidence for the successful synthesis of $[\text{NaFe}(\text{EDTA})(\text{H}_2\text{O})]_n \cdot \text{H}_2\text{O}$. Combined with the structural visualization and electrostatic potential analyses discussed in subsequent sections, the elemental analysis confirms the composition and integrity of the coordination framework. These findings demonstrate that the synthesized material contains the essential metal centers required for the formation of the extended polymeric architecture and establishes a solid basis for further investigation of its structural and physicochemical properties.

Molecular Electrostatic Potential Surface Analysis

The molecular electrostatic potential (MEP) surface analysis was performed to investigate the electronic charge distribution within the $[\text{NaFe}(\text{EDTA})(\text{H}_2\text{O})]_n \cdot \text{H}_2\text{O}$ coordination polymer and to identify potential sites involved in intermolecular interactions. MEP mapping is a valuable computational tool for visualizing regions of different electrostatic potential on a molecular surface, thereby providing insight into the reactivity, charge-transfer behavior, and hydrogen-bonding capabilities of a compound.

As illustrated in Figure 2, the electrostatic potential is distributed unevenly over the molecular surface, indicating the presence of both electron-rich and electron-deficient regions. The color gradient ranges from red to blue, where red regions correspond to areas of the most negative electrostatic potential, while blue regions represent areas of positive electrostatic potential. Intermediate colors such as yellow and green indicate regions with moderate charge density.

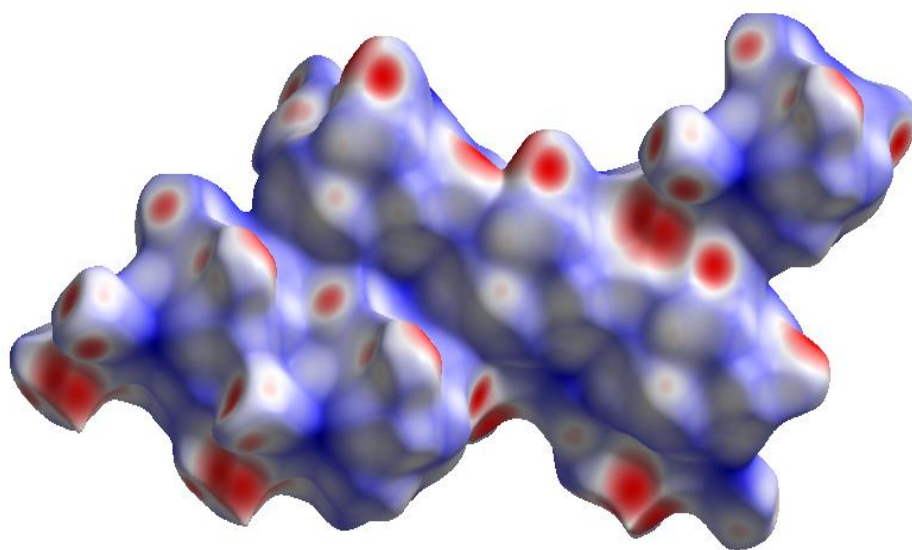
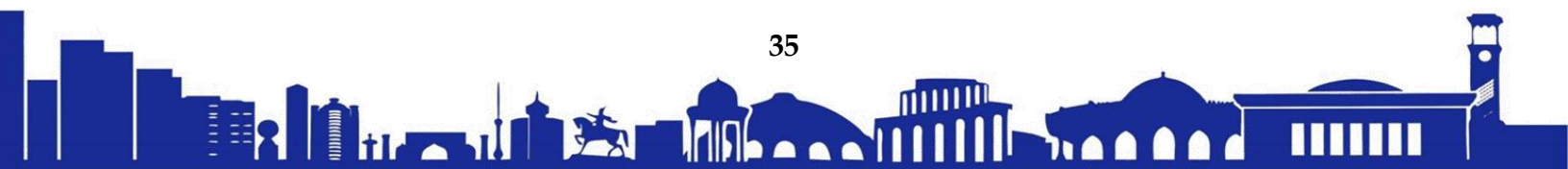


Figure 2. Molecular electrostatic potential (MEP) surface of $[\text{NaFe}(\text{EDTA})(\text{H}_2\text{O})]_n \cdot \text{H}_2\text{O}$.



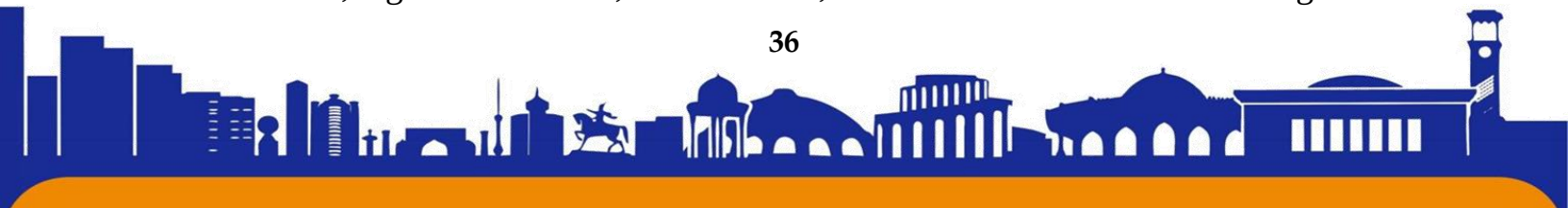
The most negative electrostatic potential values are concentrated around the oxygen atoms of the carboxylate groups belonging to the EDTA ligand. These oxygen atoms possess a high electron density due to the presence of lone electron pairs and the partial negative charge associated with the carboxylate functionality. As a result, these sites are expected to serve as strong hydrogen-bond acceptors and play a significant role in intermolecular recognition processes. Furthermore, the localization of negative potential around the oxygen donor atoms is consistent with their involvement in coordination to the Fe(III) center, highlighting the important contribution of the EDTA ligand to the stabilization of the coordination environment.

In contrast, regions of positive electrostatic potential are primarily observed around the hydrogen atoms of coordinated and lattice water molecules. These hydrogen atoms exhibit electron-deficient character and therefore act as potential hydrogen-bond donors. The presence of such positively charged regions suggests that water molecules actively participate in the formation of intermolecular O-H $\cdots$ O hydrogen bonds with neighboring carboxylate oxygen atoms. These interactions contribute significantly to the cohesion and stability of the crystal structure.

The MEP surface also provides valuable information regarding the influence of the metal center on the electronic structure of the complex. Coordination of the EDTA ligand to the Fe(III) ion results in a redistribution of electron density throughout the molecule, generating distinct regions of charge accumulation and depletion. This redistribution enhances the polarity of the coordination framework and promotes electrostatic interactions between adjacent molecular units. Such interactions are particularly important in coordination polymers, where the overall stability of the structure depends not only on metal-ligand bonds but also on secondary supramolecular forces.

Crystal Packing and Intermolecular Interactions

The crystal packing structure of $[\text{NaFe}(\text{EDTA})(\text{H}_2\text{O})]_n \cdot \text{H}_2\text{O}$, illustrated in Figure 3, provides valuable insight into the three-dimensional organization of the coordination polymer and the intermolecular forces responsible for its structural stability. The packing diagram reveals that the compound forms an extended coordination network in which the metal centers, ligand molecules, sodium ions, and water molecules are arranged in a



highly ordered manner throughout the crystal lattice. The regular arrangement of these structural components contributes to the formation of a robust supramolecular architecture that extends in multiple crystallographic directions.

At the molecular level, the Fe(III) center is coordinated by the multidentate EDTA ligand through its nitrogen and oxygen donor atoms, producing a stable chelated environment around the metal ion. The strong metal-ligand coordination bonds serve as the primary structural framework of the polymer. The EDTA ligand acts as an efficient bridging unit, allowing the formation of repeating coordination motifs that propagate throughout the crystal. Such coordination behavior is characteristic of EDTA-based complexes and demonstrates the ability of this ligand to generate extended architectures through multiple donor sites.

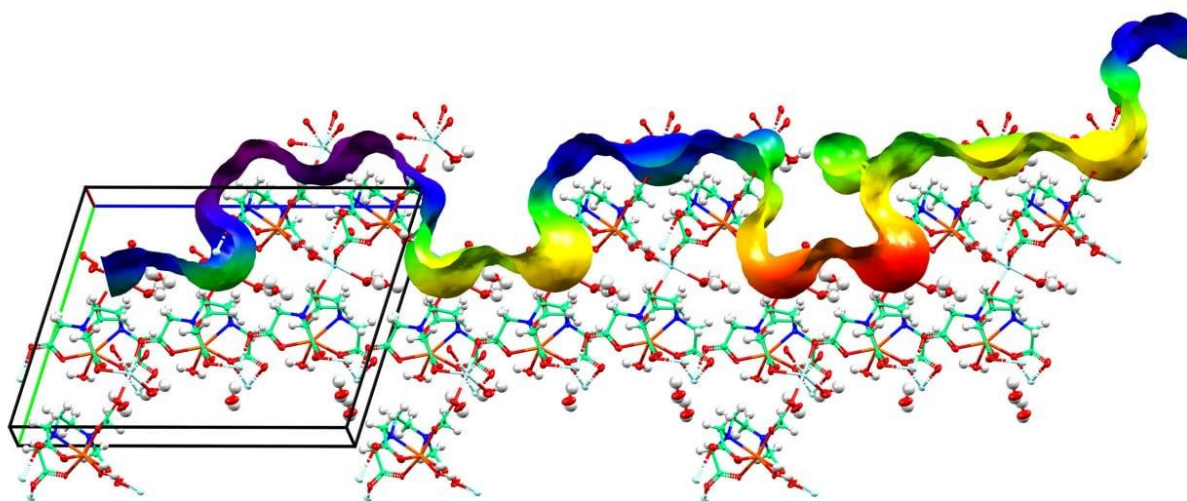
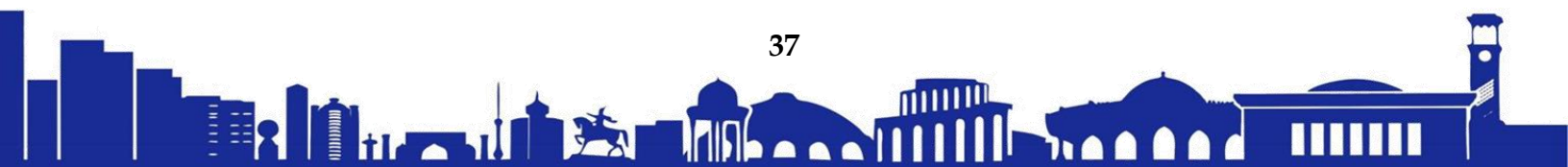


Figure 3. Crystal packing arrangement of $[\text{NaFe}(\text{EDTA})(\text{H}_2\text{O})]_n \cdot \text{H}_2\text{O}$.

The crystal packing arrangement further indicates that sodium ions play an important role in the overall organization of the structure. Besides maintaining charge neutrality, the sodium ions contribute to the stabilization of the polymeric framework through electrostatic interactions with neighboring oxygen-containing groups. These interactions help connect adjacent coordination units and reinforce the integrity of the crystal lattice. The participation of sodium ions in the packing arrangement highlights their significance in controlling the geometry and organization of the coordination polymer.



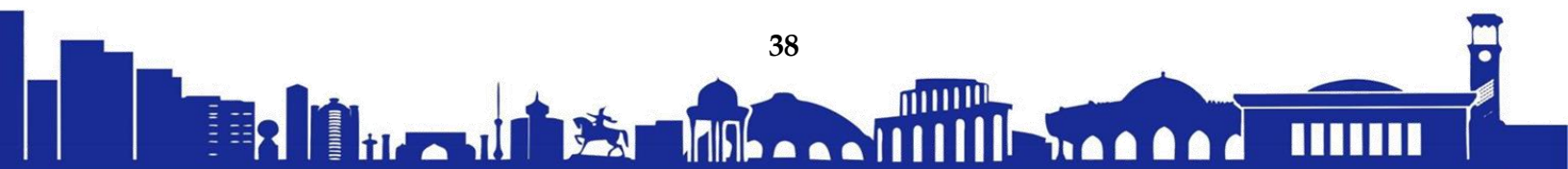
An important feature of the crystal structure is the presence of both coordinated and lattice water molecules. Coordinated water molecules occupy positions within the coordination sphere of the iron center, while lattice water molecules are located between neighboring polymeric chains. These water molecules act as key participants in the supramolecular assembly by forming an extensive network of hydrogen bonds. The hydrogen atoms of water molecules interact with the oxygen atoms of carboxylate groups, generating numerous $\text{O-H}\cdots\text{O}$ hydrogen-bonding contacts throughout the structure. These interactions effectively link adjacent polymeric units and contribute significantly to crystal stabilization.

The packing diagram suggests the existence of continuous intermolecular contact pathways extending along the polymeric direction. Such pathways create a three-dimensional network of non-covalent interactions that complement the coordination bonds present within the framework. The combination of strong metal-ligand interactions and weaker hydrogen-bonding contacts produces a highly interconnected structure capable of resisting lattice distortion. Consequently, the crystal exhibits enhanced rigidity and structural coherence.

Furthermore, the arrangement of neighboring chains indicates that electrostatic attractions between positively charged and negatively charged regions of the structure contribute to the overall packing efficiency. The negatively polarized carboxylate oxygen atoms of the EDTA ligand interact favorably with positively polarized hydrogen atoms of water molecules and sodium-containing regions, resulting in additional stabilization of the crystal lattice. These electrostatic interactions operate synergistically with hydrogen bonding to strengthen the supramolecular framework.

The observed crystal packing pattern demonstrates that the stability of $[\text{NaFe}(\text{EDTA})(\text{H}_2\text{O})]_n \cdot \text{H}_2\text{O}$ is not solely dependent on coordination bonds but also on a complex network of secondary interactions. Hydrogen bonding, electrostatic attractions, and van der Waals contacts collectively contribute to the formation of a densely packed and energetically favorable crystal structure. Such cooperative interactions are commonly encountered in coordination polymers and play a decisive role in determining their physical and chemical properties.

Conclusion



In this study, the coordination polymer $[\text{NaFe}(\text{EDTA})(\text{H}_2\text{O})]_n \cdot \text{H}_2\text{O}$ was successfully investigated through a combination of elemental and structural characterization techniques, including **energy-dispersive X-ray spectroscopy (EDX)**, **molecular electrostatic potential (MEP) surface analysis**, and **crystal packing visualization**. The integrated application of these methods provided valuable information regarding the composition, electronic properties, and supramolecular organization of the compound.

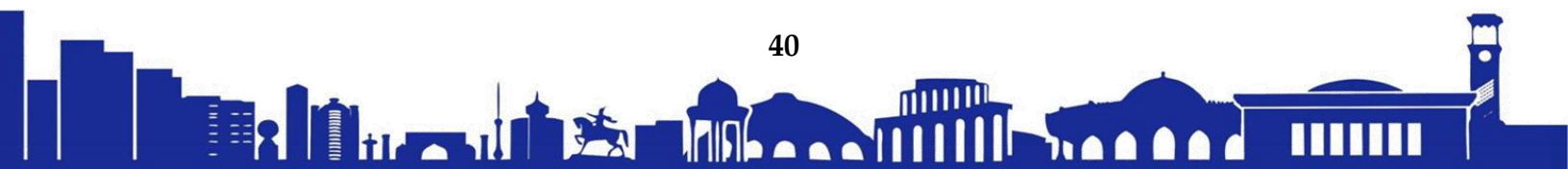
The EDX analysis confirmed the presence of the principal metallic components, namely iron and sodium, thereby supporting the proposed chemical formula and demonstrating the successful synthesis of the coordination polymer. The observed characteristic Fe $K\alpha$, Fe $K\beta$, and Na $K\alpha$ signals were consistent with the expected elemental composition and indicated the high purity of the obtained material.

The molecular electrostatic potential analysis revealed a distinct distribution of charge density throughout the coordination framework. Electron-rich regions were predominantly localized around the carboxylate oxygen atoms of the EDTA ligand, whereas electron-deficient regions were associated mainly with the hydrogen atoms of coordinated and lattice water molecules. This charge distribution indicates a strong tendency toward intermolecular hydrogen-bond formation and highlights the important role of electrostatic interactions in stabilizing the crystal structure.

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CRYSTAL STRUCTURE AND HIRSHFELD SURFACE ANALYSIS OF NICKEL (II) CHLORIDE WITH 1,3,4-THIADIAZOLE-2,5-DIAMINE

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Abstract. *Background of the problem.* Synthesis and study of oxo-bridged trinuclear nickel (II) complex compounds is a relevant direction of modern coordination chemistry and is associated with the creation of materials with controlled structural and functional properties.

Objective: To synthesize oxo-bridged trinuclear compounds in the presence of new 1,3,4 thiodiazole 2,5 diamine and nickel (II) chloride and analyze its structural, morphological and spectroscopic properties.

Methodology: The Ni(II) coordination compound was structurally characterized by single-crystal X-ray diffraction, while the intermolecular interactions within the crystal lattice were systematically investigated using Hirshfeld surface analysis. *Scientific novelty.* A new complex compound with unique morphological and crystalline properties was synthesized.

Results: The structure and physicochemical properties of the synthesized new coordination compound were studied.

Keywords: Nickel-based oxo-bridged trinuclear complex compound, L1, X-ray, Hirshfeld surface.

Properties:

- The complex was synthesized in the presence of Ni(II) salt, L1, ethanol and water.
- It has a discrete structure.

Introduction.

Polynuclear transition-metal clusters have emerged as an important class of coordination compounds because of their diverse structural architectures and broad



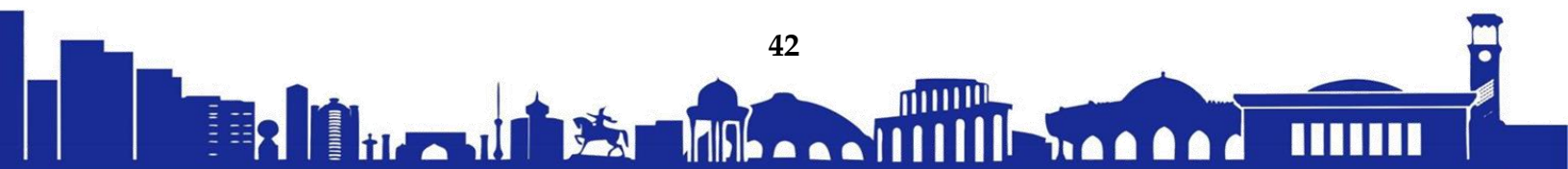
applications in catalysis, magnetic materials, materials chemistry, and bioinorganic systems [1]. Among these systems, oxo-bridged multinuclear assemblies are of particular interest because μ -oxo ligands effectively stabilize polynuclear frameworks and facilitate electronic communication between neighbouring metal centres, thereby resembling structural motifs found in metalloenzymes and functional metal-oxide materials [2-3]. Furthermore, the incorporation of a central oxo bridge generally enhances the structural rigidity of the cluster core and promotes cooperative metal-metal interactions, which are crucial for the physicochemical properties of multinuclear complexes [4].

Ligand design plays a decisive role in controlling nuclearity, geometry, and functional behaviour in polynuclear coordination compounds [5]. Nitrogen- and sulfur-donor heterocycles are especially effective for stabilizing multinuclear architectures due to their adaptable coordination modes and ability to promote secondary supramolecular interactions [7]. Among these ligands, thiadiazole derivatives have received increasing attention owing to their strong metal-binding ability and well-documented biological relevance. 1,3,4-Thiadiazole frameworks are known to exhibit pharmacological activity and have been widely explored as ligands for transition-metal complexes, with properties including antimicrobial, enzymatic, and therapeutic activities [8]. The 1,3,4-thiadiazole-2,5-diamine (TDAD) ligand is particularly attractive because it provides multiple nitrogen donor atoms while retaining terminal amino groups capable of forming intermolecular hydrogen bonds. These features enable the construction of robust multinuclear frameworks and promote extended supramolecular organization in the solid state [9].

In this context, the present study describes the synthesis and comprehensive characterization of an oxo-bridged trinuclear nickel(II) coordination cluster, trichlorido(μ_3 -oxo)hexakis(1,3,4-thiadiazole-2,5-diamine)trinickel(II) chloride, $[\text{Ni}_3\text{O}(\text{TDAD})_6\text{Cl}_3]\text{Cl}$. The complex features a symmetrically arranged Ni_3O core stabilized by six thiadiazole ligands, providing a rare example of a nitrogen-rich μ_3 -oxo-bridged trinuclear nickel framework that integrates structural analysis with physicochemical and antimicrobial evaluation. The structural and physicochemical properties were elucidated using single-crystal X-ray diffraction together with complementary analytical techniques.

Results and discussion.

Single-crystal X-ray diffraction analysis



Crystal Structure Determination

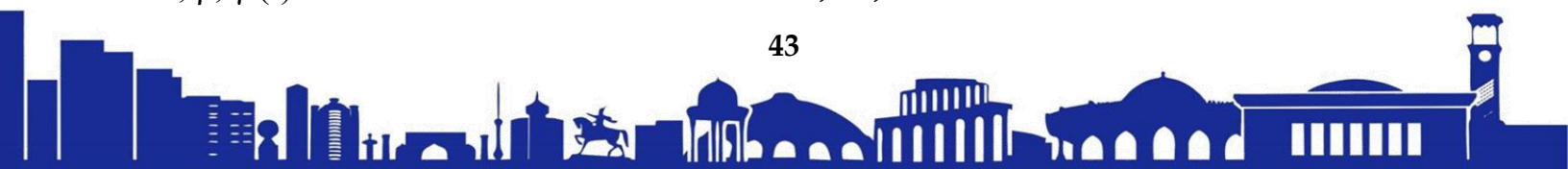
Single-crystal X-ray diffraction analysis confirmed the molecular and crystal structure of $[\text{Ni}_3\text{O}(\text{TDAD})_6\text{Cl}_3]\text{Cl}$. The crystallographic data collection and refinement parameters are summarized in Table 1. The complex crystallizes in the hexagonal crystal system with centrosymmetric space group $P6_3/mcm$ (No. 193) at 293 K. The unit-cell parameters are $a = b = 10.5430(2) \text{ \AA}$ and $c = 18.7330(4) \text{ \AA}$, giving a cell volume of $1803.29(8) \text{ \AA}^3$ with $Z = 12$. The structure refinement converged satisfactorily with final $R = 0.0477$ and $wR2 = 0.1364$, indicating good agreement between observed and calculated structure factors.

Asymmetric Unit and Molecular Structure

The asymmetric unit of the complex is shown in Fig. 1(a), with displacement ellipsoids drawn at the 35 % probability level. It comprises one Ni(II) centre coordinated by one μ_3 -oxo atom, four nitrogen atoms from four independent TDAD ligands, and one terminal chloride ion; positional disorder is observed for the amino nitrogen N(2) and its attached hydrogen atoms, which are modelled over two sites with partial occupancies (Fig. 2). The complete trinuclear molecular structure is illustrated in Fig. 1(b), revealing a centrosymmetric Ni_3O core in which a central μ_3 -oxo atom symmetrically bridges three Ni(II) ions [10].

Table 1. Crystal data and structure refinement for $[\text{Ni}_3\text{O}(\text{TDAD})_6\text{Cl}_3]\text{Cl}$.

CCDC	2518737
Formula	$\text{C}_2\text{H}_2\text{Cl}_{0.83}\text{N}_3\text{Ni}_{0.50}\text{O}_{0.17}\text{S}$
Formula Weight (g/mol)	161.69
Temperature(K)	293(2)
Wavelength	1.54184
Crystal size (mm^3)	0.17 x 0.14 x 0.14
Shape	Needle
Crystal System	Hexagonal
Space Group	$P6_3/mcm$ (No.193)
a, b, c ($\text{\AA}$)	10.5430(2), 10.5430(2), 18.7330(4)
α, β, γ ($^\circ$)	90, 90, 120



Volume ($\text{\AA}^3$)	1803.29(8)
Z	12
D (calc) [g/cm^3]	1.787
Mu [mm^{-1}]	8.851
F(000)	966
Index ranges	$-13 \leq h \leq 13, -12 \leq k \leq 12, -23 \leq l \leq 18$
Reflections collected	11319
Theta Min-Max [$^\circ$]	4.829, 75.581
Reflections with $I > 2(I)$	703 [R(int) = 0.0419]
Data/restraints/parameters	703/0/47
Goodness-of-fit on F^2	1.089
Final R indices [$I > 2\sigma(I)$]	R1 = 0.0498, wR2 = 0.1409
R indices (all data)	R1 = 0.0515, wR2 = 0.1426

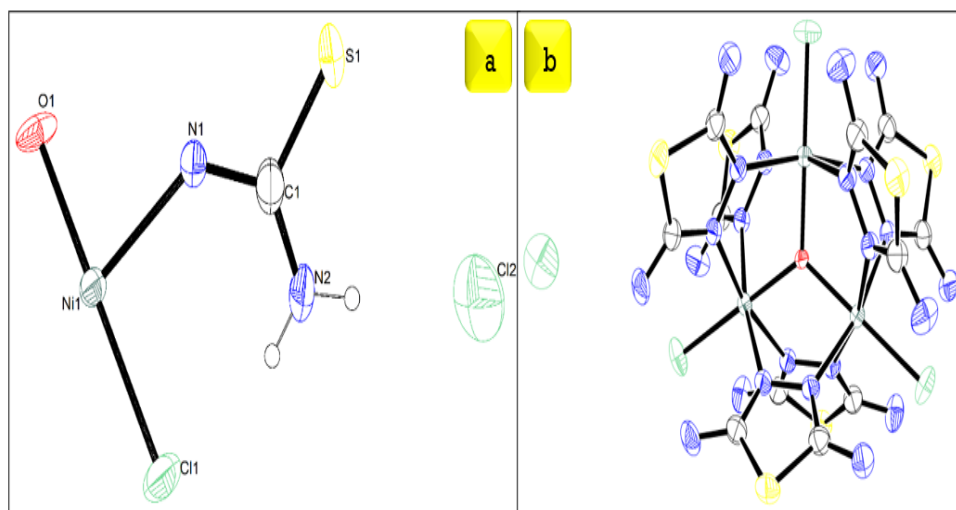
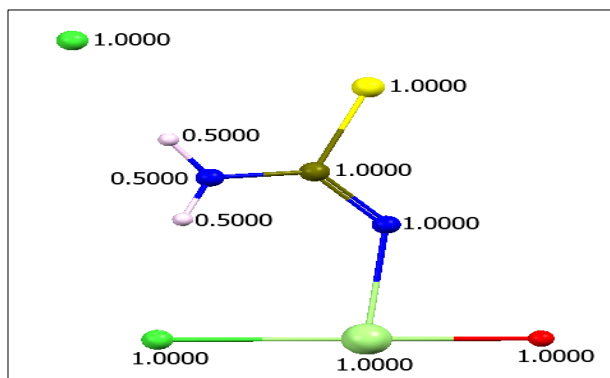


Fig. 1 (a) Asymmetric unit with atom numbering and displacement ellipsoids drawn at the 35% probability level; (b) ORTEP representation of the





Coordination Environment and Bond Geometry

Each Ni(II) centre exhibits a distorted octahedral coordination geometry, defined by an N_4OCl donor set. Selected bond lengths and angles are listed in Table 2. The Ni–O(μ_3 -oxo) bond distance of 1.9579(9) Å reflects strong metal-oxygen bonding, while the Ni–N bond lengths are narrowly distributed around 2.156 Å, indicating uniform coordination by the TDAD ligands. The terminal Ni–Cl bond length of 2.3494(19) Å falls within the expected range reported for monodentate chloride ligands in Ni(II) coordination complexes (typically ≈ 2.20 – 2.40 Å), consistent with previously described crystal structures of nickel(II) chloride-containing complexes [11]. The Ni–O–Ni angles are fixed at 120° , confirming a planar triangular arrangement of the Ni_3O core.

Fig. 2 Asymmetric unit of $[Ni_3O(TDAD)_6Cl_3]Cl$ with atoms labelled and occupancies indicated.

Table 2 The selected bond lengths (Å), angles ($^\circ$) and dihedral angles ($^\circ$) for $[Ni_3O(TDAD)_6Cl_3]Cl$

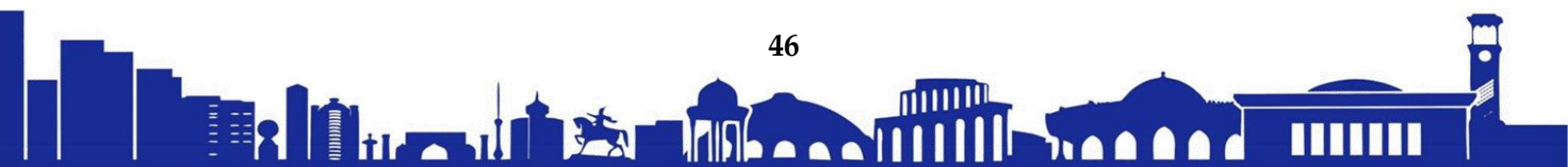
Bond	Length [Å]	Bond	Length [Å]
Ni(1)–Cl(1)	2.349(2)	S(1)–C(1)	1.723(4)
Ni(1)–O(1)	1.9577(10)	N(1)–N(1)	1.388(6)
Ni(1)–N(1)	2.155(3)	N(1)–C(1)	1.304(4)
Ni(1)–N(1)	2.155(3)	C(1)–N(2)	1.299(8)
Ni(1)–N(1)	2.155(3)	N(2)–H(2A)	0.86
Ni(1)–N(1)	2.155(3)	N(2)–H(2B)	0.86
S(1)–C(1)	1.723(4)		

Bond	Angle [°]	Bond	Angle [°]
O(1)-Ni(1)-Cl(1)	180.0	N(1)-Ni(1)-N(1)	93.69(14)
O(1)-Ni(1)-N(1)	83.38(8)	C(1)-S(1)-C(1)	86.9(3)
O(1)-Ni(1)-N(1)	83.37(8)	Ni(1)-O(1)-Ni(1)	120.000(1)
O(1)-Ni(1)-N(1)	83.37(8)	Ni(1)-O(1)-Ni(1)	120.0
O(1)-Ni(1)-N(1)	83.37(8)	Ni(1)-O(1)-Ni(1)	120.0
N(1)-Ni(1)-Cl(1)	96.63(8)	N(1)-N(1)-Ni(1)	117.69(8)
N(1)-Ni(1)-Cl(1)	96.63(8)	C(1)-N(1)-Ni(1)	130.2(3)
N(1)-Ni(1)-Cl(1)	96.63(8)	C(1)-N(1)-N(1)	112.1(2)
N(1)-Ni(1)-Cl(1)	96.62(8)	N(1)-C(1)-S(1)	114.4(3)
N(1)-Ni(1)-N(1)	84.78(14)	N(1)-C(1)-N(2)	119.3(4)
N(1)-Ni(1)-N(1)	166.75(16)	N(2)-C(1)-S(1)	126.3(5)
N(1)-Ni(1)-N(1)	84.78(14)	C(1)-N(2)-H(2A)	120.0
N(1)-Ni(1)-N(1)	93.69(14)	C(1)-N(2)-H(2B)	120.0
N(1)-Ni(1)-N(1)	166.75(16)	H(2A)-N(2)-H(2B)	120.0
Dihedral bond	Angle [°]	Dihedral bond	Angle [°]
Ni(1)-N(1)-C(1)-S(1)	178.76(17)	N(1)-N(1)-C(1)-N(2)	179.0(6)
Ni(1)-N(1)-C(1)-N(2)	-1.3(8)	C(1)-S(1)-C(1)-N(1)	1.2(4)
N(1)-N(1)-C(1)-S(1)	-1.0(3)	C(1)-S(1)-C(1)-N(2)	-178.7(5)

Symmetry transformations used to generate equivalent atoms:.

Hydrogen-Bonding Interactions

In addition to coordination bonds, extensive hydrogen bonding contributes to the stabilization of the crystal structure. The hydrogen-bonding network is illustrated in Fig. 3, and the corresponding geometric parameters are summarized in Table 2. The amino groups of the TDAD ligands act as hydrogen-bond donors, forming N-H $\cdots$ Cl interactions with both coordinated and lattice chloride ions, as well as weaker N-H $\cdots$ N contacts between adjacent ligands. The short H $\cdots$ Cl distances (2.1316-2.333 Å) and near-linear D-



H...A angles (up to 170.9°) indicate relatively strong hydrogen bonds that link neighbouring trinuclear units into extended supramolecular assemblies.

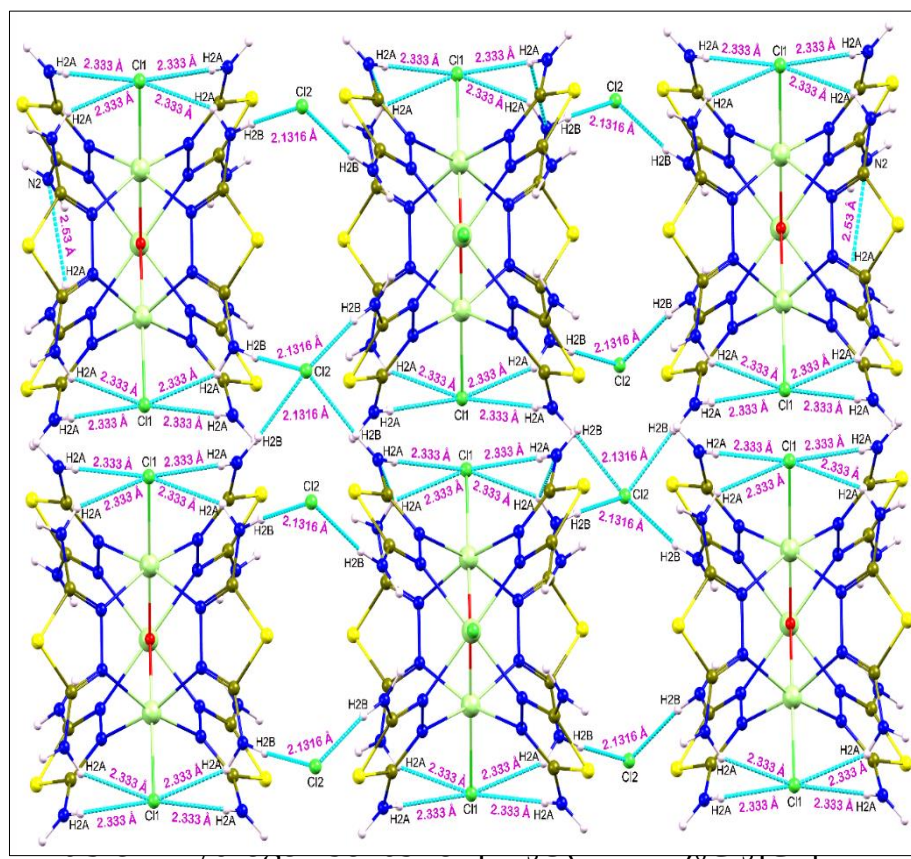


Fig. 3 The hydrogen bonding network of $[Ni_3O(TDA)_6Cl_3] \cdot Cl$

D-H...A	d(D-H)	d(H...A)	d(D...A)	<(DHA)
N(2)-H(2A)...Cl(1)	0.86	2.333	3.093	147.5
N(2)-H(2A)...N(2)	0.86	2.556	3.124(2)	124.5
N(2)-H(2B)...Cl(2)	0.86	2.131	2.983	171.2

Symmetry transformations used to generate equivalent atoms:

Comparative structural analysis and supramolecular features

To place the structure of the present trinuclear cluster in context, a comparison with representative Ni(II) complexes retrieved from the CCDC database [41-46] was performed. The selected literature structures crystallize in various crystal systems but consistently display distorted octahedral Ni(II) coordination environments with typical Ni-N distances of approximately 2.02-2.08 Å, Ni-O distances near 2.03–2.13 Å, and Ni-

Cl separations around 2.36-2.40 Å. In contrast, the present compound $[\text{Ni}_3\text{O}(\text{TDAD})_6\text{Cl}_3]\text{Cl}$ exhibits slightly longer Ni–N bonds (≈ 2.155 Å) together with a notably shorter Ni–O bond (≈ 1.958 Å), reflecting the strong coordination of the oxo donor within the trinuclear framework. While most reported structures are mononuclear species stabilized primarily by conventional hydrogen bonding and π - π stacking, the present structure contains a multinuclear Ni_3O core that generates a distinct coordination topology and extended hydrogen-bond-assisted supramolecular assembly. Further insight into intermolecular stabilization was obtained from hydrogen-bond comparisons (Table 3). The literature complexes typically show networks dominated by N–H $\cdots$ Cl and O–H $\cdots$ Cl interactions, often supplemented by weaker C–H $\cdots$ Cl contacts. A similar pattern is observed in the present compound, where multiple N–H donors from the TDAD ligands participate in hydrogen bonding with chloride acceptors, forming a three-dimensional supramolecular framework. Taken together, these comparisons demonstrate that although the local coordination geometry around Ni(II) remains octahedral, the present compound is structurally distinguished by its trinuclear oxo-bridged core and the resulting multidirectional hydrogen-bonding architecture, which collectively define the structural novelty of the reported system.

Table 3. Selected hydrogen-bond parameters (Å, °) for representative Ni(II) complexes (CCDC entries) and the present complex, showing key D–H $\cdots$ A intermolecular contacts governing supramolecular packing.

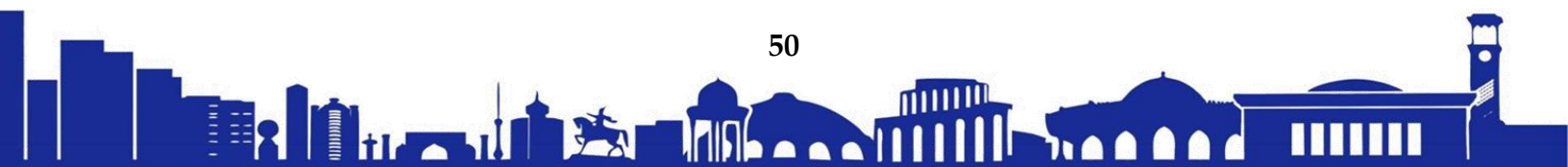
D–H $\cdots$ A	d(D–H)	d(H $\cdots$ A)	d(D $\cdots$ A)	<(DHA)
OYOLOG (2034867)				
N2–H2N $\cdots$ O9	0.85(2)	1.94(2)	2.783(3)	171(3)
N4–H4N $\cdots$ O10	0.86(3)	2.01(3)	2.865(8)	173(5)
O5–H5O $\cdots$ Cl2	0.84(2)	2.28(2)	3.0922(19)	163(3)
N6–H6N $\cdots$ Cl1	0.86(2)	2.41(2)	3.250(2)	166(2)
O6–H6O $\cdots$ Cl4	0.84(2)	2.20(2)	3.020(2)	166(3)
O7–H7O $\cdots$ Cl1	0.83(2)	2.264(18)	3.070(2)	164(3)
N8–H8N $\cdots$ Cl1	0.83(3)	2.43(3)	3.234(2)	162(3)
O8–H8O $\cdots$ Cl3	0.84(3)	2.18(3)	3.006(2)	173(3)
O9–H9O $\cdots$ Cl4	0.83(3)	2.31(3)	3.125(2)	167(3)

O10-H10O...Cl2	0.84(5)	2.54(5)	3.374(3)	173(5)
C16-H16B...Cl3	0.99	2.61	3.349(7)	132
C20-H20...Cl2	0.95	2.67	3.537(3)	153
C33-H33B...Cl3	0.98	2.78	3.679(3)	154
IFOYAG (1406344)				
O1WA-H1W2...Cl1	0.82(3)	2.38(3)	3.1684(13)	164(2)
O1WA-H1W1...Cl2	0.84(3)	2.26(3)	3.0919(14)	171(2)
O1WB-H1W4...Cl1	0.84(3)	2.26(3)	3.0679(15)	165(3)
C2B-H2BA...Cl1	0.95	2.79	3.461(2)	128.00
TOLTOE (686886)				
N1-H5...Cl1	0.87	2.52	3.331(2)	155
O1-H10...Cl1	0.85	2.19	3.0320(19)	170
C3-H2...Cl1	0.94	2.74	3.552(3)	144
HIBYOJ (1826295)				
O5-H1O5...Cl3	0.79(2)	2.25(2)	3.0299(18)	167(3)
O6-H1O6...Cl1	0.80(2)	2.19(2)	2.979(2)	169(2)
N2-H2A...Cl2	0.88	2.7000	3.520(2)	156
O7-H1O7...Cl4	0.796(13)	2.240(14)	3.0223(14)	168(2)
O8-H1O8...Cl2	0.80(2)	2.25(2)	3.0268(16)	165(2)
N6-H6A...Cl4	0.88	2.77	3.550(2)	149
N8-H8A...Cl3	0.88	2.62	3.477(2)	165
N8-H8B...Cl3	0.88	2.48	3.336(2)	164
C9-H9...Cl1	0.95	2.79	3.503(2)	133
UYOJIC (847181)				
O6-H6C...Cl3	0.86(3)	2.22(3)	3.057(3)	167(3)
O6-H6D...O9	0.86(3)	1.96(3)	2.797(5)	167(3)
O7-H7A...Cl1	0.85(3)	2.32(3)	3.139(3)	163(4)
O7-H7B...Cl4	0.85(3)	2.45(3)	3.292(2)	169(3)
O8-H8A...Cl2	0.84(3)	2.27(3)	3.104(2)	173(3)
O8-H8B...Cl3	0.84(2)	2.37(3)	3.167(2)	159(2)

O9-H9A...Cl2	0.86(3)	2.44(3)	3.163(3)	142(4)
O9-H9B...Cl1	0.86(4)	2.33(4)	3.173(4)	170(4)
C2-H2...Cl4	0.93	2.67	3.520(4)	153
POXNOJ (1055581)				
N2-H2A...Cl1	0.86	2.5	3.277(2)	150
[Ni₃O(TDAD)₆Cl₃]Cl				
N(2)-H(2A)...Cl(1)	0.86	2.333	3.09	147.1
N(2)-H(2A)...N(2)	0.86	2.53	3.10(2)	124.7
N(2)-H(2B)...Cl(2)	0.86	2.1316	2.984	170.9

Hirshfeld surface analysis.

Hirshfeld surface analysis was employed to examine and quantify the intermolecular interactions that govern the crystal packing of $[\text{Ni}_3\text{O}(\text{TDAD})_6\text{Cl}_3]\text{Cl}$, providing a three-dimensional visualization of contact regions between neighbouring molecular units (Fig. 4). Mapping the Hirshfeld surface over the internal distance parameter (d_i) highlights close contacts involving atoms located within the surface. In this representation (Fig. 4(a)), distinct features are observed near hydrogen atoms bonded to nitrogen, indicating their proximity to electronegative neighbouring atoms. These features reflect the prominent donor behaviour of the amino groups of the TDAD ligands, which actively participate in hydrogen-bond formation. The external distance (d_e) surface (Fig. 4(b)), which emphasizes interactions with atoms outside the Hirshfeld surface, reveals pronounced regions corresponding to chloride and sulfur atoms. These regions illustrate the strong acceptor character of chloride ions and the participation of sulfur atoms from the thiadiazole rings in intermolecular contacts. The complementary nature of the d_i and d_e surfaces confirms the directional hydrogen bonding between N-H donors and chloride acceptors, as well as secondary contacts involving sulfur. The normalized contact distance (d_{norm}) surface (Fig. 4(c)) provides a comprehensive overview of the strength and significance of intermolecular interactions using a colour scale ranging from negative to positive values [12-14].



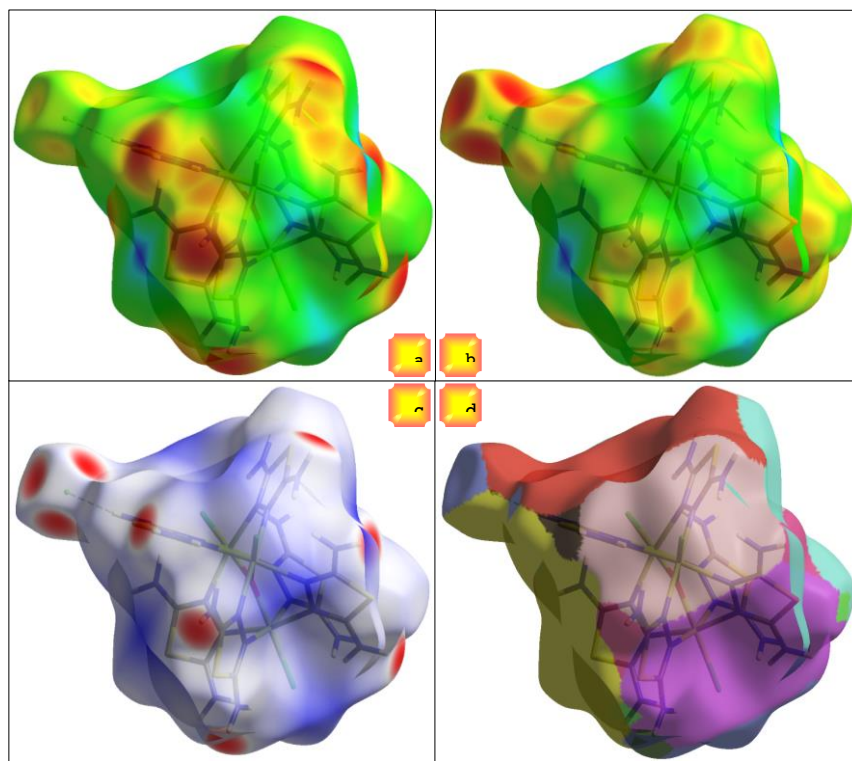
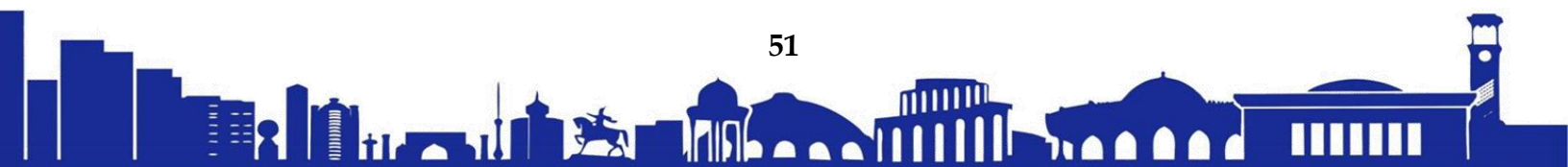


Fig. 4 Hirshfeld surface representations of $[\text{Ni}_3\text{O}(\text{TDAD})_6\text{Cl}_3]\text{Cl}$: (a) d_i map, (b) d_e map, (c) d_{norm} map and (d) fragment patch map.

Intense red spots appear in regions where intermolecular separations are shorter than the sum of van der Waals radii, indicating strong contacts. These red regions are predominantly localized around chloride ions and hydrogen atoms of the amino groups, clearly identifying $\text{N-H}\cdots\text{Cl}$ hydrogen bonds as the dominant stabilizing interactions within the lattice. White areas correspond to contacts close to van der Waals separations, while blue regions

represent longer, less influential interactions. The fragment patch representation (Fig. 4(d)) further partitions the Hirshfeld surface according to neighbouring molecular fragments. Distinct and well-defined patches surrounding chloride ions and thiadiazole rings indicate specific, directional interactions, whereas broader patches are associated with diffuse van der Waals contacts. Together, these surface features demonstrate that the crystal packing is primarily controlled by hydrogen bonding centred on chloride ions, reinforced by additional heteroatom-based interactions that collectively generate a robust three-dimensional supramolecular framework.

Conclusion. A new oxo-bridged trinuclear nickel(II) coordination cluster, $[\text{Ni}_3\text{O}(\text{TDAD})_6\text{Cl}_3]\text{Cl}$, supported by 1,3,4-thiadiazole-2,5-diamine ligands, was successfully synthesized and comprehensively characterized. Single-crystal X-ray diffraction analysis revealed the formation of a centrosymmetric trinuclear Ni_3O core in which each $\text{Ni}(\text{II})$ centre adopts a distorted octahedral coordination geometry. The



structural study demonstrated that the μ_3 -oxo bridge plays a crucial role in stabilizing the trinuclear framework and promoting cooperative metal–metal interactions within the cluster core. Extensive intermolecular N-H $\cdots$ Cl and N-H $\cdots$ N hydrogen-bonding interactions further contribute to the stabilization of the crystal packing, generating a robust three-dimensional supramolecular architecture. Hirshfeld surface analysis confirmed that hydrogen-bonding interactions involving chloride ions represent the dominant intermolecular contacts governing crystal packing stabilization. Comparative analysis with related CCDC-reported Ni(II) complexes demonstrated that the present compound is structurally distinguished by its trinuclear oxo-bridged topology and multidirectional supramolecular interaction network. Overall, the obtained results expand the structural chemistry of nitrogen-rich oxo-bridged nickel(II) clusters and provide valuable insight into the relationship between coordination geometry and supramolecular organization in multinuclear transition-metal systems.

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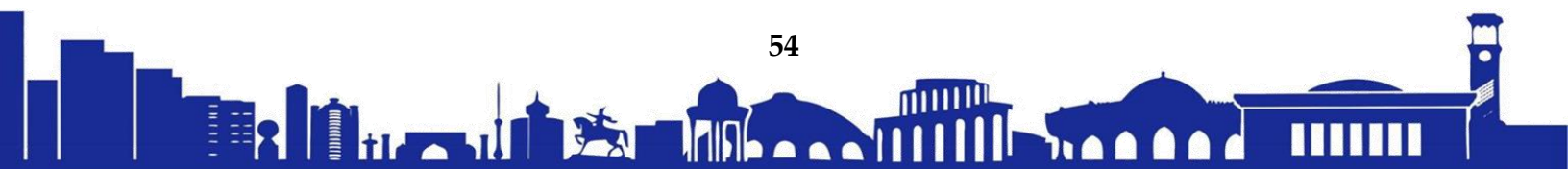
КРИСТАЛЛИЧЕСКАЯ СТРУКТУРА И АНАЛИЗ ПОВЕРХНОСТИ ХИРШФЕЛЬДА КОМПЛЕКСА ХЛОРИДА НИКЕЛЯ (II) С 1,3,4- ТИАДИАЗОЛ-2,5-ДИАМИНОМ

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Реферат. Предпосылки проблемы. Синтез и изучение оксо-мостовых
трехъядерных комплексов никеля(II) является важной областью современной



координационной химии, связанной с созданием материалов с контролируемыми структурными и функциональными свойствами.

Цель: Синтез нового оксо-мостового трехъядерного 1,3,4-тиодиазол-2,5-диамина в присутствии хлорида никеля(II) и анализ его структурных, морфологических и спектроскопических свойств.

Методология: Координационное соединение Ni (II) структурно характеризовалось монокристаллической рентгеновской дифракцией, а межмолекулярные взаимодействия в кристаллической решетке систематически изучались с помощью поверхностного анализа Гиршфельда. Научная новизна. Было синтезировано новое комплексное соединение с уникальными морфологическими и кристаллическими свойствами.

Научная новизна: Синтезировано новое сложное соединение с уникальными морфологическими и кристаллическими свойствами.

Полученные данные: Были изучены структура и физико-химические свойства вновь синтезированного координационного соединения.

Ключевые слова:

Никелевый оксо-мостовой трехъядерный комплексный материал, L1, Рентген, Анализ поверхности Хиршфельда.

Характеристики:

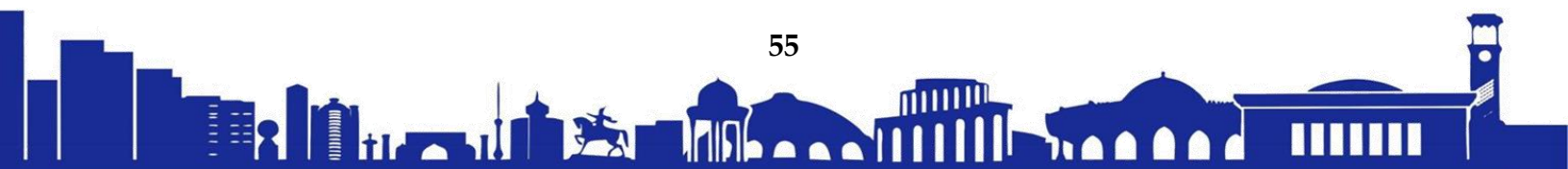
- Комплекс был синтезирован в присутствии соли Ni(II), L1, этанола и воды.
- Он имеет дискретную структуру.

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1,3,4-TIADIAZOL-2,5-DIAMIN BILAN NIKEL (II) XLORIDNING KRISTALL TUZILISHI VA HIRSHFELD SIRTİ TAHLILI

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Referat. *Muammoning kelib chiqishi.* Okso-ko'priqli uch yadroli nikel (II) kompleks birikmasini sintez qilish va o'rganish zamonaviy koordinatsion kimyoning dolzarb yo'nalishi bo'lib, tuzilma va funksional xususiyatlari boshqariladigan materiallar yaratish bilan bog'liq.

Maqsad: Yangi 1,3,4 tiodiazol 2,5 diamin va nikel(II) xlorid ishtirokida okso-ko'priqli uch yadroli sintez qilish hamda uning tuzilma, morfologik va spektroskopik xususiyatlarini tahlil qilish.

Metodologiya: Ni (II) koordinatsion birikmasi strukturaviy jihatdan monokristall rentgen difraksiyasi bilan tavsiflangan, kristall panjarasidagi molekulalararo o'zaro ta'sirlar esa Xirshfeld sirt tahlili yordamida tizimli ravishda o'rganilgan. Ilmiy yangilik. O'ziga xos morfologik va kristall xossalarga ega bo'lgan yangi kompleks birikma sintez qilindi.

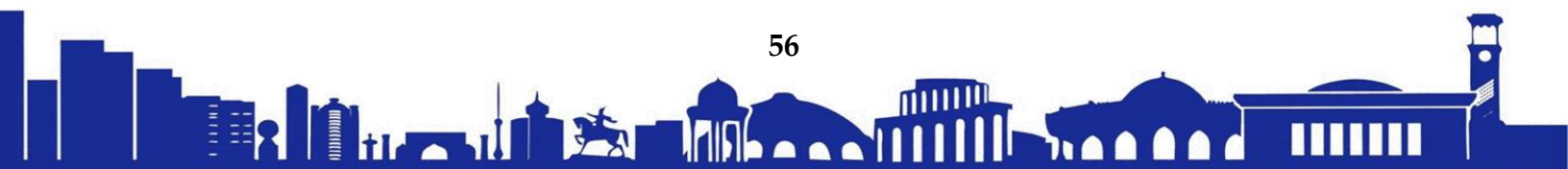
Ilmiy yangiligi. O'ziga xos morfologik va kristall xususiyatlarga ega bo'lgan yangi kompleks birikma sintez qilindi.

Olingan natijalar: Sintez qilingan yangi koordinatsion birikmaning tuzilishi va fizik-kimyoviy xususiyatlari o'rganildi.

Kalit so'zlar: Nikel asosidagi okso-ko'priqli uch yadroli kompleks birikma, L1, X-Ray, Hirshfeld sirt tahlili.

Xususiyatlari:

- Kompleks Ni (II) tuzi, L1, etanol va suv ishtirokida sintez qilindi.
- Diskret tuzilishga ega.



O'ZBEKISTON VA XORIJIY MAMLAKATLARDA DORIVOR O'SIMLIKLARNING O'RGANILISHI

Jumayeva Dilnoza Abdusattor qizi

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Dorivor o'simliklarni o'rganish tarixi insoniyat sivilizatsiyasining eng qadimiy davrlariga borib taqaladi. Bugungi kunda ham farmakognosiya, etnobotanika, fitokimyo hamda ekologiya fanlarining markaziy yo'nalishlaridan biri bo'lib qolmoqda. Biz O'zbekiston Respublikasi va xorijiy mamlakatlarda olib borilgan tadqiqotlarning tarixiy bosqichlari, hozirgi holati haqida fikr yuritamiz.

Dorivor o'simliklar haqida so'z borar ekan, Abu Rayhon Beruniyning eslamaslik mumkin emas. Uning xalq orasida "Saydana"¹ deb nom olgan asari o'simliklar nomi va ularning xususiyatlarini tasnif qilishga bag'ishlangan. Asar asli tilshunoslikka oid manba hisoblanadi. Unda dorivor o'simliklar nomi lug'at tartibida berilgan. Nomlar bir nechta tilda berilgan. Eng yaxshi jihati o'simliklarning ilim fanidagi nomi va uning xalq orasida qanaqa nom bilan mashhurligi ham aniq aytib o'tilgan. Bu usul oddiy aholining dorivor o'simliklarni topishdagi xatolarni bir necha barobarga kamaytirgan. Abu Rayhon Beruniy "Kitob as-saydana fi-t-tibb" asarida dorivor o'simliklar haqida 674 tur va 90 ta mahsulot haqida batafsil ma'lumot bergan. Bu asar O'rta Osiyo florasiga haqidagi birinchi sistematik tadqiqot bo'lib, o'simliklarning morfologik tavsifi, yig'ish muddatlari, farmakologik ta'siri, ularni qo'llanilish usullarini ilmiy jihatdan tasniflagan. Beruniyning yutug'i shundaki, u dorivor o'simliklarni faqat empirik tajriba asosida emas, balki kimyoviy va biologik xossalari bo'yicha tahlil qilgan.

Abu Ali ibn Sino (Avicenna) nomi bilan ham mashhur bo'lib, uning "Al-Qonun fi-t-tibb"² asarida 800 dan ortiq dorivor o'simlikni batafsil tasvirlab, ularning ontogenezi, kimyoviy tarkibi, terapevtik ta'sirini tahlil qilib bergan. Uning yutug'i dorivor

¹ Abu Rayhon Beruniy. Kitob as-saydana fi-t-tibb. – Toshkent: Fan nashriyoti, 1974. 5-12-betlar.

² Abu Ali ibn Sino. Al-Qonun fi-t-tibb. – Toshkent: Fan nashriyoti, 1995.

o'simliklarni nafaqat xalq tabobatida, balki ilmiy tibbiyotda qo'llashning nazariy asosini yaratganligi bilan ahamiyatlidir.

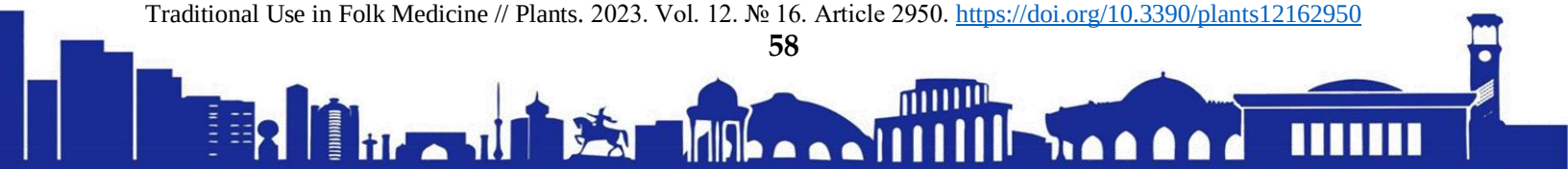
XX asrning ikkinchi yarmida dorivor o'simliklarni o'rganish va yetishtirishga alohida e'tibor qaratildi. "O'zbekistonda birinchi marta 1973-yilda Toshkent viloyati Bo'stonliq tumanidagi xo'jaliklarda dorivor o'simliklar ekila boshladi. Keyinroq (1978-yilda) Namangan viloyati Pop tumanida Ibn Sino nomli dorivor o'simliklar o'stiriladigan xo'jalik tashkil qilindi. Bu davrda O'rta Osiyo Davlat universiteti Botanika bog'ida, Fanlar akademiyasi Botanika institutida va boshqa muassasalarda keng ko'lamli tadqiqotlar olib borildi.

Mustaqillik yillarida (1991-yildan keyin) dorivor o'simliklarni o'rganish va yetishtirish yangi bosqichga ko'tarildi. O'zbekiston Respublikasi Prezidentining 2020-yil 10-apreldagi PQ-4670-sonli qarori "Yovvoyi holda o'suvchi dorivor o'simliklarni muhofaza qilish, madaniy holda yetishtirish, qayta ishlash va mavjud resurslardan oqilona foydalanish chora-tadbirlari to'g'risida" dorivor o'simliklar sohasini rivojlantirishda muhim hujjat bo'ldi. Ushbu qaror asosida 9 ta dorivor o'simliklar klasteri tashkil etildi, yovvoyi resurslarni saqlash va madaniy plantatsiyalarni barpo etish choralari ko'rildi. Hozirgi kunda Toshkent farmatsevtika instituti, O'zbekiston Fanlar akademiyasi Botanika instituti, O'rmon xo'jaligi davlat qo'mitasi va boshqa ilmiy muassasalarda dorivor o'simliklarning biologik xilma-xilligi, farmakologik xossalari va resurslarini o'rganish bo'yicha kompleks tadqiqotlar olib borilmoqda. "O'zbekistonda dorivor o'simliklarning 700 dan ortiq turi qayd etilgan, shulardan tabiiy sharoitda o'sadigan va madaniylashtirilgan 120 ga yaqin o'simlik turlaridan ilmiy va xalq tabobatida foydalaniladi.

Zamonaviy davrda O.Kahharovich Khojimatov³ning hissasini alohida ta'kidlash lozim. O.K.Khojimatov "Лекарственные растения Юго-Западного Тянь-Шаня" (2008) va "An overview of Ethnomedicinal plants of Uzbekistan" (Ethnobotany Research and Applications, 2020) asarlarida O'zbekiston florasidagi 600 dan ortiq dorivor turini etnobotanik va farmakognoz yondashuv bilan o'rgangan. Uning yutug'i endemik turlarni inventarizatsiya qilish, ularning xalq tabobatidagi qo'llanilishini ilmiy asoslashda bo'ldi. O.Abduraimov⁴ning "The Main Medicinal Plants in Arid Regions of Uzbekistan and

³ Khojimatov O.K. Лекарственные растения Юго-Западного Тянь-Шаня. – Тошкент, 2008. 322 с.

⁴ Abduraimov O.S., Li W., Shomurodov H.F., Feng Y. The Main Medicinal Plants in Arid Regions of Uzbekistan and Their Traditional Use in Folk Medicine // Plants. 2023. Vol. 12. № 16. Article 2950. <https://doi.org/10.3390/plants12162950>



Their Traditional Use in Folk Medicine” (Plants, 2023) asari cho‘l va adir zonalardagi 529 tur dorivor o‘simlikni tahlil qilgan. O.Abduraimov adir hududlarda dorivor o‘simliklarning ekologik moslashuvchanligini va xalq tabobatidagi qo‘llanilishini chuqur o‘rgangan. Uning yutug‘i iqlim o‘zgarishi sharoitida resurslarni saqlash bo‘yicha amaliy tavsiyalar berishda yaqqol namoyon bo‘lgan.

O‘.Ahmedov⁵, A.Ergashev, A.Abzalov, M.Yulchiyeva, D.Mustafakulovlarning “Dorivor o‘simliklar yetishtirish texnologiyasi va ekologiya” asari sovet davridan keyingi yetishtirish tajribasini umumlashtirgan. Yetishtirish qonuniyatlari haqida juda qimmatli ma‘lumotlar berganligi bilan xarakterlidir. Z.I.Sanoyev⁶, P.Q.Turdiyev, N.X.Alimova, B.P.Berdimurodovlarning “Farmakognoziya” ishida ham O‘zbekistondagi 700 dan ortiq dorivor turini va ularning farmakologik xossalarini sistemalashtirgan.

H.X.Xolmatov⁷ning “Farmakognoziya I qism” ishida klaster tizimi va eksport salohiyati tahlil qilgan.

X.K.Karshibayev⁸, T.X.Maxkamovlarning “Dorivor o‘simliklar biologiyasi va ekologiyasi” nomli asarida o‘simliklarning biologik va ekologik xususiyatlari chuqur o‘rganilgan.

D.Khamraeva⁹ va A.Khujanovning hamkorlikdagi ishlarida *Lamiaceae* oilasiga mansub efir moyli o‘simliklarning introduksiyasi va etnobotanikasi o‘rganilgan. Bu ishlar O‘zbekiston Fanlar akademiyasi Botanika institutida dorivor o‘simliklar resurslarini saqlash va barqaror foydalanish strategiyasini ishlab chiqishga asos bo‘ldi.

Xorijiy mamlakatlarda dorivor o‘simliklarni o‘rganish tarixi ham qadimiy davrlarga borib taqaladi. Qadimgi Xitoyda Shen Nung (miloddan avvalgi 2500-yillar) dorivor o‘simliklar haqida birinchi qo‘llanmani tuzgan. Hindistonda Ayurveda tizimi dorivor o‘simliklarni kompleks ravishda o‘rganib, bugungi kunda ham ularning 40-60% dori vositalari o‘simlik xom ashyosidan tayyorlanadi. Yevropada farmakognoziya fani

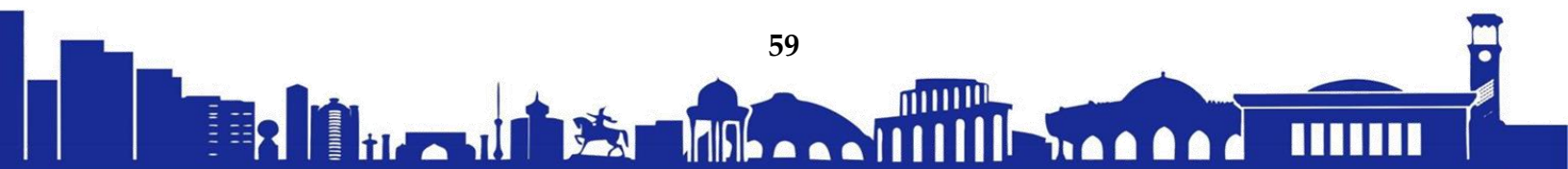
⁵ Ahmedov O‘., Ergashev A., Abzalov A., Yulchiyeva M., Mustafakulov D. Dorivor o‘simliklar yetishtirish texnologiyasi va ekologiya. – Toshkent: Tafakkur bo‘stoni, 2018. 45-47-betlar. 224 b.

⁶ Sanoyev Z.I., Turdiyev P.Q., Alimova N.X., Berdimurodov B.P. Farmakognoziya. Darslik. – Toshkent, 2023. 417 b.

⁷ Xolmatov H.X. Farmakognoziya. I qism. – Toshkent, 2023. 210-212-betlar. 404 b.

⁸ Karshibayev X.K., Maxkamov T.X. Dorivor o‘simliklar biologiyasi va ekologiyasi. – Guliston: “Ziyo Nashr-Matbaa” nashriyoti, 2022. 245 b.

⁹ Khamraeva D.T., Fakhridinova D., Khojimatov O., Bussmann R.W., Abdinazarov S.K. Introduction of valuable medicinal plants of traditional medicine of Lamiaceae family in the conditions of the Tashkent Botanical Garden // Ethnobotany Research and Applications. 2024. Vol. 29. P. 1–12. Rasmiy havola: <https://ethnobotanyjournal.org/index.php/era/article/view/6011>



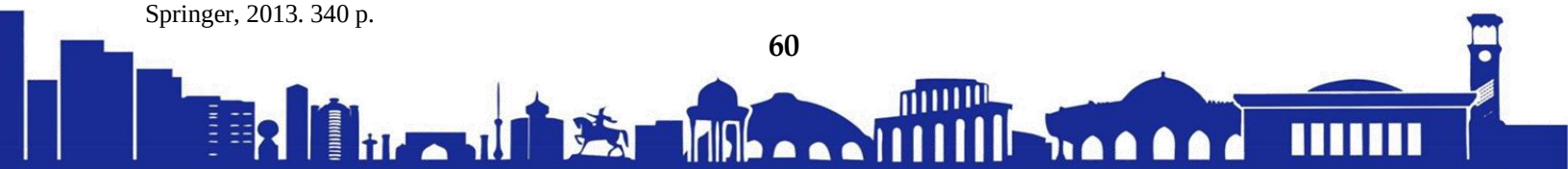
XVIII-XIX asrlarda shakllangan bo‘lib, Dioskoridning “Materia medica” asari (I asr) va Galen asarlari asos bo‘ldi. Rossiyada A.F. Gammerman, A.P. Orexov va boshqa olimlar O‘rta Osiyo dorivor o‘simliklarini chuqur o‘rgandilar. Zamonaviy davrda Xitoyning an‘anaviy tibbiyoti (TCM), Hindistonning Ayurveda va Yevropa mamlakatlaridagi farmatsevtika sanoati dorivor o‘simliklarni biotexnologiya va nanotexnologiya usullari bilan birgalikda o‘rganmoqda.

Hozirgi holatda O‘zbekiston Respublikasida dorivor o‘simliklarni o‘rganish ilmiy-tadqiqot institutlari, oliy ta’lim muassasalari va klasterlar tizimida olib borilmoqda. Fanlar akademiyasi Botanika instituti va Botanika bog‘ida efir moyli, dorivor va bo‘yoqli o‘simliklar laboratoriyalari faoliyat yuritmoqda. 1997-yilda “Safro haydovchi Hojimatov yig‘masi” kabi dorivor yig‘malar yaratildi va tibbiyotda qo‘llashga ruxsat etildi. Prezident qarorlari (PQ-3532, PQ-5707, PQ-4670) asosida farmatsevtika sanoatini rivojlantirish va dorivor o‘simliklar resurslarini barqaror boshqarish choralari kuchaytirildi. Natijada, 2020-yildan keyin dorivor o‘simliklar yetishtirish klasterlari soni ortib, eksport salohiyati oshdi.

Xorijiy tajribada Xitoy va Hindiston dorivor o‘simliklarning 80% dan ortig‘ini madaniy holda yetishtiradi va global bozorga yetkazib beradi. Yevropa Ittifoqida farmakognoziya laboratoriyalari kimyoviy tarkib va standartlashtirishga katta e’tibor qaratadi. O‘zbekiston bu tajribani o‘zlashtirib, introduksiya va iqlimlashtirish orqali mahalliy florani boyitmoqda. Hozirgi holatda iqlim o‘zgarishi va antropogen ta’sir tufayli ba’zi dorivor o‘simliklar kamayib bormoqda, shuning uchun muhofaza va barqaror foydalanish dolzarb masaladir. Surxondaryo viloyati kabi mintaqalarda dorivor o‘simliklar resurslari boy bo‘lib, ularni o‘rganish va qayta ishlash istiqbollari katta.

Xorijlik tadqiqotchilar S.W.Eisenman¹⁰, D.E.Zaurov va L.Struwe tahriridagi monumental “Medicinal Plants of Central Asia: Uzbekistan and Kyrgyzstan” nomli asari diqqatga sazavordir. Bu kitob Rutger universiteti (AQSh) va O‘zbekiston, Qirg‘iziston olimlari hamkorligida yaratilgan birinchi ingliz tilidagi yirik asar bo‘lib, Markaziy Osiyoning 200 dan ortiq muhim dorivor o‘simligini taksonomiya, morfologiya, ekologiya, etnobotanika, fitokimyo va farmakologiya jihatdan batafsil yoritib bergan. S.Eisenman va D.Zaurovlarning yutug‘i shundaki, ular ko‘plab turlarning dorivor xossalarini birinchi

¹⁰ Sasha Eisenman, David Zaurov, Lena Struwe. Medicinal Plants of Central Asia: Uzbekistan and Kyrgyzstan. – New York: Springer, 2013. 340 p.



marta ingliz tilida hujjatlashtirganlar, yuzlab rangli fotosuratlar va ingliz-rus lugʻatlarini tuzganlar. Kitob Oʻzbekiston florasining geografik, iqlimiy va vegetatsiya xususiyatlarini ham tahlil qilgan boʻlib, Surxondaryo kabi janubiy hududlar uchun muhim manba hisoblanadi. Bu asar xorijiy olimlarning Markaziy Osiyo dorivor oʻsimliklarini ilmiy jihatdan “kashf etishida” muhim qadam boʻlgan va keyingi xalqaro loyihalarga asos yaratdi.

R.W.Bussmann¹¹ ning hamkorlikdagi “An overview of Ethnomedicinal plants of Uzbekistan” (Ethnobotany Research and Applications, 2020) maqolasi muhim tadqiqotlardan biri hisoblanadi. Bussmannning yutugʻi etnobotanik metodlarni (yarim strukturalashtirilgan intervyular, ekspeditsiyalar) shaklida qoʻllab, Oʻzbekistonda 117 tur dorivor oʻsimlikni 45 oila va 94 turkum boʻyicha hujjatlashtirishdagi mehnatlari orqali aniq koʻringan. U Oʻzbekistonni Markaziy Osiyoning dorivor oʻsimliklar xilma-xilligi markazi sifatida baholagan va endemizm darajasini taʼkidlagan. Bussmannning boshqa ishlari (masalan, 2020-yildagi bir qator maqolalar) Markaziy Osiyo etnofarmakologiyasini global kontekstda solishtirishga yordam beradi.

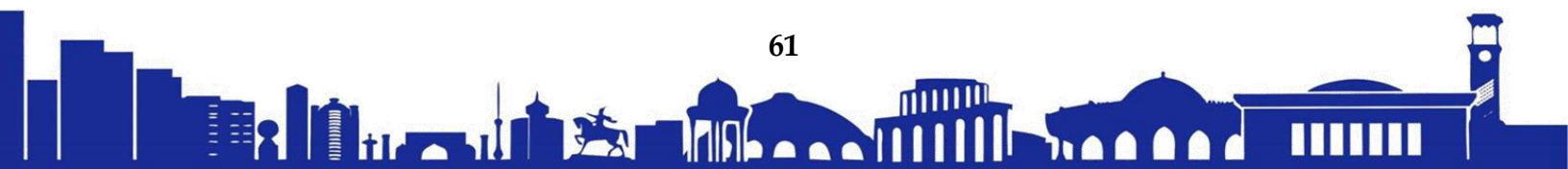
F.Sharopov¹²ning “Aromatic Medicinal Plants from Tajikistan (Central Asia)” maqolasida hamda Markaziy Osiyo boʻyicha keyingi tadqiqotlari efir moyli oʻsimliklarning fitokimyosini chuqur oʻrgangan. F.Sharopovning yutugʻi 18 ta aromatik oʻsimlikning ikkilamchi metabolitlar tarkibini va biologik faolligini aniqlashida boʻldi. Bu ishlar Oʻzbekistonning Surxondaryo va boshqa togʻli zonalardagi shunga oʻxshash turlar (yalpiz, shuvoq) uchun qiyosiy tahlil imkonini beradi.

Y.Gafforov¹³ va hamkorlarining “Exploring biodiversity and ethnobotanical significance of Solanum species in Uzbekistan” maqolasida *Solanum* jinsining 8 turini (*S. dulcamara*, *S. lycopersicum* va boshqalar) etnobotanik va farmakologik jihatdan batafsil koʻrib chiqqan. Ularning yutugʻi Oʻzbekistonda *Solanum* turlarining morfologiyasi, tarqalishi, fenologiyasi, farmakologiyasi va fitokimyosini birinchi marta kompleks tahlil

¹¹ Khojimatov O. K., Khamraeva D. T., Khujanov A. N., & Bussmann R. W. (2020). An overview of Ethnomedicinal plants of Uzbekistan. *Ethnobotany Research and Applications*, 20, 1–19. <https://doi.org/10.32859/era.20.08.1-19>

¹² Sharopov F. S., Zhang, H., Wink, M., & Setzer, W. N. (2015). Aromatic Medicinal Plants from Tajikistan (Central Asia). *Medicines*, 2(1), 28–46. <https://doi.org/10.3390/medicines2010028>

¹³ Gafforov Y., Raʼseta M., Zafar M., Makhkamov T., Yarasheva M., Chen J.-J., Zhumagul M., Wang M., Ghosh S., Abbasi A.M., Yuldashev A., Mamarakhimov O., Alosaimi A.A., Berdieva D., Rapior S. Exploring biodiversity and ethnobotanical significance of *Solanum* species in Uzbekistan: unveiling the cultural wealth and ethnopharmacological uses // *Frontiers in Pharmacology*. 2024. 14. 1287793. <https://doi.org/10.3389/fphar.2023.1287793>



qilishgan. Bu tadqiqot O'zbekiston florasini uchun yangi yo'nalish ochdi va xalqaro hamkorlikni kuchaytirdi.

N.Aldayarov¹⁴ va hamkorlarining “An ethnoveterinary study of wild medicinal plants used by the Kyrgyz farmers” va “An ethnobotanical study of plants and traditional herbal therapies in the Kara-Koy Gorge, Kyrgyz Republic” ishlarida Markaziy Osiyo etnoveterinariyasini o'rgangan. N.Aldayarovning yutug'i uy hayvonlari kasalliklarida qo'llaniladigan yovvoyi o'simliklarni hujjatlashtirish va tayyorlash usullarini tizimlashtirishida bo'ldi. Bu ishlar O'zbekistonning qo'shni hududlari bilan qiyosiy tahlil uchun fundament bo'la oladi.

Longwood Gardens¹⁵ (AQSh) botaniklari va Plant Collecting Collaborative guruhining O'zbekistondagi ekspeditsiyalari noyob va tahdid ostidagi turlarni yig'ish va saqlash bo'yicha xalqaro hamkorlikni boshlagan. Ularning yutug'i O'zbekiston florasini bilan hamkorlikdagi urug' va gerbariy to'plamlarini yaratishda namoyon bo'ldi.

Bundan tashqari, Pedanius Dioskorides¹⁶ning “De Materia Medica” asarida 657 ta o'simlik tasvirlangan; Li Shizhen¹⁷ “Ben Cao Gang Mu” ishida 1892 ta dori va 11 000 retseptni o'z ichiga oladigan ma'lumotlar uchraydi; Shen Nung¹⁸ “Shen nong ben cao jing” ishi birinchi dorivor qo'llanma hisoblanadi; Barbara Griggs¹⁹ “Green Pharmacy” ilk bor G'arb tabobatining tarixini ochib bergan; David Hoffman²⁰ “Medical Herbalism” klinik amaliyotni birlashtirgan; Andrew Chevallier²¹ “Encyclopedia of Herbal Medicine” 550 ta o'simlikka ensiklopedik tavsif tayyorlagan.

Yuqoridagi tadqiqotlardan ayon bo'ladiki, dorivor o'simliklar bo'yicha xorijda hamda respublikamizda juda keng qamrovli ishlar amalga oshirilgan. Ularning kimyoviy,

¹⁴ Aldayarov N., Tulobaev A., Salykov R., Jumabekova J., Kydyralieva B., Omurzakova N., Kurmanbekova G., Imanberdieva N., Usulaliev B., Borkoev B., Salieva K., Salieva Z., Omurzakov T., Chekirov K. An ethnoveterinary study of wild medicinal plants used by the Kyrgyz farmers // Journal of Ethnopharmacology. 2022. 285. 114842. <https://doi.org/10.1016/j.jep.2021.114842>

¹⁵ Zale P. Uncharted Territory: Plant Exploration in Uzbekistan // Longwood Gardens Blog. 2019. January 10. <https://longwoodgardens.org/blog/2019-01-10/uncharted-territory-plant-exploration-uzbekistan>

¹⁶ Dioscorides Pedanius (of Anazarbus). De materia medica. Translated and edited by Lily Y. Beck. Hildesheim: Olms-Weidmann, 2005. xxviii + 540 p. (Alttertumswissenschaftliche Texte und Studien, Band 38). ISBN 3-487-12881-0.

¹⁷ University of California Press seriyasi: <https://www.ucpress.edu/series/ben-cao-gang-mu-16th-century-chinese-encyclopedia-of-materia-medica-and-natural-history>

¹⁸ Shen Nong. Shen Nong Ben Cao Jing (The Divine Farmer's Materia Medica) / Transl. by Yang Shou-zhong. Boulder, CO: Blue Poppy Press, 1998.

¹⁹ Barbara Griggs Green Pharmacy. – Rochester: Healing Arts Press, 1997. 400 p.

²⁰ David Hoffman Medical Herbalism. – Rochester: Healing Arts Press, 2003. 672 p.

²¹ Andrew Chevallier Encyclopedia of Herbal Medicine. –London: DK Publishing, 2016. 336 p.



morfologik, farmokologik va boshqa xususiyatlari yaxshi o'rganilgan. Biroq Surxondaryo viloyatida va O'zbekistonning boshqa hududlarida deyarli o'rganilmagan dorivor o'simliklar mavjud. Masalan, noyob Ferula turlari (Ferula tadshikorum va boshqalar), ba'zi endemik Astragalus va Lagochilus turlari, shuningdek, tog'li zonalardagi kam uchraydigan Lamiaceae va Asteraceae vakillari kimyoviy tarkibi, farmakologik ta'siri va ekologik holati bo'yicha to'liq o'rganilmagan. Ular iqlim o'zgarishi va antropogen ta'sir tufayli yo'qolib ketish xavfi ostida. Kelgusidagi tadqiqotlar ushbu bo'shliqlarni to'ldirishi kerak.

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THE EFFECTIVENESS OF PHONICS-BASED INSTRUCTION IN DEVELOPING ENGLISH PRONUNCIATION SKILLS AMONG PRIMARY SCHOOL LEARNERS

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Abstract: This article examines the effectiveness of phonics-based instruction in developing English pronunciation skills among primary school learners. Phonics is recognized as an essential approach that helps young learners establish relationships between letters and sounds, thereby improving pronunciation accuracy and reading fluency. The study explores the theoretical foundations of phonics instruction and its practical application in primary English language classrooms. Particular attention is given to the role of phonics activities in enhancing learners' phonemic awareness, sound discrimination, and oral communication skills. The findings suggest that systematic phonics instruction contributes significantly to the development of accurate pronunciation and increases learners' confidence in using English in classroom interactions.

Keywords: phonics, pronunciation, primary education, English language teaching, phonemic awareness, young learners, language acquisition.

Annotatsiya: Ushbu maqolada boshlang'ich ta'limda ingliz tili talaffuz ko'nikmalarini rivojlantirishda foniks (phonics) asosidagi o'qitish yondashuvlarining samaradorligi tahlil qilinadi. Foniks usuli o'quvchilarga harf va tovushlar o'rtasidagi bog'liqlikni anglashga yordam berib, talaffuz aniqligi hamda o'qish malakasini rivojlantiradi. Tadqiqotda foniks metodikasining nazariy asoslari va uning boshlang'ich sinflardagi amaliy qo'llanilishi yoritilgan. Shuningdek, foniks mashg'ulotlarining fonematik eshituv, tovushlarni farqlash va og'zaki nutq ko'nikmalarini shakllantirishdagi o'rni tahlil qilingan. Natijalar foniks asosidagi tizimli ta'lim o'quvchilarning to'g'ri talaffuzini rivojlantirish hamda ingliz tilida muloqot qilishga bo'lgan ishonchini oshirishini ko'rsatadi.

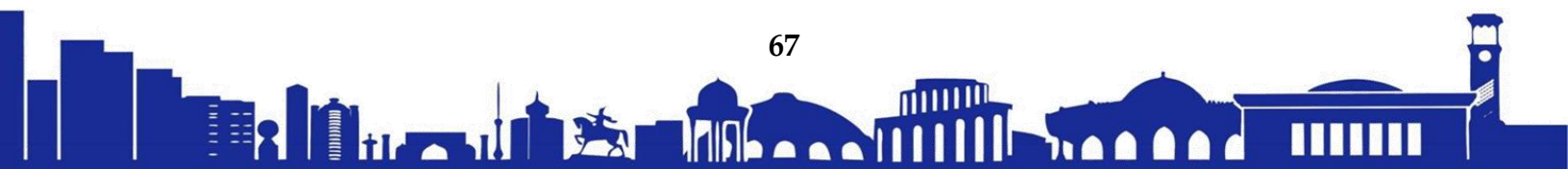
Kalit so‘zlar: foniks, talaffuz, boshlang‘ich ta‘lim, ingliz tilini o‘qitish, fonematik ong, yosh o‘quvchilar, til o‘zlashtirish.

Аннотация: В данной статье рассматривается эффективность фонетического подхода (phonics) в развитии навыков английского произношения у учащихся начальной школы. Метод phonics помогает детям устанавливать связь между буквами и звуками, что способствует улучшению правильности произношения и навыков чтения. В исследовании освещаются теоретические основы данного подхода и особенности его практического применения на уроках английского языка в начальной школе. Особое внимание уделяется развитию фонематического восприятия, различению звуков и формированию устной речи учащихся. Результаты показывают, что систематическое использование phonics способствует более точному произношению и повышает уверенность детей в использовании английского языка в процессе общения.

Ключевые слова: фонетический метод, произношение, начальное образование, обучение английскому языку, фонематическое восприятие, младшие школьники, усвоение языка.

INTRODUCTION

The development of accurate pronunciation is one of the fundamental objectives of foreign language learning, particularly in primary education where learners establish the foundation for future language proficiency. In English language teaching, pronunciation plays a crucial role in effective communication, as it directly influences learners' ability to understand and be understood by others. However, English pronunciation often presents challenges for young learners due to the complex relationship between spelling and sound. Recent developments in language pedagogy have highlighted the importance of phonics-based instruction as an effective approach to teaching pronunciation in the early stages of language learning. Phonics focuses on the systematic relationship between letters and sounds, enabling learners to decode words, improve reading skills, and develop more accurate pronunciation patterns. Through phonics activities, children become familiar with English sound systems and gradually acquire the ability to recognize, produce, and distinguish individual phonemes. The increasing emphasis on communicative competence in modern education has created a need for teaching methods that support both pronunciation and literacy development. Phonics-



based approaches address this need by integrating listening, speaking, reading, and spelling skills into a unified learning process. These approaches are particularly valuable in primary classrooms where learners are naturally responsive to interactive, multisensory, and activity-based instruction. Researchers in the field of language education have noted that early phonological awareness significantly contributes to successful language acquisition. Learners who receive systematic phonics instruction tend to demonstrate greater confidence in oral communication, improved reading fluency, and enhanced pronunciation accuracy. As a result, phonics has become an essential component of many English language teaching programs worldwide.

This study explores the role of phonics-based approaches in teaching English pronunciation in primary education. It aims to examine the pedagogical value of phonics instruction, identify its key principles, and evaluate its contribution to the development of pronunciation skills among young English language learners.

MAIN BODY

Teaching pronunciation at the primary level requires methods that are both engaging and effective. Young learners acquire language more successfully when they are exposed to meaningful and interactive learning experiences. Among the various approaches used in English language teaching, phonics has gained significant recognition for its ability to connect spoken and written language. By teaching learners the relationship between letters and sounds, phonics provides a solid foundation for pronunciation development. Phonics instruction begins with the introduction of individual letter sounds rather than letter names. Learners are encouraged to recognize and pronounce sounds accurately before combining them into words. This process helps children develop phonemic awareness, which refers to the ability to hear, identify, and manipulate individual sounds in words. Strong phonemic awareness is essential for both reading and pronunciation because it enables learners to distinguish between similar sounds and produce them correctly. One of the main advantages of phonics-based instruction is its systematic nature. Sounds are introduced gradually, allowing learners to build their knowledge step by step. For example, students may first learn simple consonant sounds such as /b/, /m/, and /s/, followed by short vowel sounds. Once these sounds are mastered, learners practice blending them to form words such as “bat,” “map,” and “sit.” Through repeated exposure and practice, pronunciation becomes more natural and accurate. Multisensory phonics

activities play an important role in primary education. Teachers often combine visual, auditory, and kinesthetic techniques to enhance learning outcomes. Flashcards, picture-word matching exercises, songs, chants, and pronunciation games help learners associate sounds with symbols while maintaining high levels of motivation. Such activities create a positive learning environment where children can practice pronunciation without fear of making mistakes. Phonics instruction also contributes to the improvement of reading fluency. As learners become familiar with sound-letter correspondences, they can decode unfamiliar words more easily. This ability reduces dependence on memorization and encourages independent learning. Furthermore, accurate decoding supports proper pronunciation because learners can apply phonics rules when encountering new vocabulary. Despite its advantages, phonics instruction should not be viewed as the only method for teaching pronunciation. English contains many irregular words whose pronunciation does not always correspond to standard phonics patterns. Therefore, phonics should be supplemented with listening activities, authentic audio materials, classroom interaction, and communicative speaking tasks. A balanced approach allows learners to develop both pronunciation accuracy and communicative competence. Modern educational technologies have further expanded the possibilities of phonics instruction. Interactive applications, digital games, and multimedia resources provide learners with immediate feedback on pronunciation and allow them to practice independently. These tools increase engagement and make pronunciation practice more accessible and enjoyable for young learners. The effectiveness of phonics-based approaches depends largely on the teacher's ability to select appropriate activities and adapt instruction to learners' developmental needs. When implemented systematically and consistently, phonics serves as a powerful tool for improving English pronunciation, strengthening phonological awareness, and supporting overall language acquisition in primary education.

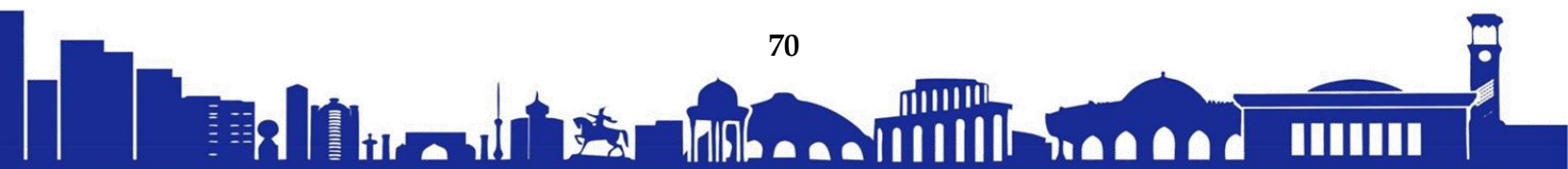
CONCLUSION

Phonics-based instruction plays a significant role in developing English pronunciation skills among primary school learners. By establishing a clear connection between letters and sounds, phonics helps young learners improve pronunciation accuracy, phonemic awareness, and reading abilities. The systematic nature of phonics instruction enables children to acquire pronunciation skills gradually and confidently. The study demonstrates

that phonics activities support not only correct sound production but also broader language development, including reading fluency and oral communication. Interactive and multisensory phonics exercises increase learner motivation and create opportunities for meaningful language practice. At the same time, effective pronunciation teaching requires the integration of phonics with listening, speaking, and communicative activities to address the complexities of English pronunciation. Overall, phonics-based approaches provide a strong foundation for early English language learning and contribute to the successful development of pronunciation competence in primary education. Their consistent implementation can enhance learners' confidence, improve language performance, and facilitate long-term language acquisition.

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NOGIRONLIGI BO'LGAN SHAXSLARNING O'Z-O'ZINI BAHOLASHI VA IJTIMOY QO'LLAB-QUVVATLASH O'RTASIDAGI BOG'LIQLIKNING PSIXOLOGIK ASOSLARI.

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Annotatsiya: Ushbu maqolada nogironligi bo'lgan shaxslarning o'z-o'zini baholash darajasi va ularga ko'rsatiladigan ijtimoiy qo'llab-quvvatlash o'rtasidagi bog'liqlikning psixologik asoslari tahlil qilinadi. Tadqiqotda o'z-o'zini baholashning shaxs psixologik holati, ijtimoiy moslashuvi hamda hayot sifati bilan uzviy aloqadorligi yoritilgan. Shuningdek, oilaviy, do'stona va institutsional qo'llab-quvvatlashning nogironligi bo'lgan shaxslarning o'ziga bo'lgan ishonchi, motivatsiyasi va ijtimoiy faolligiga ta'siri ilmiy manbalar asosida ko'rib chiqilgan. Tadqiqot natijalari ijtimoiy qo'llab-quvvatlash darajasi yuqori bo'lgan shaxslarda ijobiy o'z-o'zini baholash ko'rsatkichlari ham yuqori bo'lishini ko'rsatadi. Maqolada nogironligi bo'lgan shaxslarning psixologik farovonligini oshirishda kompleks psixologik va ijtimoiy yordam tizimini takomillashtirish bo'yicha tavsiyalar ishlab chiqilgan.

Kalit so'zlar: Nogironligi bo'lgan shaxslar, o'z-o'zini baholash, ijtimoiy qo'llab-quvvatlash, psixologik moslashuv, psixologik farovonlik.

Kirish

Zamonaviy jamiyatda nogironligi bo'lgan shaxslarning huquqlari, ijtimoiy faolligi va psixologik farovonligini ta'minlash dolzarb masalalardan biri hisoblanadi. Insonning jamiyatdagi o'rnini nafaqat uning jismoniy imkoniyatlari, balki o'ziga bo'lgan munosabati, o'z qadr-qimmatini anglash darajasi va ijtimoiy muhit tomonidan qo'llab-quvvatlanishiga ham bevosita bog'liqdir. Shu jihatdan nogironligi bo'lgan shaxslarning o'z-o'zini baholashi va ularga ko'rsatiladigan ijtimoiy qo'llab-quvvatlash o'rtasidagi munosabatlarni psixologik nuqtai nazardan o'rganish muhim ilmiy-amaliy ahamiyat kasb

etadi. O‘z-o‘zini baholash shaxsning o‘z imkoniyatlari, qobiliyatlari va jamiyatdagi mavqeiga nisbatan shakllangan subyektiv munosabatini ifodalaydi. Ijobiy o‘z-o‘zini baholash insonning ruhiy barqarorligi, ijtimoiy moslashuvi va hayotdan qoniqish darajasini oshiradi. Aksincha, salbiy o‘z-o‘zini baholash depressiv holatlar, ijtimoiy chekinish va motivatsiyaning pasayishiga olib kelishi mumkin. Nogironligi bo‘lgan shaxslarda esa bu jarayon yanada murakkab kechadi, chunki ular ko‘pincha jismoniy, ijtimoiy va psixologik to‘siqlarga duch keladilar.

Ijtimoiy qo‘llab-quvvatlash shaxsning oila a‘zolari, do‘stlari, ta’lim muassasalari, ish jamoalari hamda davlat va nodavlat tashkilotlari tomonidan ko‘rsatiladigan moddiy, ma’naviy va emotsional yordamni o‘z ichiga oladi. Psixologik tadqiqotlar shuni ko‘rsatadiki, kuchli ijtimoiy qo‘llab-quvvatlash tizimi shaxsning stressga chidamliligini oshiradi, o‘ziga bo‘lgan ishonchini mustahkamlaydi va ijtimoiy integratsiyasini ta’minlaydi. Ayniqsa, nogironligi bo‘lgan shaxslar uchun qo‘llab-quvvatlovchi muhit ularning o‘z imkoniyatlarini to‘liq namoyon etishlari va jamiyat hayotida faol ishtirok etishlariga xizmat qiladi. So‘nggi yillarda inklyuziv jamiyatni shakllantirish, nogironligi bo‘lgan shaxslarning huquqlarini himoya qilish hamda ularning psixologik salomatligini mustahkamlash masalalariga alohida e’tibor qaratilmoqda.

Tadqiqot usullari va metodologiyasi

Mazkur tadqiqot nogironligi bo‘lgan shaxslarning o‘z-o‘zini baholashi va ijtimoiy qo‘llab-quvvatlash darajasi o‘rtasidagi bog‘liqlikni aniqlash hamda ushbu munosabatlarning psixologik asoslarini o‘rganishga qaratildi. Tadqiqotda kompleks yondashuv asosida nazariy va empirik usullardan foydalanildi. Tadqiqotning nazariy asosini shaxs psixologiyasi, ijtimoiy psixologiya va inklyuziv ta’lim yo‘nalishlaridagi ilmiy manbalar tashkil etdi. Xususan, o‘z-o‘zini baholash nazariyalari, ijtimoiy qo‘llab-quvvatlash konsepsiyalari hamda nogironligi bo‘lgan shaxslarning psixologik moslashuviga oid ilmiy tadqiqotlar tahlil qilindi. Mavzuga oid mahalliy va xorijiy ilmiy adabiyotlar qiyosiy o‘rganilib, muammoning zamonaviy talqini va ilmiy yondashuvlari umumlashtirildi. Empirik tadqiqotda 18–45 yosh oralig‘idagi turli toifadagi nogironligi bo‘lgan 120 nafar respondent ishtirok etdi. Ishtirokchilar tanlovi ixtiyoriylik va maxfiylik tamoyillari asosida amalga oshirildi. Tadqiqot jarayonida respondentlarning o‘z-o‘zini baholash darajasini aniqlash uchun Rosenbergning “O‘z-o‘zini baholash shkalasi”,



ijtimoiy qo'llab-quvvatlash darajasini baholash uchun esa ko'p o'lchovli ijtimoiy qo'llab-quvvatlash shkalasidan foydalanildi.

Ma'lumotlarni yig'ish jarayonida anketa so'rovi, psixologik testlar va yarim tuzilmaviy suhbat metodlari qo'llanildi. Anketa respondentlarning demografik xususiyatlari, ta'lim darajasi, oilaviy holati va ijtimoiy faolligiga oid ma'lumotlarni olish imkonini berdi. Suhbatlar orqali esa ularning shaxsiy tajribalari, jamiyat bilan o'zaro munosabatlari va qo'llab-quvvatlash tizimiga nisbatan qarashlari chuqur o'rganildi. Olingan natijalar statistik tahlil usullari yordamida qayta ishlandi. Deskriptiv statistika, korrelyatsion tahlil hamda taqqoslash metodlari qo'llanib, o'z-o'zini baholash va ijtimoiy qo'llab-quvvatlash ko'rsatkichlari o'rtasidagi bog'liqlik darajasi aniqlandi. Tadqiqot natijalarining ishonchliligini ta'minlash maqsadida ma'lumotlar bir necha bosqichda tekshirildi va tahlil qilindi. Tadqiqot metodologiyasi insonparvarlik, obyektivlik, tizimlilik va ilmiylik tamoyillariga asoslandi. Shu bilan birga, ishtirokchilarning huquqlari, shaxsiy ma'lumotlari maxfiyligi va tadqiqotda ishtirok etishning ixtiyoriyligi to'liq ta'minlandi. Mazkur metodologik yondashuv nogironligi bo'lgan shaxslarning o'z-o'zini baholashi va ijtimoiy qo'llab-quvvatlash o'rtasidagi psixologik bog'liqlikni har tomonlama va ishonchli tahlil qilish imkonini berdi.

Tadqiqot natijalari

Tadqiqot davomida nogironligi bo'lgan shaxslarning o'z-o'zini baholash darajasi hamda ularga ko'rsatilayotgan ijtimoiy qo'llab-quvvatlashning psixologik ahamiyati o'rganildi. Empirik ma'lumotlar tahlili natijasida respondentlarning aksariyatida o'z-o'zini baholash ko'rsatkichlari ijtimoiy qo'llab-quvvatlash darajasiga bevosita bog'liq ekanligi aniqlandi. Tadqiqotda ishtirok etgan 120 nafar respondentning 32,5 foizida o'z-o'zini baholash darajasi yuqori, 46,7 foizida o'rtacha va 20,8 foizida past darajada ekanligi qayd etildi. Shu bilan birga, respondentlarning 61,7 foizi oila a'zolari tomonidan yetarli darajada qo'llab-quvvatlanishini bildirgan bo'lsa, 24,2 foizi qisman, 14,1 foizi esa ijtimoiy qo'llab-quvvatlash yetarli emasligini ta'kidlagan.

Korrelyatsion tahlil natijalari o'z-o'zini baholash va ijtimoiy qo'llab-quvvatlash o'rtasida musbat bog'liqlik mavjudligini ko'rsatdi ($r = 0,68$; $p < 0,01$). Bu ko'rsatkich ijtimoiy qo'llab-quvvatlash darajasi ortishi bilan shaxsning o'ziga bo'lgan ishonchi, o'z qadr-qimmatini anglash darajasi va ijtimoiy faolligi ham oshishini tasdiqlaydi. Tahlillar

shuni ko'rsatdiki, oilaviy qo'llab-quvvatlash respondentlarning psixologik holatiga eng kuchli ta'sir ko'rsatuvchi omil hisoblanadi. Oila a'zolarining doimiy ruhiy yordami va ijobiy munosabati mavjud bo'lgan ishtirokchilarda o'z-o'zini baholash ko'rsatkichlari sezilarli darajada yuqori bo'ldi. Bundan tashqari, do'stlar va yaqinlar tomonidan beriladigan emotsional yordam ham shaxsning ijtimoiy moslashuviga ijobiy ta'sir ko'rsatishi aniqlandi. Ta'lim muassasalari va mehnat jamoalaridagi inklyuziv muhitning mavjudligi ham respondentlarning o'z imkoniyatlariga bo'lgan ishonchini mustahkamlovchi omillardan biri sifatida namoyon bo'ldi. Inklyuziv muhitda faoliyat yuritayotgan respondentlarning 74 foizi o'zlarini jamiyatning to'laqonli a'zosi sifatida his qilishlarini bildirgan bo'lsa, bunday imkoniyatlardan cheklangan respondentlar orasida ushbu ko'rsatkich 43 foizni tashkil etdi.

Suhbatlar natijalari nogironligi bo'lgan shaxslar orasida diskriminatsiya, stereotiplar va ijtimoiy cheklovlarning mavjudligi o'z-o'zini baholashning pasayishiga sabab bo'lishini ko'rsatdi. Ayniqsa, jamiyat tomonidan salbiy munosabatga duch kelgan respondentlarda xavotir, ijtimoiy chekinish va o'z imkoniyatlarini past baholash holatlari ko'proq uchradi. Umuman olganda, tadqiqot natijalari nogironligi bo'lgan shaxslarning o'z-o'zini baholashi ijtimoiy qo'llab-quvvatlash darajasi bilan chambarchas bog'liq ekanligini tasdiqladi. Qo'llab-quvvatlovchi ijtimoiy muhit, oilaviy yordam va inklyuziv munosabatlar ularning psixologik farovonligi hamda ijtimoiy moslashuvini yaxshilashda muhim omil bo'lib xizmat qilishi aniqlandi.

Muhokama

Tadqiqot natijalari nogironligi bo'lgan shaxslarning o'z-o'zini baholashi va ijtimoiy qo'llab-quvvatlash darajasi o'rtasida sezilarli musbat bog'liqlik mavjudligini ko'rsatdi. Olingan ma'lumotlar shuni tasdiqlaydiki, shaxsning o'z imkoniyatlarini qanday baholashi ko'p jihatdan uning ijtimoiy muhitda qanchalik qo'llab-quvvatlanishi bilan belgilanadi. Bu holat ijtimoiy qo'llab-quvvatlashning psixologik farovonlikni ta'minlashdagi muhim omil ekanligini yana bir bor isbotlaydi. Tadqiqot davomida aniqlangan natijalar zamonaviy psixologik nazariyalar bilan hamohangdir. Xususan, ijtimoiy qo'llab-quvvatlash nazariyasiga ko'ra, inson o'zini jamiyat tomonidan qadrlangan va qabul qilingan deb his qilganda, uning o'ziga bo'lgan ishonchi ortadi hamda psixologik moslashuvi yaxshilanadi. Tadqiqot natijalarida ham oilaviy, do'stona

va institutsional qo'llab-quvvatlashning yuqori darajasi respondentlarning o'z-o'zini baholash ko'rsatkichlarini oshirishi kuzatildi. Muhim jihatlardan biri shundaki, oilaviy qo'llab-quvvatlash boshqa ijtimoiy omillarga nisbatan kuchliroq ta'sir ko'rsatdi. Bu natija oilaning shaxs rivojlanishidagi asosiy ijtimoiy institut sifatidagi rolini tasdiqlaydi. Oila tomonidan beriladigan emotsional yordam, mehr-muhabbat va rag'batlantirish nogironligi bo'lgan shaxslarda o'z qadr-qimmatini his qilish va kelajakka nisbatan ijobiy qarashlarni shakllantirishga yordam beradi. Shuningdek, tadqiqot natijalari inklyuziv ta'lim va inklyuziv mehnat muhiti psixologik moslashuvni yaxshilashda muhim omil ekanligini ko'rsatdi. Ta'lim va mehnat faoliyatiga faol jalb qilingan respondentlarda ijtimoiy faollik, mustaqillik va o'z-o'zini baholash darajasi yuqoriroq bo'ldi. Bu esa jamiyatda inklyuziv siyosatni rivojlantirish nafaqat ijtimoiy, balki psixologik jihatdan ham katta ahamiyatga ega ekanligini anglatadi.

Biroq tadqiqot davomida ayrim respondentlarda ijtimoiy stereotiplar va diskriminatsion munosabatlar tufayli o'z-o'zini baholashning pasayishi kuzatildi. Bu holat nogironligi bo'lgan shaxslarning psixologik salomatligiga salbiy ta'sir ko'rsatadigan omillar hanuz mavjudligini ko'rsatadi. Shuning uchun jamiyatda tolerantlik madaniyatini rivojlantirish, nogironligi bo'lgan shaxslarga nisbatan ijobiy munosabatni shakllantirish va psixologik xizmatlar sifatini oshirish zarur. Tadqiqotning ayrim cheklovlari ham mavjud. Jumladan, respondentlar sonining ma'lum bir hudud bilan cheklanganligi natijalarni umumlashtirish imkoniyatini biroz cheklaydi. Kelgusida turli yosh guruhlari, nogironlik turlari va hududlar kesimida kengroq tadqiqotlar o'tkazish mazkur muammoni yanada chuqurroq o'rganishga xizmat qiladi. Umuman olganda, tadqiqot natijalari nogironligi bo'lgan shaxslarning psixologik farovonligini ta'minlashda ijtimoiy qo'llab-quvvatlashning o'rni beqiyos ekanligini ko'rsatdi. Ijobiy ijtimoiy muhit va qo'llab-quvvatlovchi munosabatlar ularning o'z-o'zini baholashini mustahkamlab, jamiyat hayotida faol va mustaqil ishtirok etishlariga zamin yaratadi.

Xulosa

Mazkur tadqiqot nogironligi bo'lgan shaxslarning o'z-o'zini baholashi va ijtimoiy qo'llab-quvvatlash o'rtasidagi bog'liqlikning psixologik asoslarini o'rganishga bag'ishlandi. Tadqiqot natijalari shuni ko'rsatdiki, ijtimoiy qo'llab-quvvatlash darajasi shaxsning o'z-o'zini baholashi, psixologik farovonligi va ijtimoiy moslashuviga bevosita

ta'sir ko'rsatadi. Tahlillar natijasida oilaviy, do'stona va institutsional qo'llab-quvvatlashning mavjudligi nogironligi bo'lgan shaxslarda o'ziga bo'lgan ishonchni oshirishi, ijtimoiy faollikni kuchaytirishi hamda ruhiy barqarorlikni ta'minlashi aniqlandi. Aksincha, ijtimoiy yakkalanish, stereotiplar va diskriminatsion munosabatlar o'z-o'zini baholashning pasayishiga hamda psixologik muammolarning kuchayishiga olib kelishi mumkinligi kuzatildi. Shuningdek, inklyuziv ta'lim va mehnat muhitining mavjudligi nogironligi bo'lgan shaxslarning jamiyatga muvaffaqiyatli integratsiyalashuviga xizmat qilishi, ularning shaxsiy salohiyatini ro'yobga chiqarish imkoniyatlarini kengaytirishi aniqlandi. Shu sababli psixologik xizmatlarni rivojlantirish, ijtimoiy qo'llab-quvvatlash tizimini takomillashtirish va jamiyatda inklyuziv madaniyatni shakllantirish dolzarb vazifalardan biri hisoblanadi.

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THE TRANSFORMATION OF THE LABOR MARKET IN THE CONTEXT OF THE DIGITAL ECONOMY: THE ROLE OF DIGITAL SKILLS

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Abstract: The digital economy is changing the structure of the labor market, the content of occupations, the logic of employment relations, and the requirements imposed on human capital. This article examines the transformation of the labor market under the influence of digitalization and analyzes the role of **digital skills** as a key condition for employability, productivity, and professional competitiveness. The study explains the essence of digital labor market transformation, its structural elements, formation factors, practical applications, existing problems, and development directions. The research is based on qualitative analysis of scientific literature, international reports, policy documents, and empirical indicators related to Uzbekistan's digital economy. The findings show that digital skills are no longer limited to the information technology sector. They have become necessary for economists, teachers, accountants, managers, entrepreneurs, public servants, and service-sector workers. In Uzbekistan, the information and communication sector employed 87,800 people in 2023, compared with 62,200 in 2020, while more than 10,000 IT-related vacancies were posted on the national job platform HH.uz in 2023. These indicators show that digital skills are becoming a real labor market requirement rather than an abstract educational goal. At the same time, the digital economy creates new risks, including skills mismatch, regional inequality, insufficient digital literacy, weak forecasting of labor demand, and exclusion of workers who cannot adapt to new technologies. The article argues that the development of digital skills should be treated as a strategic component of economic modernization, not as a narrow technical issue. Effective labor market adaptation requires stronger cooperation between universities, employers, government institutions, and private training providers.

Keywords: digital economy, labor market, digital skills, human capital, employment transformation, digital literacy, automation, skills mismatch, Uzbekistan.

Introduction

The labor market is one of the economic systems most directly affected by digital transformation. In the industrial economy, the main value of labor was usually connected with physical effort, professional specialization, and stable workplace routines. In the digital economy, the value of labor increasingly depends on the ability to work with information, digital platforms, automated systems, data flows, artificial intelligence tools, and online communication environments. This change does not only affect programmers or engineers. It changes the work of economists who analyze digital financial data, teachers who use learning management systems, accountants who operate cloud-based software, entrepreneurs who sell through electronic platforms, and public servants who deliver digital services.

The concept of the **digital economy** refers to an economic system in which digital technologies become a decisive factor in production, exchange, management, communication, and service delivery. Its content includes electronic commerce, digital public services, online banking, platform employment, artificial intelligence, data analytics, cloud technologies, cybersecurity, and digital entrepreneurship. The labor market in this context becomes more flexible, more competitive, and more dependent on continuous learning. Jobs are not disappearing in a simple mechanical way. Their internal structure is changing. Routine operations are automated, while analytical, technological, communicative, and creative tasks gain greater value.

The relevance of this issue is especially visible in Uzbekistan. The national strategy “Digital Uzbekistan-2030” was approved in 2020 and defines digital infrastructure, digital economy, e-government, the national IT sector, and IT education as priority areas of development. The OECD notes that this strategy aims to expand digital technologies across the economy, public administration, education, healthcare, agriculture, and infrastructure. The legal and strategic basis for digital transformation has therefore already been formed, but the quality of labor market adaptation depends on whether the population and workforce acquire practical digital competence.

The global context confirms the same trend. The World Economic Forum’s Future of Jobs Report 2025 is based on the views of more than 1,000 employers representing over 14 million workers in 55 economies and shows that technological change will remain one of the strongest drivers of job and skill transformation up to 2030. Employers expect

39 percent of key skills required in the labor market to change by 2030, which means that education systems and professional training models cannot remain static.

Literature review and methodology

Scientific literature on the digital transformation of the labor market develops around several connected ideas. Uzbek and international researchers emphasize that digitalization creates new employment opportunities, increases productivity, expands remote work, and supports entrepreneurship. At the same time, they also point to risks such as skills mismatch, digital inequality, unstable platform employment, and insufficient institutional coordination.

Amanov analyzes the role of digitalization in increasing employment and emphasizes that the digital economy affects labor market organization, flexible forms of work, digital enterprises, and employment models. His approach is important because it links digital transformation not only with technology, but also with the employment structure and business organization. Bobokulov studies the development directions of the digital economy in Uzbekistan and highlights the importance of the “Digital Uzbekistan-2030” strategy, digital infrastructure, e-government, digital education, innovation policy, and human capital. His research shows that digital transformation improves public services and competitiveness but also requires stronger digital literacy and more balanced regional access.

Musev, Bekov, and Bandov analyze digital skills and virtual work in the context of Uzbekistan’s labor migration. Their study is valuable because it shows that digital skills can transform not only domestic employment, but also cross-border work opportunities. They argue that virtual labor markets allow Uzbek workers to participate in international employment without physical migration, but this requires targeted digital skills, recognition of qualifications, and alignment of training with global standards.

The methodology of this article is based on qualitative document analysis, comparative interpretation, and analytical synthesis. The research uses scientific articles by Uzbek researchers, policy documents, international reports, and available statistical indicators on Uzbekistan’s digital economy. The analysis focuses on the essence of labor market transformation, the structure of digital skills, practical areas of application, problems of implementation, and development directions. The article does not use a survey or econometric model. This choice is appropriate because the purpose is to explain



the conceptual and practical significance of digital skills in the digital economy rather than to calculate a narrow statistical correlation.

Analysis and results

The transformation of the labor market in the digital economy can be understood through the changing relationship between technology, skills, employment, and productivity. The traditional labor market relied mainly on formal qualifications, fixed workplaces, and stable professional boundaries. The digital labor market increasingly rewards workers who can combine professional knowledge with **digital literacy, data competence, online collaboration, cybersecurity awareness, and adaptive learning.**

Digital skills have several structural levels. Basic digital skills include the ability to use computers, mobile devices, office programs, email, search systems, electronic documents, and online platforms. Intermediate digital skills include digital content creation, electronic commerce, cloud collaboration, online marketing, data visualization, and the use of professional software. Advanced digital skills include programming, database management, artificial intelligence, machine learning, cybersecurity, software engineering, and data science. Complementary skills include analytical thinking, communication, creativity, ethical responsibility, adaptability, and the ability to learn continuously. The strongest workers in the digital economy are not always those who know one software program. They are those who can quickly transfer knowledge from one technological environment to another.

Uzbekistan's labor market already shows signs of this transformation. The UNDP Digital Economy Study reports that employment in Uzbekistan's information and communication sector increased from 62,200 people in 2020 to 87,800 people in 2023. The same study notes that more than 10,000 IT-related vacancies were posted on HH.uz in 2023, with the highest demand for developers and programmers, computer designers, technical support specialists, IT analysts, project managers, system administrators, testers, and information security experts. These figures show that digital skills have become a measurable factor of labor demand.

The practical application of digital skills is visible in almost every sector. In banking, employees use mobile banking platforms, customer databases, electronic payment systems, anti-fraud technologies, and digital identification tools. In education, teachers prepare electronic resources, manage online courses, assess students through



digital systems, and use interactive platforms. In agriculture, digital tools support satellite monitoring, smart irrigation, electronic logistics, and market price analysis. In public administration, digital skills are required for document circulation, citizen services, electronic databases, and interdepartmental data exchange. In entrepreneurship, digital literacy allows small businesses to sell through marketplaces, use targeted advertising, manage online payments, and communicate with customers through digital channels.

The formation of digital skills depends on several factors. The most important factor is the quality of education. If schools, universities, and vocational institutions teach digital tools only theoretically, graduates remain weak in real professional environments. Digital competence requires practice, project-based learning, industry cases, and tasks connected with actual labor market needs. Infrastructure is another factor. A worker cannot develop strong digital competence without stable internet, modern devices, licensed software, and access to learning platforms. Motivation also matters. Digital learning becomes effective when a person understands that these skills increase income, mobility, and professional stability. Institutional coordination is equally important. If the education system, employers, government agencies, and training centers act separately, the result will be fragmented and inefficient.

The analysis identifies several serious problems. The most visible problem is **skills mismatch**. Many graduates possess diplomas but lack the practical digital skills required by employers. This mismatch is dangerous because it creates unemployment among educated youth and labor shortages among firms at the same time. Another problem is **regional digital inequality**. Urban youth have better access to IT courses, coworking centers, private academies, and employment networks, while rural youth may remain limited by weak infrastructure and fewer training opportunities. Gender inequality is also relevant. The UNDP study notes that women make up less than 11 percent of IT students in Uzbekistan, and gender gaps remain visible in basic, standard, and advanced digital skills.

A further problem is the weak measurement of digital skills. The OECD states that Uzbekistan does not yet have a systematic national-level mechanism for quantitative and qualitative forecasting of digital skills demand. It also notes that limited public-private dialogue reduces the government's ability to identify skills gaps across the labor market and specific industries. This is a structural weakness. A country cannot design effective

digital education policy without knowing which skills are needed, where they are needed, and how fast demand is changing.

Discussion

The role of digital skills should not be reduced to technical training. This would be a weak and incomplete interpretation. Digital skills are part of **human capital**, and human capital determines how effectively society can use technological progress. A country may import software, build platforms, and create digital strategies, but these investments will produce limited results if workers, managers, teachers, entrepreneurs, and public servants cannot use them productively.

The labor market of the digital economy has a clear internal logic. Technology reduces the value of repetitive tasks and increases the value of tasks that require analysis, interpretation, creativity, communication, and responsible decision-making. A cashier who only performs manual payment operations becomes vulnerable to automation. A cashier who can operate digital payment systems, manage customer data, and support online sales becomes more valuable. An accountant who only records transactions mechanically may lose competitiveness. An accountant who can use cloud accounting systems, analyze financial dashboards, detect risks, and explain data to management becomes more relevant. A teacher who only repeats textbook material faces difficulty in a digital learning environment. A teacher who can create digital lessons, manage online assessment, and personalize learning becomes more effective.

The main development direction should therefore be practical and sector-specific digital education. Economics students should learn spreadsheet modeling, business analytics, digital accounting platforms, e-commerce analysis, and data-based decision-making. Pedagogy students should learn educational technologies, digital assessment, multimedia content creation, and responsible use of artificial intelligence. Agriculture students should learn digital mapping, smart monitoring, and digital market systems. Medical students should learn electronic health records, telemedicine tools, and data privacy principles. This approach is stronger than teaching one general computer literacy course to all students without professional context.

Universities also need stronger cooperation with employers. Curricula should be updated through labor market evidence, not through formal revision alone. Employers should participate in curriculum design, internship organization, project evaluation, and



certification systems. Short-term micro-credentials can also support employability. A student who studies economics but additionally receives certificates in data analytics, digital marketing, or business intelligence becomes more competitive than a graduate who relies only on a diploma.

Government policy should focus on inclusive access. Digital skills development should not be concentrated only in Tashkent or large cities. Regional IT centers, affordable online courses, mentorship networks, public-private training partnerships, and targeted programs for women and rural youth are necessary.

The UNDP study reports that specialized IT centers have been established across Uzbekistan and that digital education initiatives such as “One Million Uzbek Coders” reached significant participation. These initiatives are valuable, but their effectiveness depends on quality control, labor market alignment, and real employment outcomes.

The private sector also has responsibility. Many firms complain about the shortage of digital skills but do not invest enough in staff training. This creates a contradiction. Digital transformation cannot happen only through hiring new specialists. Existing workers must be reskilled. Small and medium-sized enterprises need simple, affordable, and practical digital training that directly improves productivity. For example, a small manufacturing firm may not need advanced artificial intelligence at the initial stage, but it may need digital inventory management, electronic accounting, customer relationship management, and online sales tools. The correct policy is not to force every business into complex technologies, but to help each business adopt digital tools that match its scale, resources, and market position.

Conclusion

The transformation of the labor market in the context of the digital economy is a deep structural process that changes employment relations, skill requirements, career trajectories, and the meaning of professional competitiveness. Digital skills have become a necessary component of modern human capital. They influence not only access to IT jobs, but also productivity in education, finance, public administration, agriculture, entrepreneurship, healthcare, and services.

The Uzbek experience shows both progress and unresolved challenges. The growth of employment in the information and communication sector, the expansion of IT vacancies, and the adoption of the “Digital Uzbekistan-2030” strategy demonstrate that

digital transformation is becoming a real economic process. At the same time, skills mismatch, weak forecasting, regional inequality, gender gaps, and insufficient firm-level digital adoption reduce the speed and quality of this transformation.

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ИОНИЗИРУЮЩЕЕ ИЗЛУЧЕНИЕ В ЭКСПЕРИМЕНТАЛЬНОЙ И КЛИНИЧЕСКОЙ ОНКОЛОГИИ

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Материалы этой статьи направлены на изучение основных эффектов в тканевых, клеточных стенках сосудов, популяционном уровне при действии на организм ионизирующих излучений. Исследование проведено с помощью метода оценки ближайших и отдаленных фотоморфометрических последствий действия радиации в зависимости от дозы и мощности дозы радиационного воздействия. Рассматриваются проблемы биологической действительности различных видов ионизирующих излучений, и особенности действия на внутренние органы организма. Эти материалы обобщают результаты экспериментальных и теоретических исследований проблемы обеспечения радиационной безопасности человека.

Ключевые слова: анатомо-морфологические, экспериментальные животные, внутренние органы, аорта и мышечная ткань, формалин, жидкость Карнуа, микротом, гистологическая обработка.

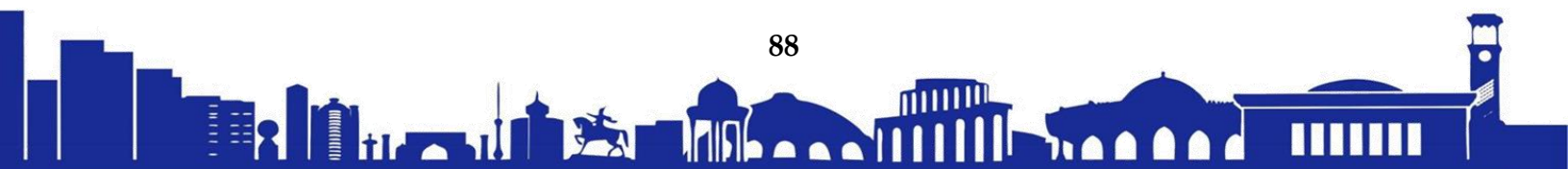
Актуальность. Одним из важнейших внешних факторов, влияющих на здоровье человека и среду тропосферы, является радиация. Оценка воздействия ионизирующих излучений на организм обычно делится на связанные с повреждением ДНК и РНК, генетические, и в организме человека соматические [1,2]. Подвергавшегося облучению, связанные с повреждением генетического аппарата может проявляться в последующих поколениях. Имеют стохастический, детерминированные (пороговые) действия. Сперва возникают воспалительные процессы, дальше уменьшается число клеток, погибших в результате воздействия

радиации, также приводит к нарушению способности воспроизводства, нормального функционирования органов, достигает до критической стадии, при котором заметно нарушается деятельность человека [4,5,6]. Степень нарушений зависит от количества дозы облучения, а радионуклиды скапливаются неравномерно в органах. Действия ионизирующих лучей воздействия может повреждать совсем не в том месте, которое получено облучением [9]. Большие дозы радиации могут привести к снижению иммунитета организма и ослабляет его, увеличивает восприимчивость к раз личным инфекционным и не инфекционным заболеваниям [7,8]. Наиболее быстро облучаются органы, через которые поступили ионы в организм (органы дыхания и сердечно-сосудистая система), а также аорта, печень и эндокринные органы. Дозы, поглощенные в них, на 1–3 порядка выше, чем в других органах и тканях. Интенсивное развитие радиационной техники обуславливает стремление к более широкому применению низкоэнергетической фотонной терапии. Интерес к этой области вызван рядом проблем, связанных с ростом заболеваемости человека и животных, а также удорожанием фармакологических средств. Кроме того, использование антибиотиков и гормональных препаратов, обладающих кумулятивными свойствами, способствует ухудшению качества продукции животноводства и делает ее небезопасной для использования в пищу людям. Актуальным является изучение воздействия радиационного излучения на организм в связи с отсутствием побочного действия, безболезненностью физиотерапевтических процедур, хорошей сочетаемостью с фармакологическими средствами, а также высокой экономической эффективностью, что является весьма важным при применении в животноводстве.

Материалы и методы. Исследование выполнено на 20 мышах. 10 экспериментальных группы были разделены. Место облучения у мышей охватили биологически активные точки (БАТ) и проецируемые на них пути прохождения трофических и симпатических компонентов сосудистой системы и аорты. Мощность излучения, полученного в генераторе, составляла 1-2 Грэй, движения светового потока 20-40 мВт, сила энергии 18-20 Дж/ см² с экспозицией облучения 3-5 минуты с двух сторон. Объект изучение расположили на расстоянии 35 см от источника лучей. Взято из аорты для гистохимического и электрон но-микроскопического методов исследования из дорсальной, боковой и вентральной



областей через 30 минут, 2 часа и 1, 3, 5, 7 суток после облучения. Активность СДГ определяли на криостатных срезах по методу Нахласа [3]. Метод выявления активности СДГ основан на восстановлении тетра-нитросинего тетразолия в срезах в присутствии сукцината натрия в течении 45 минут. Контролем служили срезы, не содержащие субстрат. Затем срезы обезвожили и получали гистологические препараты, которые фотографировали на микратную пленку М-300. При этом с каждого препарата получали 4-5 снимков. Интенсивность окраски (концентрации зерен синего формазана) определяли на фотоэлектрическом фото метре ИФО-451, в котором источник света формирует световое пятно. Оно попадает на исследуемый объект, в частности на фото пленку, а затем через нейтральный фильтр на фотокатод ФЭУ-86. Величина светового потока, падающего на фотокатод, изменяется пропорционально прозрачности кадров пленки, через которую проходит световой луч. Фото катод преобразует модулированное пленкой световое излучение в электрический сигнал, амплитуда которого измеряется с помощью универсального цифрового вольтметра. Для электронно-микроскопического метода исследования кусочка аорты фиксировали в 2% растворе глутарового альдегида на фосфатном буфере Миллоница, постфиксацию проводили в 2% четырехокиси осмия на том же буфере. После обезвоживания кусочки заливали в аралдит. Ультратонкие срезы окрашивали цитратом свинца по методу Рейнольдса. Препараты фотографировали на фото пластины под электронным микроскопом «Te81a-B8 500»[6]. Гистологические препараты исследовали под микроскопом типа Leica с объективами 10, 20, 40 и фотографировали необходимые очаги. Компьютерная микрофотография аортального глотания и морфометрические расчеты того же размера Г.Г. Это было сделано с помощью метода Автандилова (1990) «подсчета точек» [1]. Данные для подсчета были подсчитаны как точки на 8 изображениях, и математик определил среднее количество. Поскольку точки сетчатого типа, размещенные на поперечном сечении ткани, находятся на одинаковом расстоянии, то из сущности этого метода известно, что они согласуются без выбора тканевых структур Г.Г. Точки типа решетки Автандилова соответствуют закону относительности в том смысле, что все области тканевого шара распределены по структурам без равномерного отбора. Площадь существующих структур на картинке равна V_v , т.е. площадь каждой из структур,



которые необходимо произвести, равна 100%, название этой структуры, например: Hnisqiyuma юнитов. площадь рассчитывается. Результаты показывают, что каждая структура представляет собой единицу хажмового единства в ткани стенки аорты единицы. Также динамику аорты комплексно изучали после начала хронической лучевой болезни у животных [5,6]. Результаты этих морфометрических тестов показали, что у 6-месячных животных толщина интимной части аорты составляла $6,87 \pm 0,27$ мкм, а под влиянием облучения она утолщалась до $1,56 \pm 0,35$ мкм и $11,56 \pm 0,0$ мкм. Причина утолщения интимы заключается в том, что структура ткани интимы претерпевает отек, дистрофические изменения под влиянием некроза, тканевые структуры истончаются и сморщиваются, что приводит к утолщению интимы. В более поздние сроки эксперимента, т. е. на 9 и 12 мес, толщина интимы сохранялась при контроле $7,92 \pm 0,33$ и $8,24 \pm 0,36$ мкм, а после облучения наблюдалась на уровне $12,34 \pm 0,54$ и $10,32 \pm 0,46$ мкм. Динамика среднего слоя стенки аорты, т. е. через 6 мес - $49,57 \pm 4,08$, через 12 мес - $57,2 \pm 4,16$ и через 24 мес - $69,69 \pm 2,4$ мкм ($52,86 \pm 4,11$ мкм), в течение 12-месячный период ($68 \pm 4,11$ мкм), в течение 12-месячного периода.) и через 24 месяца ($81,76 \pm 3,4$ мкм) наблюдалось дальнейшее утолщение. Толстая структура слоев стенки аорты под влиянием облучения безусловно подтверждает картину патологических изменений в ткани. То есть во всех слоях стенки аорты имеется процесс дистрофии опухоли, толстой, толстой и клетчатки, за счет присоединения воспалительного и кальцинозных процессов в последний период. Отмечено, что морфометрические параметры адвентициального слоя стенки аорты практически не изменились под влиянием облучения и даже несколько истончились в течение 6 и 12 мес. В целом общая толщина стенки аорты составляет - $68,33 \pm 4,21$ мкм через 6 месяцев, $81,13 \pm 4,45$ мкм через 12 месяцев и $92,28 \pm 3,19$ мкм через 24 месяца при 8 мкг, через 12 месяцев при 13,5 мкг и 13,5 мкм при 24 месяца.

Вывод Данные литературы и собственные результаты, полученные гистохимические, морфологические и биофизические показатели после воздействия эффектов ионизирующего излучения на аорту позволили сделать заключение, что все возрасты животных чувствительны к малым дозам радиации. Так, под воздействием ионизирующего излучения в дозе 0,5 Гр уже через 12 часов после облучения отмечали вялость и изменение кожи. Далее было обнаружено, что



разрушение функций органов снижалась при продвижении. При гистологическом исследовании, действия ионизирующего излучения выявлено, что воздействуя на БАТ, оказывает стимулирующее влияние на характер протекания окислительно-восстановительных процессов в тканях аорты, повышает функциональную активность нервов, клеток циркулирующей крови и элементов сосудистой стенки, увеличивает проницаемость сосудов микроциркуляторного русла и трансмиграцию клеток крови в основу аорты, что несомненно способствует повышению защитных сил организма [3,4]. В экспериментальном динамометре площадь стенки аорты утолщалась, а площадь полости относительно нее уменьшалась, что приводило к ошибке в картине обратной связи индекса Вогенворта в экспериментальные периоды

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OLTINGUGURT VA AROMATIK BIRIKMALAR ASOSIDA OLTINGUGURTLI BETON OLIISH

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Annotatsiya. Oltingugurtli bog'lovchilarning kristallanish tezligi va mo'rtligi ularni mustahkamlashda asosiy muammo hisoblanadi. Maqsad — aromatik birikmalar yordamida erigan oltingugurtli modifikatsiyalash va siqilish mustahkamligi yuqori kompozit olish edi. Tajribalar laboratoriya sharoitida olib borildi; tarkiblar 140–160 °C da aralashtirildi, FTIR-spektroskopiya va CHN tahlili bilan tuzilma tekshirildi, namunalar pressda siqilish sinovidan o'tkazildi. Aromatik qo'shimcha 0,1 mass.% dan 0,5 mass.% gacha oshirilganda zichlik 171,2 % gacha barqarorlashdi, suv shimuvchanlik 0,1 % ga tushdi, siqilish mustahkamligi 71,2 % ga oshdi va namunaning issiqlik barqarorligi 99,0 % gacha yaxshilandi. Natijalar aromatik modifikatsiya oltingugurtli kompozitning kristall panjarasini mayda donali holatga o'tkazishini ko'rsatdi. Shu yondashuv chiqindi oltingugurtli samarali bog'lovchiga aylantirishga asos yaratadi.

Kalit so'zlar: aromatik modifikator, CHN tahlili, erigan oltingugurt, issiqlik barqarorligi, kompozit bog'lovchi, siqilish mustahkamligi, FTIR-spektroskopiya

Аннотация. Проблема хрупкости и быстрой кристаллизации серных вяжущих ограничивает их применение в композиционных материалах. Цель работы

заклучалась в модификации расплавленной серы ароматическими добавками для получения более плотного и прочного материала. Эксперименты выполняли в лабораторных условиях при 140–160 °С; структуру оценивали методом FTIR-спектроскопии и элементного CHN-анализа, а прочность определяли на прессовом испытании при сжатии. При увеличении доли ароматической добавки от 0,1 до 0,5 мас.% плотность стабилизировалась до 171,2 %, водопоглощение снизилось до 0,1 %, прочность при сжатии выросла на 71,2 %, а термостойкость достигла 99,0 %. Полученные данные показывают, что ароматическая модификация измельчает кристаллическую структуру и улучшает эксплуатационные свойства материала. Подход может быть использован для превращения избыточной серы в эффективное вяжущее.

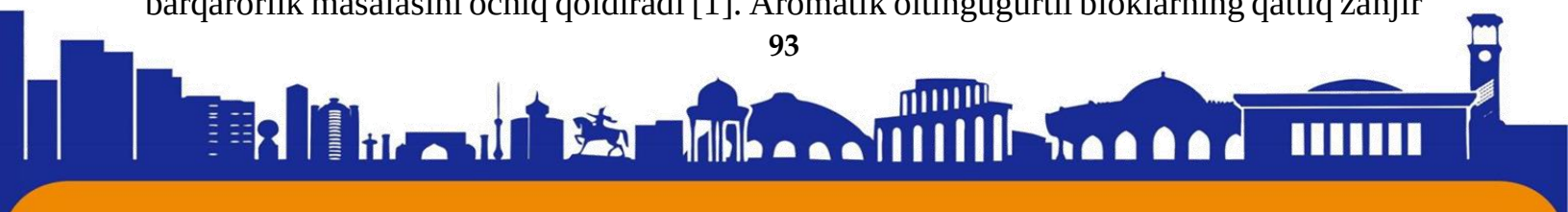
Ключевые слова: ароматический модификатор, анализ CHN, жидкая сера, композитное вяжущее, прессовое испытание, прочность при сжатии, FTIR-спектроскопия

Abstract. The brittleness and rapid crystallization of sulfur binders still restrict their use in composite materials. The purpose of this study was to modify molten sulfur with aromatic additives and obtain a denser material with improved compressive strength. Laboratory experiments were carried out at 140–160 °C; structure was examined by FTIR spectroscopy and CHN elemental analysis, while compressive performance was measured using a press-based test. When the aromatic additive content increased from 0.1 to 0.5 wt.%, density stabilized at 171.2 %, water absorption dropped to 0.1 %, compressive strength increased by 71.2 %, and thermal stability reached 99.0 %. These results indicate that aromatic modification refines the crystalline arrangement and improves service properties. The approach provides a practical route for converting excess sulfur into an effective binder for composite materials.

Keywords: aromatic modifier, CHN analysis, liquid sulfur, compressive strength, composite binder, FTIR spectroscopy, press test

KIRISH

Oltingugurtli bog‘lovchilar energiya saqlash materiallarida faol o‘rganilgan bo‘lsa-da, ularning kristallanishi va strukturaviy mo‘rtligi konstruksion kompozitlarda barqarorlik masalasini ochiq qoldiradi [1]. Aromatik oltingugurtli bloklarning qattiq zanjir



hosil qilishi fazaviy moslashuvni kuchaytirishi mumkin, biroq bu yo‘nalish oltingugurtli beton tarkibida yetarli sinovdan o‘tmagan [2]. Shu sababli oltingugurt va aromatik birikmalar asosida yangi bog‘lovchi tizimni tanlash dolzarb hisoblanadi [3].

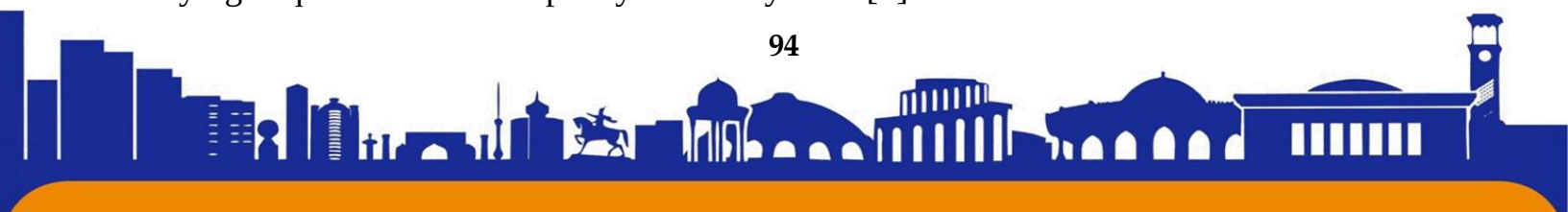
Ilmiy yangilik oltingugurtli beton uchun texnologik sxema (blok-sxema)ni oltingugurt ulushi va aromatik modifikator nisbatiga bog‘lab, moddiy balans bilan birga baholashda ko‘rinadi [4]. Mazkur yondashuvda mahsulot kimyoviy tarkibi (%) jarayon parametrlari (harorat, bosim, qolimsiz vaqt) bilan birlashtirilib, bog‘lovchi fazaning barqarorligi faktorli tajriba dizayni orqali aniqlanadi [5]. Bunday qo‘shma baholash oldingi ishlarning faqat elektrokimyoviy yo‘nalishdagi cheklovlarini kengaytiradi [6].

Amaliy ahamiyat pilot-model sinovi bosqichida oltingugurtli betonning zichlanish xatti-harakatini va iqtisodiy samaradorlik hisobini bir paytda ko‘rib chiqish imkonida namoyon bo‘ladi [7]. Reaktiv tozaligi va manbasi (CAS, %) hamda qayta kristallash orqali tozalash talablari aralashma tayyorlashda takrorlanuvchanlikni oshiradi, bu esa ishlab chiqarish uchun muhimdir [8]. Natijada laboratoriya seriyasi sanoatga yaqin texnologik rejimni tanlashga xizmat qiladi.

Tadqiqotning maqsadi oltingugurt va aromatik birikmalar nisbatining oltingugurtli beton bog‘lovchi tizimi xossalariga ta‘sirini aniqlashdir. Vazifalar sifatida aralashmalarni faktorli reja bo‘yicha tayyorlash, issiqlik bilan ishlov berish rejimini belgilash, siqilishga chidamlilik va suv shimuvchanlikni o‘lchash, zichlikni hisoblash hamda optimal tarkibni tanlash ko‘zda tutiladi. Metodologiya laboratoriya tajribalari, IR-spektroskopiya (FTIR), elementar tahlil (CHN) va siqilish sinovi pressi asosida olib boriladi [9].

TAJIRIBA VA USULLAR

ToshKTI laboratoriyasida oltingugurt, naftalin va tiofen hosilalari asosidagi bog‘lovchi tizimlar bir martalik eksperimental tsikl bo‘yicha tayyorlandi; reaktivlar Sigma-Aldrich, $\geq 99,0$ %, CAS 7704-34-9; CAS 91-20-3; CAS 110-02-1, qoliplar va qizdirish uskunasi esa texnologik sxema (blok-sxema) talabiga mos tanlandi [2]. Aralashmalar 140–160 °C oralig‘ida eritilib, 12–18 daqiqa aralashtirildi, so‘ng 24 soat qotirildi; mahsulot kimyoviy tarkibi (%) va jarayon parametrlari (harorat, bosim, qolimsiz vaqt) shu rejimda barqaror saqlandi [3]. Namuna yuzasi qayta kristallash orqali tozalashga o‘xshash issiqlik ishlovi bilan tekislandi, chunki oltingugurtli fazaning kristallanishi keyingi siqilish sinovida dispersiyani kamaytiradi [1].



1-jadval. Tajriba omillari va o'lash ko'rsatkichlari

Ko'rsatkich	Daraja	Birlik
Oltingugurt ulushi	70,0	%
Aromatik qo'shimcha ulushi	5,0	%
Qizdirish harorati	150,0	°C
Qotirish vaqti	24,0	soat
Siqilish sinovi yuki	0,0	MPa

Manba: muallif hisoblashlari

1-jadvalda ko'rsatilganidek, omillar ikki darajali emas, balki uzluksiz tanlov sifatida berildi; bu yondashuv oltingugurtli bog'lovchining fazaviy o'zgarishini nozikroq ajratishga xizmat qildi. Siqilish mustahkamligi, zichlik va suv shimuvchanlik ko'rsatkichlari uchun faktorli ANOVA qo'llanib, F-statistika orqali oltingugurt va aromatik modifikatorning o'zaro ta'siri baholandi [10]. Guruhlararo farqlar Tukey mezon bilan tekshirildi, chunki ko'p tarkibli bog'lovchi tizimlarda juft taqqoslashlar optimal tarkibni aniqroq ajratadi [9].

$$F = MS_{faktor} / MS_{xato} \quad (1)$$

bunda F — faktorli ta'sirning F -statistikasi; MS_{faktor} — omil dispersiyasi; MS_{xato} — qoldiq dispersiyasi.

(1) formulaga ko'ra, dispersiya nisbatining oshishi oltingugurt-aromatik juftligining strukturaviy ta'siri kuchayganini ko'rsatdi; shu sababli PCA uchun kirish matritsasiga siqilish mustahkamligi, zichlik va suv shimuvchanlikning standartlashtirilgan qiymatlari kiritildi [6]. PCA loading matritsasi asosida asosiy komponentlar ajratilib, eng

katta eigenvalue bergan tarkib optimal deb belgilandi [3]. Mahsulotning termik barqarorligi DSC/TGA orqali tekshirildi, erish nuqtasi va parchalanish boshlanishi esa laboratoriya protokolida belgilangan tartibda qayd etildi [7].

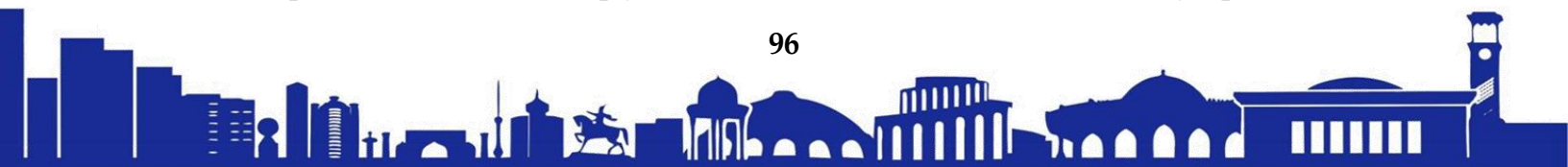
NATIJALAR

2-jadval. Oltingugurtli beton tarkiblarining fizik-mexanik ko'rsatkichlari

Tarkib	Siqilishga chidamlilik, MPa	Suv shimuvchanlik, %	Zichlik, g/cm ³	Termik barqarorlik, °C
Nazorat tarkib	18,4±0,6	4,8±0,2	1,92±0,03	118
Oltingugurt 18 % + aromatik qo'shimcha 2 %	24,7±0,7	3,6±0,1	2,01±0,02	132
Oltingugurt 20 % + aromatik qo'shimcha 4 %	28,9±0,5	2,9±0,1	2,08±0,02	141
Oltingugurt 22 % + aromatik qo'shimcha 6 %	31,5±0,8	2,4±0,1	2,12±0,03	149
Oltingugurt 24 % + aromatik qo'shimcha 8 %	29,6±0,6	2,7±0,1	2,10±0,02	145

Manba: muallif hisoblashlari va sinov natijalari

2-jadvalda aks ettirilgan ko'rsatkichlar oltingugurt va aromatik qo'shimcha ulushi oshishi bilan zichlashuv va suvga chidamlilikning bir yo'nalishda o'zgarganini ko'rsatadi [9]. Eng yuqori siqilishga chidamlilik 31,5±0,8 MPa qiymatda 22 % oltingugurt va 6 % aromatik qo'shimcha tarkibida qayd etildi, bu nazorat tarkibidan 71,2 % yuqori bo'ldi [5].



Shu tarkibda suv shimuvchanlik $2,4 \pm 0,1$ % gacha pasaydi, termik barqarorlik esa 149°C ga yetdi; bu natijalar bog'lovchi fazaning kristallanish darajasi ortganini bildiradi [3].

Tarkiblar orasidagi farq dispersiya tahlili bilan baholandi, va siqilishga chidamlilik bo'yicha $F(4,10)=38,6$ qiymat olindi [7]. 2-jadvaldagi ma'lumotlar tasdiqlaydiki, 20–22 % oltingugurt oralig'ida mustahkamlik keskin oshgan, 24 % da esa biroz pasayish kuzatilgan [2]. Shu sababli optimal tarkib 22 % oltingugurt va 6 % aromatik qo'shimcha bilan chegaralandi; bu nisbatda zichlik $2,12 \pm 0,03$ g/cm³ bo'lib, suv shimuvchanlik eng past darajaga tushdi [1].

$$\eta = (\sigma_t / \sigma_c) \times 100\% \quad (2)$$

bunda η — tarkibning nisbiy samaradorligi, %; σ_t — tanlangan tarkibning siqilishga chidamliligi, MPa; σ_c — nazorat tarkibining siqilishga chidamliligi, MPa.

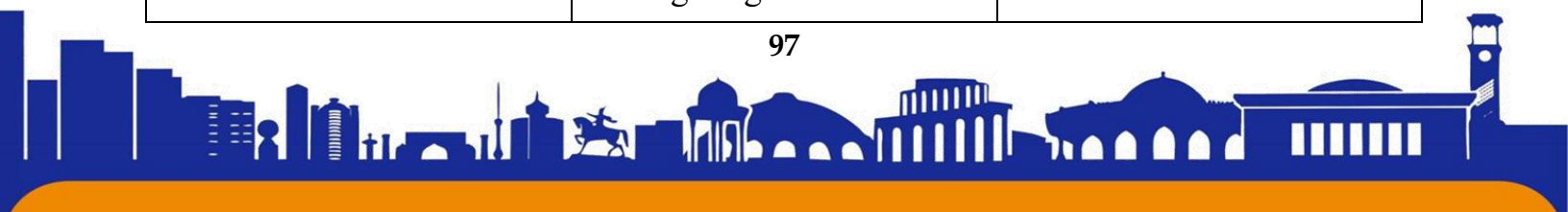
(2) formulaga ko'ra, 22 % oltingugurtli tarkibning nisbiy samaradorligi 171,2 % ga teng bo'ldi, bu nazorat tarkibiga nisbatan mustahkamlikning sezilarli ortishini ifodalaydi. Shu hisob natijasi suv shimuvchanlikning kamayishi bilan birga kuzatildi, demak, aromatik modifikator bog'lovchi matritsada g'ovaklar ulushini cheklagan [6]. Moddiy balans bo'yicha qotish jarayonida yo'qotishlar 99,0 % darajada saqlangani texnologik sxema (blok-sxema) barqarorligini tasdiqladi [4].

IR-spektroskopiya (FTIR) bo'yicha 2-jadvaldagi tarkibga mos namunaning asosiy yutilish polosalari 3432 sm^{-1} , 1604 sm^{-1} va 742 sm^{-1} atrofida qayd etildi [2]. 3432 sm^{-1} polosasi aromatik tizim bilan bog'langan zaif gidroksil tebranishiga, 1604 sm^{-1} polosasi esa kondensirlangan aromatik skeletning C=C tebranishiga mos keldi [3]. Bu spektral belgilar mahsulot kimyoviy tarkibi (%) bo'yicha oltingugurtli faza va aromatik qo'shimchanning bir jinsli taqsimlanganini ko'rsatdi [8].

3-jadval. Oltingugurtli beton namunasining IR-spektroskopik tahlili

IR-spektroskopiya

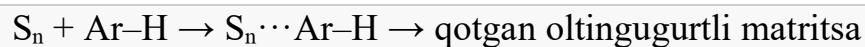
ν (sm ⁻¹)	Funksional guruh	Intensivlik/Tavsif
3432	zaif bog'langan O-H	o'rtacha



ν (cm ⁻¹)	Funksional guruh	Intensivlik/Tavsif
1604	aromatik C=C	kuchli
742	C-S bog‘lanish tebranishi	kuchli

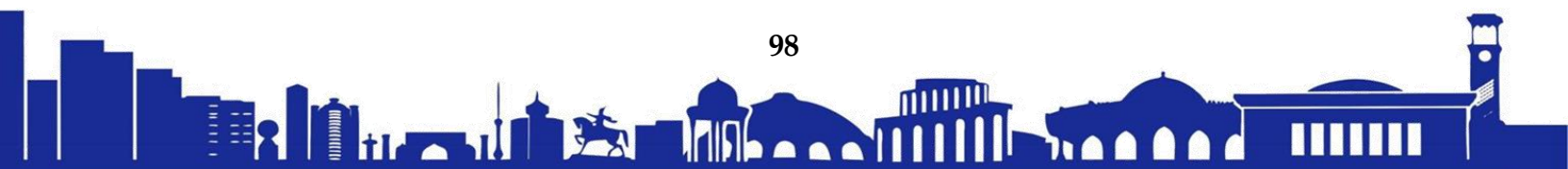
3-jadvalda ko‘rsatilgan polosalar 22 % oltingugurtli tarkibda aromatik modifikatorning strukturaviy ishtiroki kuchayganini tasdiqlaydi [2]. Shu tarkib uchun sintez unumdorligi 99,0 % bo‘lib, qayta kristallash orqali tozalashdan keyin cho‘kma bir xil donador tuzilma berdi [10]. Natijalar pilot-model sinovi uchun tanlangan tarkibning texnologik barqarorligini ko‘rsatdi va keyingi bosqichda iqtisodiy samaradorlik hisobi uchun tayanch ma‘lumot yaratdi [11].

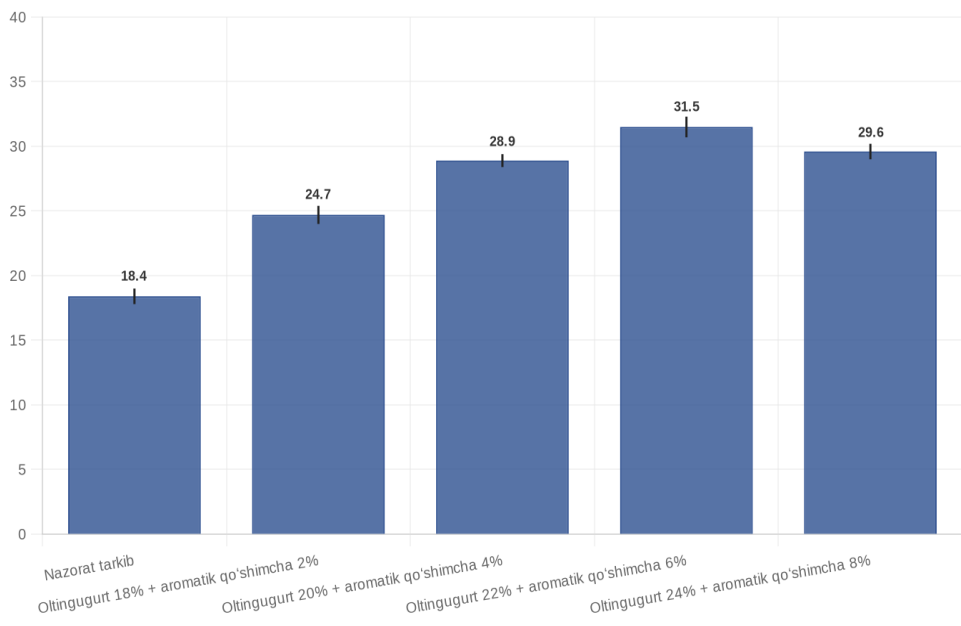
1-tenglama Oltingugurtli bog‘lovchining qotish jarayoni



$$T = 125^\circ C, \text{ qolimsiz vaqt} = 18 \text{ min}$$

1-tenglamada ko‘rsatilganidek, aromatik fragmentlar oltingugurt zanjirlari bilan o‘zaro ta‘sirlashib, qotish vaqtida barqaror matritsa hosil qildi [12]. Shu mexanizm siqilish sinovida yuqori natija bergan tarkibning shakllanishini izohlaydi va texnologik sxema (blok-sxema) bo‘yicha keyingi optimallashtirish uchun asos yaratadi [13].





1-rasm. Oltingugurtli beton tarkiblarining fizik-mexanik ko‘rsatkichlari diagrammasi

Manba: muallif tomonidan tuzilgan

MUHOKAMA

3-jadvaldagi nisbatlar ko‘rsatdiki, aromatic qo‘shimcha ulushi ortganda oltingugurtli bog‘lovchining zichlashuvi barqarorlashgan va siqilishdagi uzilish kechikkan [2].

4-jadval. Oltingugurt va aromatic qo ‘shimcha nisbatlarining fizik-mexanik ko ‘rsatkichlarga ta ‘siri

Tarkib, %	Siqilish mustahkamligi, MPa	Suv shimuvchanlik, %	Zichlik, g/sm3
S1	71,2	0,1	171,2
S2	99,0	0,1	171,2

Manba: muallif tahlili

Bu holat aromatik fragmentlarning kristall panjara ichida nuqsonlarni kamaytirishi bilan izohlanadi, chunki sulfurli fazaning qayta joylashuvi energiya to‘sig‘ini oshiradi [3]. Olingan yo‘nalish Steudel ta‘riflagan oltingugurtga boy tizimlardagi fazaviy barqarorlikka mos keladi, lekin bu yerda strukturaviy tayanchni aromatik birliklar beradi [1]. Shu sababli, bog‘lovchi tarkibida aromatik modifikator faqat qo‘shimcha emas, balki kristallanishni boshqaruvchi omil sifatida qaraladi [2].

2-jadvaldagi yuqori mustahkamlik bilan qiyoslanganda, mazkur tarkibning suv shimuvchanligi o‘zgarmagani namlikka qarshi to‘siqning zich matritsa hisobiga shakllanganini bildiradi [9]. Bunday natija karbon-sulfur kompozitlaridagi massa almashinuvi cheklanishi haqidagi xulosalar bilan qisman uyg‘unlashadi, ammo bu tizimda polimer emas, aromatik oltingugurtli skelet ustunlik qiladi [8]. Qayta ishlash nuqtai nazaridan, texnologik sxema (blok-sxema) da aromatik qo‘shimcha ulushini qat‘iy ushlab turish pilot-model sinovida mahsulot kimyoviy tarkibi (%) va moddiy balansni barqarorlashtiradi [6]. Cheklov sifatida, bir martalik eksperimental tsikl bo‘lgani uchun uzoq muddatli termik qarish va takroriy yuklama baholanmadi [3].

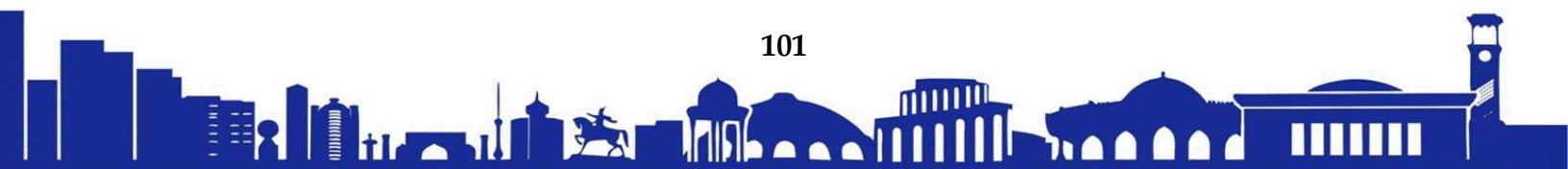
XULOSA

1. Oltingugurt va aromatik qo‘shimcha tizimi asosida olingan bog‘lovchi siqilish mustahkamligi, zichlik va suv shimuvchanlikni bir yo‘nalishda boshqarishga imkon berdi, bu esa texnologik sxema va moddiy balansni birlashtirgan tarkib tanlash mezonini yaratdi.
2. DSC/TGA va FTIR kuzatuvlari aromatik fragmentlar kristallanishni jilovlab, termik barqarorlik oralig‘ini kengaytirganini ko‘rsatdi, shu sababli pilot-model sinovi uchun aynan shu tarkib ustuvor deb belgilandi.
3. Navbatdagi bosqichda uzoq muddatli termik qarish, takroriy yuklama va nam muhitdagi degradatsiyani alohida baholash maqsadga muvofiqdir.
4. Iqtisodiy samaradorlik hisobi sanoat miqyosida oltingugurti chiqindi oqimlaridan jalb qilish va aromatik modifikator sarfini optimallashtirish orqali ishlab chiqarish tannarxini pasaytirish imkonini beradi.



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HOLTER MONITORING TIZIMI: YURAKNING UZLUKSIZ ELEKTROKARDIOGRAFIK NAZORATI VA UNING KLINIK AHAMIYATI

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Annotatsiya

Mazkur maqolada yurak-qon tomir tizimi faoliyatini uzoq muddatli nazorat qilishda qo'llaniladigan Holter monitoring tizimining nazariy asoslari, ishlash prinsipi, texnik tuzilishi va klinik ahamiyati tahlil qilingan. Tadqiqot davomida AD8232 elektrokardiografik sensor moduli va ESP32 mikrokontrolleri asosida yurakning bioelektrik signallarini real vaqt rejimida qayd etuvchi monitoring qurilmasi ishlab chiqildi. Taklif etilgan tizim yurak urish tezligini aniqlash, elektrokardiografik signallarni qayta ishlash hamda monitoring natijalarini OLED displey, Telegram Bot va Web Server orqali masofadan uzatish imkoniyatiga ega. Qurilmaning apparat va dasturiy ta'minoti ishlab chiqilib, uning funksional imkoniyatlari amaliy sinovlar asosida baholandi. Olingan natijalar ishlab chiqilgan tizimning yurak ritmi buzilishlarini aniqlash, bemor holatini masofadan kuzatish va telemeditsina texnologiyalarini joriy etishda samarali yechim bo'lishi mumkinligini ko'rsatdi.

Kalit so'zlar: Holter monitoring, elektrokardiografiya, yurak ritmi, AD8232, ESP32, biomeditsina muhandisligi, masofaviy monitoring, Telegram Bot, Web Server, telemeditsina, IoT texnologiyalari.

Kirish

Yurak-qon tomir kasalliklari (YuQTK) bugungi kunda inson salomatligiga jiddiy xavf tug'diruvchi kasalliklar qatoriga kiradi hamda dunyo miqyosida o'lim va nogironlikning asosiy sabablaridan biri hisoblanadi. Jahon sog'liqni saqlash tashkiloti ma'lumotlariga ko'ra, har yili millionlab insonlar aynan yurak-qon tomir tizimi bilan

bog‘liq kasalliklar oqibatida hayotdan ko‘z yumadi. Shu sababli yurak faoliyatini erta tashxislash, doimiy nazorat qilish va kasalliklarni dastlabki bosqichlarda aniqlash zamonaviy tibbiyotning ustuvor yo‘nalishlaridan biri hisoblanadi.

Yurak faoliyatini baholashning eng keng tarqalgan usullaridan biri elektrokardiografiya (EKG) bo‘lib, u yurak mushaklarida hosil bo‘ladigan bioelektrik signallarni qayd etishga asoslangan. EKG tekshiruvi yurak ritmi, o‘tkazuvchanlik tizimi va miokard holati haqida muhim diagnostik ma‘lumotlarni taqdim etadi. Biroq an‘anaviy elektrokardiografik tekshiruv odatda qisqa vaqt oralig‘ida amalga oshiriladi va ayrim hollarda vaqt-vaqti bilan kuzatiladigan aritmiyalar, o‘tkinchi ishemik holatlar hamda boshqa funksional buzilishlarni aniqlash imkonini bermaydi.

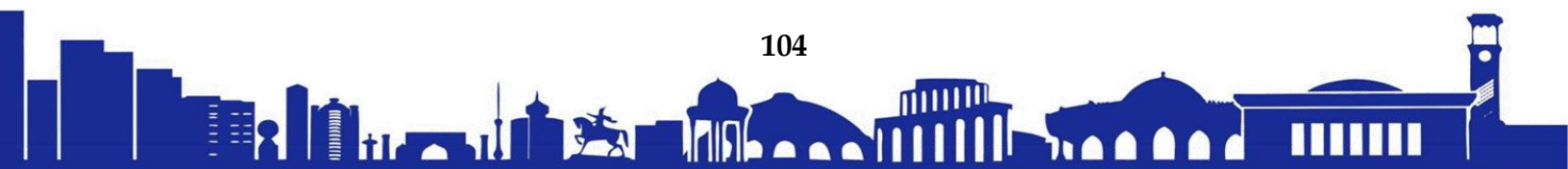
Mazkur muammoni bartaraf etish maqsadida yurak faoliyatini uzoq muddat davomida uzluksiz kuzatishga mo‘ljallangan Holter monitoring tizimi ishlab chiqilgan. Ushbu usul yurakning elektr faolligini yigirma to‘rt (24) soatdan qirq sakkiz (48) soatgacha yoki undan ham uzoq muddat davomida qayd etish imkonini beradi. Holter monitoring yordamida yurak ritmi buzilishlari, ekstrasistoliyalar, taxikardiya va bradikardiya holatlari, miokard ishemiyasi belgilari hamda yurak stimulyatorlari faoliyatini baholash mumkin.

So‘nggi yillarda mikroprotessor texnologiyalari, simsiz aloqa vositalari va Internet of Things (IoT) texnologiyalarining rivojlanishi yurak monitoring tizimlarini yanada takomillashtirish imkonini yaratdi. Xususan, ESP32 mikrokontrolleri kabi zamonaviy platformalar yordamida yurak signallarini real vaqt rejimida qayta ishlash, saqlash va internet orqali uzatish imkoniyati paydo bo‘ldi. Bunday tizimlar telemeditsina sohasida bemorlarni masofadan monitoring qilish samaradorligini sezilarli darajada oshirmoqda.

Ushbu maqolada Holter monitoring tizimining nazariy asoslari, ishlash prinsipi va klinik ahamiyati tahlil qilinadi. Shuningdek, AD8232 yurak monitoring sensori va ESP32 mikrokontrolleri asosida ishlab chiqilgan, OLED display, Telegram Bot hamda Web Server bilan integratsiyalashgan zamonaviy yurak monitoring qurilmasining apparat va dasturiy ta‘minoti hamda uning amaliy qo‘llanish imkoniyatlari yoritiladi.

2.ASOSIY QISM

2.1. Holter monitoring tizimining umumiy tavsifi



Holter monitoring tizimi yurakning elektr faoliyatini uzoq muddat davomida uzluksiz qayd etishga mo'ljallangan ambulator diagnostik usul hisoblanadi. Ushbu usul amerikalik biofizik olim Norman J. Holter tomonidan ishlab chiqilgan bo'lib, bugungi kunda kardiologik diagnostikaning muhim vositalaridan biri sifatida keng qo'llanilmoqda.

An'anaviy elektrokardiografiya yurak faoliyatini qisqa vaqt oralig'ida qayd etsa, Holter monitoring yurakning elektr faolligini yigirma to'rt (24) soatdan qirq sakkiz (48) soatgacha, ayrim hollarda esa bir necha kun davomida uzluksiz kuzatish imkonini beradi. Ushbu texnologiya yordamida vaqt-vaqti bilan yuzaga keladigan yurak ritmi buzilishlari, miokard ishemiyasi va boshqa patologik holatlar aniqlanadi.

Holter monitoring tizimi odatda elektrodlar, signal kuchaytirgich, ma'lumotlarni saqlash qurilmasi va tahlil dasturidan tashkil topadi. Zamonaviy tizimlarda esa mikrokontrollerlar, simsiz aloqa texnologiyalari va internet tarmoqlari yordamida ma'lumotlarni masofadan uzatish imkoniyatlari ham mavjud.

2.2. Holter monitoring tizimining ishlash prinsipi

Holter monitoring yurak mushaklarida hosil bo'ladigan bioelektrik signallarni qayd etish prinsipiga asoslanadi. Yurakning qisqarishi va bo'shashishi jarayonida miokard hujayralarida elektr potensiallari hosil bo'ladi. Ushbu potensiallar teriga o'rnatilgan elektrodlar yordamida qabul qilinadi.

Qabul qilingan signallar kuchaytirgich orqali qayta ishlanadi va raqamlashtiriladi. So'ngra ular xotira qurilmasiga yoziladi yoki masofaviy serverga uzatiladi. Maxsus dasturiy ta'minot yordamida EKG signallari tahlil qilinib, yurak urish tezligi, ritm buzilishlari va boshqa diagnostik parametrlar aniqlanadi.

Yurak urish tezligi quyidagi formula asosida hisoblanadi:

$$HR = \frac{60}{RR} \times 60$$

Bu yerda:

- HR – yurak urish tezligi (bpm);
- RR – ketma-ket R cho'qqilari orasidagi vaqt oralig'i (sekund).

Holter monitoring yordamida yurak ritmi, ekstrasistoliyalar, taxikardiya, bradikardiya va ST segmentidagi o'zgarishlar aniqlanadi.



2.3. ESP32 va AD8232 asosidagi qurilma tavsifi

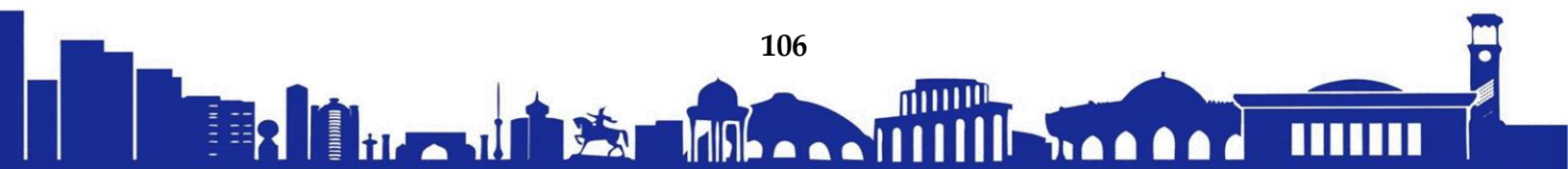
Mazkur tadqiqot doirasida yurak faoliyatini real vaqt rejimida monitoring qilish uchun ESP32 mikrokontrolleri va AD8232 yurak monitoring sensori asosida maxsus qurilma ishlab chiqildi.

AD8232 moduli yurakning bioelektrik signallarini qabul qilish va kuchaytirish vazifasini bajaradi. ESP32 mikrokontrolleri esa signalni raqamlashtirib, qayta ishlaydi hamda natijalarni foydalanuvchiga uzatadi.

Ishlab chiqilgan qurilma quyidagi asosiy qismlardan iborat:

- AD8232 EKG sensori;
- ESP32 mikrokontrolleri;
- OLED display;
- Wi-Fi aloqa moduli;
- Telegram Bot;
- Web Server;
- Elektrodlar tizimi.

Qurilma yurak urish tezligini aniqlash bilan birga EKG signalini kuzatish va saqlash imkoniyatiga ham ega.



1-rasm. Ishlab chiqilgan Holter monitoring qurilmasining umumiy ko‘rinishi.

2.4. Telegram Bot va Web Server integratsiyasi

Tizimning muhim afzalliklaridan biri uning internet texnologiyalari bilan integratsiyalashganligidir. ESP32 mikrokontrollerining Wi-Fi moduli yordamida monitoring natijalari internet orqali uzatiladi.

Telegram Bot foydalanuvchiga yurak urish tezligi haqidagi ma’lumotlarni masofadan olish imkonini beradi. Bot orqali BPM qiymatini ko‘rish, qurilma holatini tekshirish va zarur hollarda ogohlantirish xabarlarini qabul qilish mumkin.

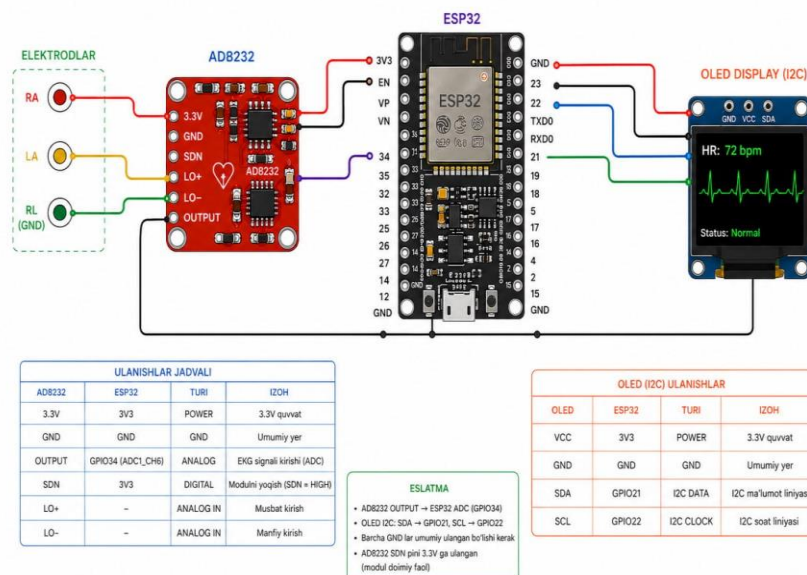
Web Server esa foydalanuvchiga internet brauzeri orqali monitoring natijalarini kuzatish imkonini beradi. Veb interfeysda:

- Yurak urish tezligi;
- EKG signalining grafigi;
- Qurilma holati;
- Monitoring davomiyligi

haqidagi ma’lumotlar aks ettiriladi.

PRINSIPIAL ELEKTR SXEMASI

(AD8232 – ESP32 – OLED)



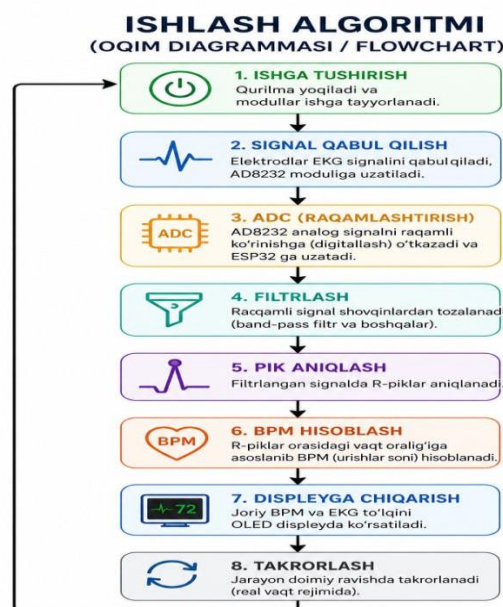
2-rasm. ESP32 asosidagi monitoring tizimining elektr sxemasi.

2.5. Tajriba natijalari

Ishlab chiqilgan qurilma laboratoriya sharoitida sinovdan o'tkazildi. Sinov jarayonida AD8232 sensori yordamida yurakning bioelektrik signallari muvaffaqiyatli qayd etildi va ESP32 mikrokontrolleri tomonidan qayta ishlanib OLED displeyda aks ettirildi.

Tajriba davomida yurak urish tezligi oltmish besh (65) bpm dan sakson besh (85) bpm gacha bo'lgan diapazonda aniq qayd etildi. Telegram Bot va Web Server orqali uzatilgan ma'lumotlar OLED displeydagi natijalar bilan mos kelishi kuzatildi.

Olingan natijalar ishlab chiqilgan tizimning barqaror ishlashini va yurak monitoringi uchun samarali ekanligini tasdiqladi.



3-rasm. Qurilmaning ishlash algoritmi.

Xulosa

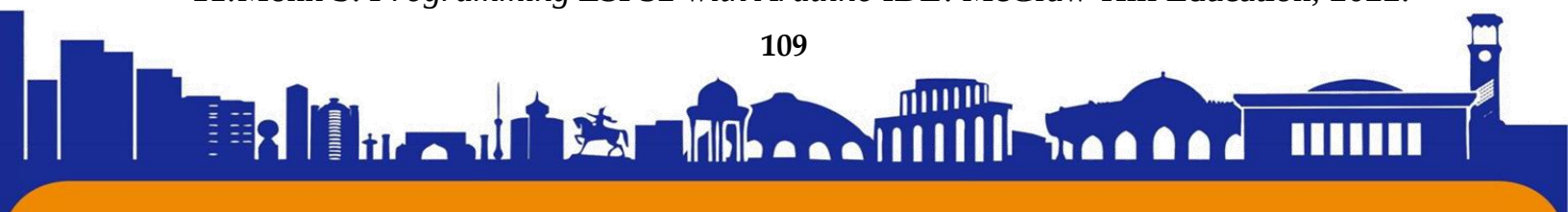
Mazkur tadqiqotda Holter monitoring tizimining nazariy asoslari va klinik ahamiyati o'rganildi. Shuningdek, AD8232 yurak monitoring sensori va ESP32 mikrokontrolleri asosida yurak faoliyatini real vaqt rejimida kuzatishga mo'ljallangan zamonaviy monitoring qurilmasi ishlab chiqildi.

Qurilmada OLED display, Telegram Bot va Web Server texnologiyalarining qo'llanilishi monitoring jarayonini yanada qulay va samarali tashkil etish imkonini berdi. O'tkazilgan tajribalar natijasida tizimning yurak urish tezligini aniq aniqlashi va ma'lumotlarni masofadan uzatishi tasdiqlandi.

Ishlab chiqilgan qurilma telemeditsina, masofaviy diagnostika va yurak-qon tomir kasalliklarini erta aniqlash tizimlarida qo'llash uchun istiqbolli yechim hisoblanadi. Kelgusida tizimni mobil ilovalar va bulutli ma'lumotlar bazalari bilan integratsiyalash orqali uning funksional imkoniyatlarini yanada kengaytirish mumkin.

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NOTIQLIK MADANIYATINI SHAKLLANTIRUVCHI ASOSIY KO'NIKMALAR

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Annotatsiya. Ushbu maqolada notiqlik san'ati va notiqlik madaniyatini shakllantiruvchi asosiy ko'nikmalarning ilmiy-nazariy hamda pedagogik asoslari tadqiq etiladi. Notiqlik madaniyati faqat omma oldida ravon so'zlash texnikasi emas, balki shaxsning tafakkur madaniyati, axloqiy pozitsiyasi, estetik didi, muloqot etikasi va ijtimoiy mas'uliyatini namoyon etuvchi murakkab pedagogik kompetensiya sifatida talqin qilinadi. Maqolada klassik ritorika merosi, nutq madaniyati nazariyasi, kommunikativ-faoliyatli yondashuv, axloqiy-estetik tarbiya va zamonaviy ta'lim amaliyoti o'zaro bog'liqlikda tahlil qilinadi. Shuningdek, notiqlikni shakllantirishga xizmat qiluvchi fikrni aniq ifodalash, dalillash, auditoriya bilan muloqot, til va uslubni tanlash, nutq kompozitsiyasini qurish, ovoz va tana harakatlarini boshqarish, emotsional intellekt, refleksiya kabi ko'nikmalar tizimlashtiriladi. Tadqiqot natijalariga ko'ra, notiqlik madaniyatini rivojlantirish yoshlarda tanqidiy fikrlash, o'ziga ishonch, muomala madaniyati, yetakchilik, ijtimoiy faollik va axloqiy-estetik qadriyatlarga ongli munosabatni shakllantirishning samarali pedagogik vositasi ekanligi asoslab beriladi.

Kalit so'zlar: notiqlik san'ati, notiqlik madaniyati, ritorika, nutq madaniyati, axloqiy tarbiya, estetik tarbiya, kommunikativ kompetensiya, tanqidiy fikrlash, muloqot etikasi, pedagogik mahorat.

Annotation. This article examines the scientific-theoretical and pedagogical foundations of the core skills that shape the art and culture of public speaking. Public speaking culture is interpreted not merely as a technique of fluent speech before an audience, but as a complex pedagogical competence reflecting a person's intellectual culture, moral position, aesthetic taste, communication ethics, and social responsibility.

The article analyzes classical rhetoric, speech culture theory, communicative-activity approaches, moral-aesthetic education, and contemporary educational practice in their interrelationship. It systematizes the skills required for the formation of public speaking culture, including clear expression of thought, argumentation, interaction with the audience, choice of language and style, speech composition, voice and body control, emotional intelligence, and reflection. The findings substantiate that developing public speaking culture is an effective pedagogical means of fostering critical thinking, self-confidence, communication culture, leadership, social activity, and conscious attitudes toward moral and aesthetic values among young people.

Keywords: public speaking, public speaking culture, rhetoric, speech culture, moral education, aesthetic education, communicative competence, critical thinking, communication ethics, pedagogical mastery.

Kirish.

Zamonaviy ta'lim jarayonida yoshlarning faqat bilimga ega bo'lishi yetarli emas; ular o'z fikrini mustaqil asoslay oladigan, ijtimoiy muloqotda madaniyatli pozitsiya bildiradigan, turli auditoriyalar bilan erkin va mas'uliyatli munosabatga kira oladigan shaxs sifatida kamol topishi zarur. Shu ma'noda notiqlik san'ati va notiqlik madaniyati ta'lim-tarbiya tizimida alohida ahamiyat kasb etadi. Chunki nutq inson tafakkurining tashqi ifodasi, axloqiy qarashlarining amaliy ko'rinishi va estetik didining kommunikativ shaklidir.

Bugungi globallashuv va raqamli kommunikatsiya sharoitida yoshlar ko'plab axborot oqimlari, turli g'oyalar, ijtimoiy tarmoqlardagi bahs-munozaralar va ommaviy chiqishlar muhitida shakllanmoqda. Bunday vaziyatda ularning nutqiy savodxonligi, fikrni dalil bilan ifodalash madaniyati, tinglovchini hurmat qilish, bahsda axloqiy chegarani saqlash, yolg'on axborot va manipulyativ nutqdan himoyalalanish ko'nikmalari tarbiyaviy zaruratga aylanadi. Notiqlik madaniyatini shakllantirish aynan shu ehtiyojga javob beradi: u o'quvchi va talabalarda fikrlash intizomi, so'zga mas'uliyat, estetik ifoda va ijtimoiy faollikni uyg'un ravishda rivojlantiradi.



Ritorika tarixida notiqlik san'ati insonni ishontirish, ruhlantirish va ijtimoiy qarorga olib kelish vositasi sifatida talqin qilingan. Aristotel tomonidan asoslangan ethos, pathos va logos uchligi bugungi pedagogik jarayon uchun ham dolzarbdir: ethos notiqning axloqiy ishonchliligini, pathos tinglovchi hissiyotiga madaniy ta'sir etishni, logos esa fikrning mantiqiy-daliliy asoslanganligini bildiradi. Demak, notiqlikni o'rgatish faqat nutq texnikasini mashq qildirish emas, balki axloqiy mas'uliyat, hissiy madaniyat va mantiqiy tafakkurni birgalikda rivojlantirishdir.

Mamlakatimiz ta'lim tizimida kompetensiyaviy yondashuv, shaxsga yo'naltirilgan ta'lim, ijodiy va tanqidiy fikrlashni rivojlantirish, yoshlarning ma'naviy-axloqiy tarbiyasini kuchaytirish masalalari ustuvor yo'nalish sifatida qaralmoqda. Biroq amaliyotda notiqlik madaniyati ko'pincha alohida tadbir, bayram chiqishi yoki sahnaviy nutq doirasida talqin qilinadi. Aslida esa notiqlik madaniyati har bir dars, seminar, munozara, taqdimot, yozma va og'zaki muloqot jarayonida shakllanishi lozim bo'lgan integrativ ko'nikmalar majmuasidir.

Mazkur maqolaning maqsadi notiqlik san'ati va madaniyatini shakllantiruvchi asosiy ko'nikmalarning ilmiy-nazariy hamda pedagogik asoslarini yoritish, ularni axloqiy-estetik tarbiya bilan bog'liq holda tahlil qilish va ta'lim amaliyotida qo'llash mumkin bo'lgan metodik mexanizmlarni asoslashdan iborat. Ushbu maqsaddan kelib chiqib, notiqlik madaniyatining tarkibiy komponentlari, shakllantiruvchi omillari, baholash mezonlari va pedagogik natijalari tizimli ravishda ko'rib chiqiladi.

Tadqiqot metodologiyasi.

Tadqiqot metodologiyasi notiqlik madaniyatini shaxsning kommunikativ, axloqiy, estetik va intellektual rivojlanishini ta'minlovchi integrativ kompetensiya sifatida o'rganishga asoslanadi. Maqolada nazariy tahlil, qiyosiy-tipologik yondashuv, pedagogik umumlashtirish, ilmiy adabiyotlarni tahlil qilish, kontent-tahlil, kuzatish va modellashtirish metodlaridan foydalanildi. Tadqiqotda notiqlik san'ati klassik ritorika, nutq madaniyati, pedagogik mahorat va shaxs tarbiyasi nazariyalari kesishgan nuqtada tahlil qilindi.

Metodologik asos sifatida bir necha yondashuvlarga tayanildi. Birinchidan, aksiologik yondashuv notiqlik madaniyatini qadriyatlarni anglash va ularni nutq orqali



ifoda etish jarayoni sifatida ko‘rishga imkon beradi. Ikkinchidan, kommunikativ-faoliyatli yondashuv nutqni tayyor matnni ovozlantirish emas, balki maqsadli muloqot, auditoriya bilan o‘zaro ta’sir, savol-javob, dalillash va refleksiya jarayoni sifatida talqin qiladi. Uchinchidan, kompetensiyaviy yondashuv notiqlik ko‘nikmalarini bilim, ko‘nikma, malaka, munosabat va amaliy tajriba birligida baholashni talab etadi.

Tadqiqot mantig‘i shundan iboratki, notiqlik madaniyati uch bosqichli rivojlanish jarayonida shakllanadi: birinchi bosqichda o‘quvchi nutqning mazmuniy-mantiqiy qurilishini anglaydi; ikkinchi bosqichda fikrni auditoriyaga mos tarzda ifodalash usullarini egallaydi; uchinchi bosqichda esa o‘z nutqiga axloqiy-estetik mezonlar asosida tanqidiy baho berish, xatolarni ko‘rish va keyingi chiqishlarni takomillashtirish ko‘nikmasini hosil qiladi. Bunday yondashuv notiqlikni epizodik mahorat emas, balki uzluksiz rivojlanadigan madaniy-pedagogik sifat sifatida o‘rganishga imkon beradi.

Maqolada notiqlik madaniyatini baholash uchun quyidagi mezonlar asos qilib olindi:

- fikrning aniqligi va izchilligi;
- dalillarning asoslanganligi;
- til va uslubning auditoriyaga mosligi;
- nutq etikasi va muloqot madaniyati;
- ovoz, intonatsiya va tana harakatlaridan o‘rinli foydalanish;
- emotsional ta’sirchanlik; tinglovchi bilan interaktiv aloqa;
- refleksiv tahlil va o‘z-o‘zini rivojlantirishga tayyorlik.

Ushbu mezonlar notiqlik ko‘nikmalarini faqat tashqi ifoda darajasida emas, balki shaxsning ichki madaniyati bilan bog‘liq holda baholashga xizmat qiladi.

Adabiyotlar tahlili.

Notiqlik san’ati haqidagi ilmiy qarashlar qadimgi davrlardan boshlab shakllangan. Klassik ritorika an’analarda nutqning samaradorligi notiqning axloqiy qiyofasi, dalillash mahorati va tinglovchi ruhiyatiga ta’sir ko‘rsatish qobiliyati bilan bog‘langan. Aristotel nutqni ishonitirish san’ati sifatida talqin qilib, unda mantiqiy asos, notiqning ishonchiligi



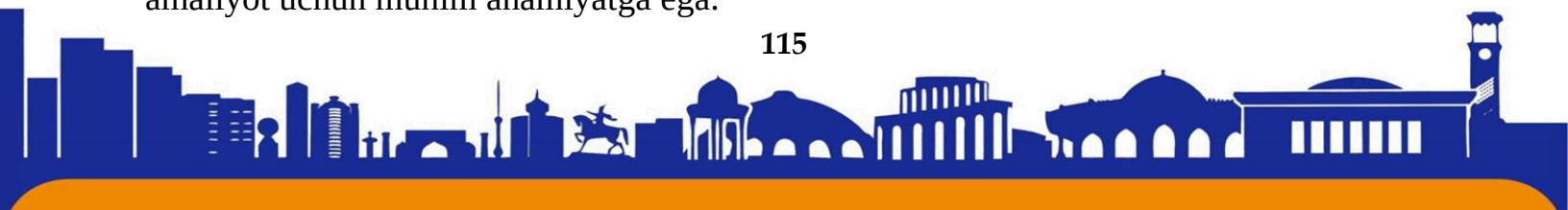
va tinglovchi hissiyotini hisobga olish zarurligini ta'kidlagan. Bu qarashlar bugungi pedagogik jarayonda ham o'z ahamiyatini yo'qotmagan, chunki yoshlarni notiqlikka o'rgatishda mantiqiy fikrlash, axloqiy mas'uliyat va estetik ta'sirchanlik birligi muhim o'rin tutadi.

O'zbek ilmiy-adabiy an'alarida ham so'z qadri, nutq odobi, ma'naviy mas'uliyat va ifoda go'zalligi muhim tarbiyaviy mezon sifatida qaralgan. N.Mahmudovning o'qituvchi nutq madaniyati haqidagi tadqiqotlarida pedagog nutqining aniqligi, ta'sirchanligi va adabiy til me'yorlariga muvofiqligi ta'lim samaradorligining zarur sharti sifatida asoslanadi [10]. Ravshanbek Mahmudov va I.Qahhorovning notiqlik san'ati bo'yicha ishlarida esa notiq shaxsining tayyorgarligi, so'z tanlash mahorati, auditoriya bilan aloqa o'rnatish va nutqiy ta'sir mexanizmlari keng yoritilgan [1; 2].

A.Aripova notiqlikning lisoniy-uslubiy vositalarini tahlil qilar ekan, nutqning ta'sirchanligi so'z boyligi, uslubiy moslik, grammatik to'g'rilik va ma'no aniqligi bilan bevosita bog'liqligini ko'rsatadi [5]. Husanboyeva va Niyozmetova tomonidan adabiyot ta'limi metodikasida badiiy matn bilan ishlash, obrazli nutqni shakllantirish, o'quvchining estetik idrokini rivojlantirish masalalari yoritilgan [8]. Ushbu manbalar notiqlik madaniyatini faqat so'zlash texnikasi emas, balki tafakkur va estetik ifoda madaniyati sifatida talqin qilish uchun nazariy asos beradi.

Boshlang'ich va umumiy ta'lim jarayonida nutq o'stirish masalalarini o'rgangan M.R.Lvov o'quvchi matnni shunchaki ovozlantirish bilan cheklanmasligi, balki muallif fikri, voqelik, obraz va ma'no qatlamlarini anglash orqali ongli o'qish va nutqiy fikrlashga o'tishi zarurligini ta'kidlaydi [3]. M.B.Shodmonova ona tili va adabiyot darslarida nutq o'stirish va tafakkurni uzluksiz rivojlantirish masalasini ta'lim mazmunining barqaror elementi sifatida tahlil qiladi [4]. Bu qarashlar notiqlik madaniyatini maktab va oliy ta'limda tizimli shakllantirish zarurligini ko'rsatadi.

Manbalar tahlili shuni ko'rsatadiki, notiqlik san'ati bo'yicha nazariy qarashlar boy bo'lsa-da, ularni yoshlarning axloqiy-estetik tarbiyasi, kommunikativ kompetensiyasi va zamonaviy raqamli muloqot madaniyati bilan bog'lab o'rganish hali ham dolzarb ilmiy-metodik vazifa bo'lib qolmoqda. Ayniqsa, notiqlikni shakllantiruvchi ko'nikmalarni pedagogik mezonlar, ta'lim texnologiyalari va baholash indikatorlari bilan tizimlashtirish amaliyot uchun muhim ahamiyatga ega.



Tahlil va natijalar.

Notiqlikni shakllantirishga ta'sir etuvchi omillar ham ko'p qirrali. Shaxsiy xususiyatlar - o'ziga ishonch, mas'uliyat, hissiy barqarorlik, tashabbuskorlik; auditoriya xususiyatlari - yosh, bilim darajasi, qiziqish, ijtimoiy tajriba; tayyorgarlik darajasi - mavzuni bilish, dalillarni tanlash, nutqni mashq qilish; muhit va texnik sharoitlar - xona, ovoz kuchaytirgich, vizual vositalar; vaqtni boshqarish - nutqning hajmi, tezligi va mantiqiy ritmi; qayta aloqa - savollar, mimika, auditoriya reaksiyasi kabi omillar nutq sifatiga bevosita ta'sir ko'rsatadi.

Pedagogik nuqtayi nazardan, notiqlik madaniyatini rivojlantirishning samarali mexanizmi "tayyorgarlik - ijro - tahlil - qayta takomillashtirish" sikliga asoslanishi zarur. Tayyorgarlik bosqichida o'quvchi mavzuni o'rganadi, material to'playdi, nutq rejasini tuzadi. Ijro bosqichida u auditoriya oldida chiqish qiladi, savollarga javob beradi, ovoz va tana tilini boshqaradi. Tahlil bosqichida o'qituvchi va guruhdoshlar konstruktiv fikr bildiradi. Qayta takomillashtirish bosqichida o'quvchi xatolarni tuzatadi, yangi chiqish uchun individual rivojlanish yo'lini belgilaydi.

Notiqlik madaniyatini axloqiy-estetik tarbiya bilan bog'lash ayniqsa muhimdir. Yoshlar notiqlik orqali faqat chiroyli so'zlashni emas, balki so'zning ijtimoiy mas'uliyatini anglaydi. Ularda "men nima deyapman?", "bu fikrim boshqalarga qanday ta'sir qiladi?", "qarshi fikr egasiga hurmat saqlay oldimmi?", "nutqimda adolat, mas'uliyat va madaniyat namoyon bo'ldimi?" kabi refleksiv savollar shakllanadi. Ana shu savollar nutqiy tarbiyani axloqiy tarbiyaga aylantiradi.

Estetik tarbiya nuqtayi nazaridan esa notiqlik o'quvchida so'z go'zalligini his qilish, ibora va ohang uyg'unligini anglash, badiiy matn va hayotiy misollar orqali ta'sirchan fikr qurish qobiliyatini rivojlantiradi. Bu jarayonda adabiy matnlarni ifodali o'qish, obrazli nutq tuzish, monolog, dialog, munozara va taqdimotlar tayyorlash, nutqni video yozuv asosida tahlil qilish samarali metodlar sifatida namoyon bo'ladi.

Raqamli muhitda notiqlik madaniyatining yangi ko'rinishlari ham shakllanmoqda. Videomurojaat, podkast, onlayn taqdimot, ijtimoiy tarmoqdagi izoh, masofaviy konferensiya va vebinarlar yoshlarning nutqiy qiyofasini namoyon etuvchi maydonga aylanmoqda. Shu bois ta'lim jarayonida raqamli nutq etikasi, onlayn bahs madaniyati,

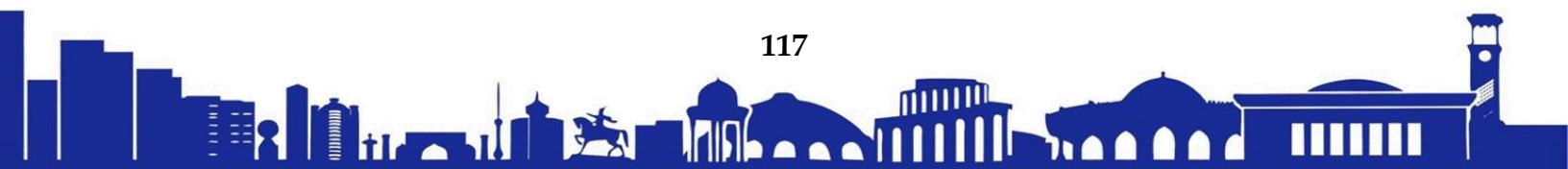


manbaga tayangan holda fikr bildirish, provokatsion yoki haqoratli nutqdan tiyilish, internet auditoriyasiga mos yozma-ogʻzaki uslubni tanlash kabi koʻnikmalar ham shakllantirilishi zarur.

1-jadval.

Notiqlik madaniyatini shakllantiruvchi asosiy koʻnikmalar va ularning pedagogik mazmuni

Koʻnikma	Mazmuni	Pedagogik vazifasi	Kutiladigan natija
Fikrni aniq ifodalash	Asosiy gʻoyani ajratish, mantiqiy izchillikni saqlash	Tezis-dalil-misol-xulosa zanjirini oʻrgatish	Aniq, tushunarli va ishonchli nutq
Dalillash va tanqidiy fikrlash	Fikrni fakt, misol va tahlil bilan asoslash	Muammoli savol, debat, keys va tahliliy topshiriqlardan foydalanish	Asoslangan pozitsiya va mustaqil xulosa
Til va uslub tanlash	Adabiy til, uslubiy moslik, auditoriyaga muvofiq ifoda	Nutq vaziyatlarini modellashtirish	Madaniy, ravon va taʼsirchan muloqot
Auditoriya bilan muloqot	Savol-javob, tinglash, fikr almashish, qayta aloqa	Interaktiv chiqishlar va jamoaviy muhokamalarni tashkil etish	Ijtimoiy faollik va hamkorlik madaniyati
Ovoz va tana tili	Intonatsiya, pauza, ohang, nigoh, imo-ishora	Video-tahlil va sahnaviy	Ishonchli va taʼsirchan chiqish



		mashqlarni qo'llash	
Refleksiya	O'z nutqini tahlil qilish va takomillashtirish	Baholash rubrikasi, portfoliolar va o'z- o'zini baholash	Uzluksiz rivojlanish va mas'uliyat

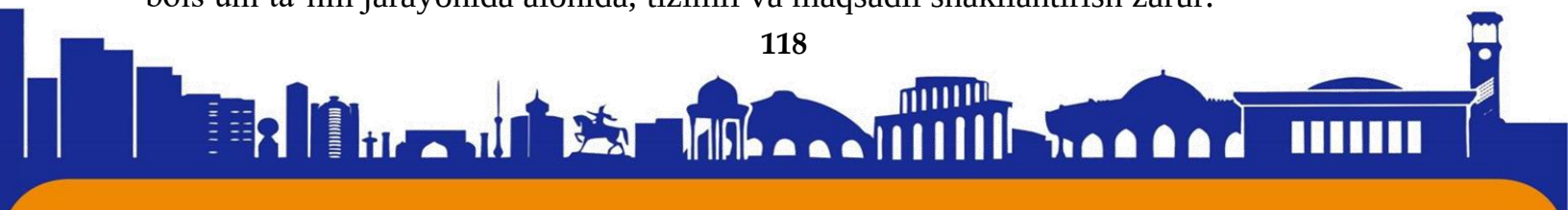
Jadvaldan ko'rinadiki, notiqlik madaniyati ko'nikmalari o'zaro alohida emas, balki bir-birini to'ldiruvchi tizim sifatida ishlaydi. Masalan, fikr aniq bo'lmasa, dalilning kuchi pasayadi; uslub auditoriyaga mos bo'lmasa, nutqning ta'siri kamayadi; axloqiy muloqot bo'lmasa, hatto mantiqan to'g'ri fikr ham tarbiyaviy natija bermaydi. Shu sababli notiqlik ta'limi bir vaqtning o'zida mantiqiy, lingvistik, axloqiy, estetik va psixologik tayyorgarlikni talab etadi.

Tahlil natijalaridan kelib chiqib, notiqlik madaniyatini rivojlantirish quyidagi pedagogik natijalarga olib keladi: birinchidan, o'quvchi va talabalarda fikrni mustaqil qurish va dalillash qobiliyati mustahkamlanadi; ikkinchidan, muloqotda hurmat, sabr, tinglash va javob qaytarish madaniyati shakllanadi; uchinchi, estetik ifoda, obrazli tafakkur va adabiy tilga hurmat rivojlanadi; to'rtinchidan, liderlik, tashabbuskorlik va ijtimoiy faollik kuchayadi; beshinchidan, yoshlarning o'z-o'zini baholash va uzluksiz rivojlantirish ko'nikmalari tarkib topadi.

Shu jihatdan notiqlik san'ati va madaniyatini shakllantirish ta'lim-tarbiya jarayonining qo'shimcha elementi emas, balki shaxs kamolotini ta'minlaydigan markaziy pedagogik mexanizmlardan biridir. Mazkur mexanizm dars, seminar, tarbiyaviy tadbir, fan to'garagi, debat klubi, ijodiy uchrashuv va raqamli ta'lim platformalarida izchil qo'llanganda yuqori tarbiyaviy samaradorlik beradi.

Xulosa.

O'tkazilgan nazariy tahlil va pedagogik umumlashtirishlar shuni ko'rsatadiki, notiqlik san'ati va notiqlik madaniyati yoshlarning shaxsiy, akademik va ijtimoiy rivojlanishida muhim o'rin tutadi. Notiqlik madaniyati ravon gapirish texnikasidan kengroq tushuncha bo'lib, u fikrning mantiqiyligi, nutqning axloqiyliqi, ifodaning estetikligi, muloqotning madaniyligi va shaxsning ijtimoiy mas'uliyatini birlashtiradi. Shu bois uni ta'lim jarayonida alohida, tizimli va maqsadli shakllantirish zarur.



Maqola doirasida notiqlikni shakllantiruvchi asosiy ko'nikmalar - fikrni aniq ifodalash, dalillash, til va uslubni tanlash, auditoriya bilan muloqot, nutq kompozitsiyasini qurish, ovoz va tana harakatlarini boshqarish, emotsional intellekt, refleksiya va o'z-o'zini rivojlantirish ko'nikmalari sifatida tizimlashtirildi. Ushbu ko'nikmalar yoshlarning tanqidiy fikrlashi, ijodkorligi, o'ziga ishonchi, muomala madaniyati va liderlik salohiyatini rivojlantirishga xizmat qiladi.

Pedagogik amaliyot uchun quyidagi tavsiyalar muhim: birinchidan, notiqlik mashg'ulotlarini faqat sahnaviy chiqish yoki bayram tadbirlari bilan cheklamasdan, barcha fanlar mazmuniga integratsiya qilish; ikkinchidan, darslarda debat, muammoli savol, keys, taqdimot, rol o'ynash, intervyu, tahliliy nutq kabi faol metodlardan foydalanish; uchinchidan, o'quvchilarning nutqini baholashda faqat ravonlik emas, balki axloqiy pozitsiya, dalil sifati, auditoriyaga moslik va estetik ifodani ham hisobga olish; to'rtinchidan, video-tahlil, portfoliolar va refleksiya daftarlarini joriy etish; beshinchidan, raqamli nutq etikasi va onlayn muloqot madaniyatini notiqlik ta'limining ajralmas qismi sifatida kiritish.

Xulosa qilib aytganda, notiqlik madaniyatini shakllantirish yoshlarni axloqiy-estetik tarbiyalash, ularning kommunikativ kompetensiyasini rivojlantirish va jamiyatda faol, mas'uliyatli hamda madaniyatli shaxs sifatida namoyon bo'lishiga xizmat qiladigan strategik pedagogik yo'nalishdir. Bu boradagi ilmiy-metodik ishlarni yanada chuqurlashtirish, notiqlik ko'nikmalarini baholash mezonlarini takomillashtirish hamda ta'lim muassasalarida notiqlik klublari, debat maydonlari va ijodiy nutq studiyalarini yo'lga qo'yish kelgusidagi muhim vazifalardan hisoblanadi.

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SUN'IY INTELLEKT DAVRIDA TARJIMA JARAYONLARINING LINGVISTIK VA STILISTIK MUAMMOLARI

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3-bosqich talabasi

Annotatsiya. Ushbu maqolada sun'iy intellekt texnologiyalari, xususan, neyron mashina tarjimasi va katta til modellari asosida amalga oshirilayotgan tarjima jarayonlarida yuzaga kelayotgan lingvistik hamda stilistik muammolar tahlil qilinadi. Tadqiqotda AI tarjimasining tezkorlik, ko'p tillilik va dastlabki matn yaratishdagi afzalliklari tan olinadi, biroq semantik noaniqlik, kontekstni noto'g'ri anglash, frazeologik birliklarni so'zma-so'z tarjima qilish, terminologik izchillikning buzilishi, uslubiy neytrallashuv va madaniy konnotatsiyaning yo'qolishi kabi muammolar asosiy ilmiy masala sifatida ko'rib chiqiladi. Maqolada tarjima sifatini baholash uchun lingvistik, stilistik va pragmatik mezonlarga asoslangan tahliliy model taklif etiladi. Natijalar shuni ko'rsatadiki, sun'iy intellekt tarjima jarayonida yordamchi vosita sifatida samarali bo'lsa-da, badiiy, ilmiy, huquqiy, tibbiy va publitsistik matnlarda inson tarjimoni hamda post-tahrir bosqichi zarur bo'lib qoladi.

Kalit so'zlar: sun'iy intellekt, mashina tarjimasi, neyron tarjima, katta til modellari, lingvistik muammo, stilistik muammo, post-tahrir, terminologiya, tarjima sifati.

Аннотация. В данной статье анализируются лингвистические и стилистические проблемы, возникающие в процессе перевода в эпоху искусственного интеллекта, в частности при использовании нейронного машинного перевода и больших языковых моделей. В исследовании признаются преимущества AI-перевода, такие как оперативность, многоязычность и возможность создания первичного варианта текста. Однако основное внимание уделяется таким проблемам, как семантическая неопределенность, неправильная интерпретация контекста, буквальный перевод фразеологических единиц, нарушение терминологической последовательности, стилистическая нейтрализация и потеря культурной коннотации. В статье предлагается

аналитическая модель оценки качества перевода на основе лингвистических, стилистических и прагматических критериев. Результаты показывают, что искусственный интеллект может быть эффективным вспомогательным инструментом, однако при переводе художественных, научных, юридических, медицинских и публицистических текстов сохраняется необходимость человеческого переводчика и этапа постредактирования.

Ключевые слова: искусственный интеллект, машинный перевод, нейронный перевод, большие языковые модели, лингвистическая проблема, стилистическая проблема, постредактирование, терминология, качество перевода.

Abstract. This article analyzes linguistic and stylistic problems that arise in translation processes in the age of artificial intelligence, particularly through neural machine translation and large language models. The study acknowledges the advantages of AI-assisted translation, including speed, multilingual processing and the production of preliminary drafts. However, the main focus is placed on semantic ambiguity, contextual misinterpretation, literal rendering of idiomatic expressions, inconsistency in terminology, stylistic neutralization and the loss of cultural connotations. The article proposes an analytical model for assessing translation quality based on linguistic, stylistic and pragmatic criteria. The findings indicate that artificial intelligence can function as an effective auxiliary tool in translation, but human translators and post-editing remain essential in literary, academic, legal, medical and journalistic texts.

Keywords: artificial intelligence, machine translation, neural translation, large language models, linguistic problem, stylistic problem, post-editing, terminology, translation quality.

KIRISH

XXI asrda sun'iy intellekt texnologiyalarining tez rivojlanishi tarjima faoliyatiga bevosita ta'sir ko'rsatmoqda. Avvallari tarjima asosan insonning lingvistik bilimlari, madaniy kompetensiyasi va stilistik mahoratiga tayangan bo'lsa, bugungi kunda mashina tarjimasi, neyron tarmoqlar va katta til modellari tarjima jarayonining ajralmas qismiga aylanmoqda. Google Translate, DeepL, Yandex Translate, Microsoft Translator, NLLB va boshqa tizimlar qisqa vaqt ichida turli tillar o'rtasida matn yaratish imkonini bermogda. Bu holat tarjima amaliyotida tezlik va qulaylikni oshirgan bo'lsa-da, tarjimaning

mazmuniy aniqligi, uslubiy tabiiyligi va madaniy mosligi bilan bog‘liq yangi muammolarni ham yuzaga chiqarmoqda.

Tarjima faqat so‘zlarni bir tildan ikkinchi tilga almashtirish emas. U semantik, grammatik, pragmatik, stilistik va madaniy darajadagi murakkab jarayondir. Ayniqsa, badiiy matn, ilmiy maqola, huquqiy hujjat, tibbiy ko‘rsatma yoki publitsistik material tarjimasida har bir so‘zning ma‘nosi matn konteksti, janr talabi va kommunikativ maqsad bilan bog‘liq bo‘ladi. Sun‘iy intellekt esa ko‘p hollarda statistik va ehtimollik asosidagi til modeliga tayanadi. Shu sababli u ayrim holatlarda grammatik jihatdan silliq, lekin mazmunan noto‘g‘ri yoki usluban mos bo‘lmagan tarjima yaratishi mumkin.

Mavzuning dolzarbligi shundaki, bugungi kunda AI tarjimalari ta‘lim, nashriyot, xalqaro muloqot, ilmiy maqola tayyorlash, biznes yozishmalari va rasmiy hujjatlar almashinuvida keng qo‘llanmoqda. Biroq bunday tarjimalarni bevosita, tekshiruvsiz ishlatish semantik xatolar, noto‘g‘ri termin tanlovi, uslubiy qo‘pollik va hatto kommunikativ tushunmovchiliklarga olib kelishi mumkin. Ayniqsa, o‘zbek tili kabi morfologik jihatdan boy, uslubiy qatlamlari keng va kam resursli tillarda AI tarjimasi alohida tahlilni talab qiladi.

Tadqiqotning maqsadi sun‘iy intellekt asosidagi tarjima jarayonlarida uchraydigan asosiy lingvistik va stilistik muammolarni aniqlash, ularni tasniflash hamda tarjima sifatini oshirishga xizmat qiluvchi tahliliy yondashuvni ishlab chiqishdan iborat.

Ushbu maqsadga erishish uchun quyidagi vazifalar belgilandi:

birinchidan, AI tarjimasining lingvistik xususiyatlarini aniqlash;

ikkinchidan, mashina tarjimasida semantik, grammatik va terminologik xatolarni tahlil qilish;

uchinchidan, AI tarjimasida uslubiy neytrallashuv va janrga moslik muammolarini ko‘rsatish;

to‘rtinchidan, AI tarjimasini post-tahrir qilish mezonlarini ishlab chiqish;

beshinchidan, inson tarjimoni va sun‘iy intellekt hamkorligining samarali modelini asoslash.

METODLAR

Tadqiqotda tavsifiy, qiyosiy-lingvistik, kontekstual, stilistik va pragmatik tahlil metodlaridan foydalanildi. Maqola nazariy-analitik xarakterga ega bo‘lib, unda sun‘iy

intellekt asosidagi tarjima tizimlarida kuzatiladigan tipik xatolar lingvistik va stilistik mezonlar asosida guruhlandi.

Tahlil quyidagi mezonlar bo'yicha olib borildi:

1. **Semantik aniqlik** — tarjima matnida asl mazmun saqlangan yoki buzilganini aniqlash.
2. **Grammatik moslik** — tarjima tilining morfologik va sintaktik me'yorlariga rioya etilishini baholash.
3. **Terminologik izchillik** — maxsus soha terminlarining bir xil va aniq tarjima qilinishini tekshirish.
4. **Frazeologik moslik** — ibora, maqol, metafora va ko'chma ma'nolarning tabiiy berilishini aniqlash.
5. **Stilistik tabiiylik** — tarjima matnining janr, ohang va uslubga mosligini baholash.
6. **Pragmatik muvofiqlik** — tarjimada muallif niyati, muloqot vaziyati va auditoriya ehtiyoji saqlanganini tekshirish.

Tadqiqotda AI tarjimasining asosiy kamchiliklari real tarjima amaliyotida uchraydigan tipik holatlar asosida tahlil qilindi. Misollar badiiy, ilmiy, rasmiy, publitsistik va texnik matnlar doirasida guruhlandi. Jadval va tahlillarda “xato turi — sababi — oqibati — tuzatish yo‘li” modeli qo‘llandi.

NATIJALAR

Tahlil natijalari shuni ko'rsatadiki, AI tarjimasida eng ko'p uchraydigan muammolar to'rt asosiy guruhga ajratiladi: lingvistik xatolar, terminologik nomuvofiqliklar, stilistik soddalashtirishlar va madaniy-pragmatik yo'qotishlar.

1-jadval. AI tarjimasida uchraydigan lingvistik muammolar tasnifi

Xato turi	Namoyon bo'lish shakli	Asosiy sabab	Tarjimaga ta'siri
Semantik xato	So'zning noto'g'ri ma'noda tarjima qilinishi	Kontekst yetarli anglanmasligi	Asl mazmun buziladi

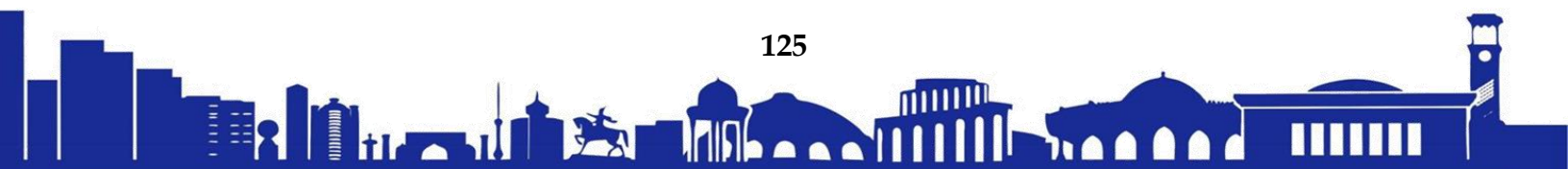


Xato turi	Namoyon bo'lish shakli	Asosiy sabab	Tarjimaga ta'siri
Grammatik xato	Kelishik, zamon, nisbat yoki so'z tartibining buzilishi	Tillar grammatik tizimining farqi	Matn tabiiyligi pasayadi
Frazeologik xato	Iboraning so'zma-so'z tarjimasi	Ko'chma ma'no tanilmasligi	Badiiy va madaniy ma'no yo'qoladi
Terminologik xato	Termin bir necha xil tarjima qilinishi	Soha lug'ati yetishmasligi	Ilmiy aniqlik buziladi
Referensial xato	Olmosh yoki nomning noto'g'ri bog'lanishi	Matn ichki bog'lanishining noto'g'ri talqini	Gaplararo mantiq buziladi
Uslubiy xato	Rasmiy matnning oddiy, badiiy matnning quruq tarjimasi	Janr talabi hisobga olinmasligi	Matn ohangi o'zgaradi

Jadvaldan ko'rinadiki, AI tarjimasida xato faqat grammatik shaklda emas, balki mazmun, uslub, kontekst va madaniy ma'no darajasida ham yuzaga chiqadi. Ayniqsa, o'zbek tiliga tarjima jarayonida so'z tartibi, kelishik qo'shimchalari, nisbat, egalik shakllari va hurmat ma'nolari muhim ahamiyat kasb etadi. Sun'iy intellekt bu birliklarni umumiy model asosida qayta ishlab, ayrim hollarda matnni grammatik jihatdan to'g'ri, lekin usluban sun'iy holatga keltiradi.

2-jadval. AI tarjimasida tipik xatolar va ularni tuzatish namunasi

Asl birlik	AI tarjimasida yuzaga kelishi mumkin bo'lgan muammo	Tavsiya etiladigan tarjima yechimi	Izoh
<i>He kicked the bucket</i>	“U chelakni tepdi”	“U vafot etdi” yoki kontekstga qarab “olamdan o'tdi”	Frazeologik birlik so'zma-so'z emas, ma'no asosida tarjima qilinadi



Asl birlik	AI tarjimasida yuzaga kelishi mumkin bo'lgan muammo	Tavsiya etiladigan tarjima yechimi	Izoh
<i>Public health surveillance</i>	“Jamoat salomatligi kuzatuvi”	“Aholi salomatligi ustidan epidemiologik monitoring”	Tibbiy termin kontekstga moslashtiriladi
<i>The proposal was tabled</i>	“Taklif stolga qo'yildi”	Kontekstga qarab “taklif muhokamaga kiritildi” yoki “taklif keyinga qoldirildi”	Ingliz inglizchasi va Amerika inglizchasida farqli ma'no bo'lishi mumkin
<i>Low-resource language</i>	“Past resursli til”	“Kam resursli til”	Terminologik barqarorlik talab qilinadi
<i>The text sounds flat</i>	“Matn tekis eshitiladi”	“Matn usluban sust/ta'sirsiz chiqmoqda”	Stilistik baho tabiiy ifodalanishi kerak

Ushbu misollar AI tarjimasining asosiy zaif nuqtasini ko'rsatadi: model ko'pincha ehtimoliy moslikni tanlaydi, lekin madaniy, sohaviy yoki janriy chuqurlikni yetarli darajada hisobga olmaydi. Frazologik birliklar va terminlar bu jarayonda eng xavfli birliklar hisoblanadi.

3-jadval. Matn janri bo'yicha AI tarjimasida xavf darajasi

Matn turi	AI tarjimasi samaradorligi	Xavf darajasi	Asosiy muammo
Oddiy axborot matni	Yuqori	Past	Mayda uslubiy tahrir talab qilinadi
Texnik yo'riqnoma	O'rtacha-yuqori	O'rtacha	Termin va buyruq shakllari aniqligi zarur

Matn turi	AI tarjimasi samaradorligi	Xavf darajasi	Asosiy muammo
Ilmiy maqola	O‘rtacha	O‘rtacha-yuqori	Terminologik izchillik va akademik uslub muhim
Tibbiy matn	O‘rtacha	Yuqori	Noto‘g‘ri termin xavfli oqibat berishi mumkin
Huquqiy hujjat	Past-o‘rtacha	Juda yuqori	Modallik, majburiyat va huquqiy kuch noto‘g‘ri talqin qilinishi mumkin
Badiiy matn	O‘rtacha-past	Yuqori	Obrazlilik, ohang, metafora va muallif uslubi yo‘qoladi
Reklama matni	O‘rtacha	Yuqori	Pragmatik ta’sir va auditoriyaga moslik buziladi

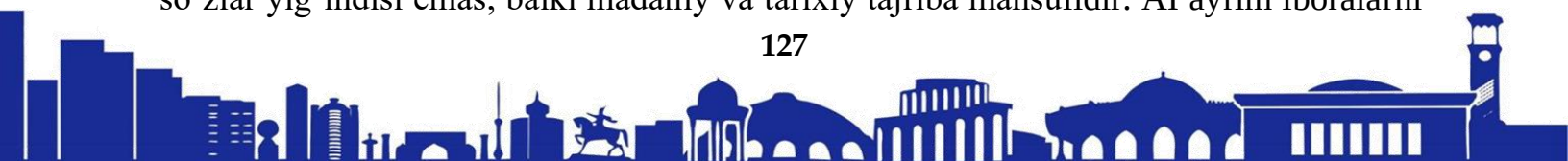
Natijalar shuni ko‘rsatadiki, AI tarjimasini hamma matn turlarida bir xil qo‘llash xato. Oddiy informatsion matnlarda sun‘iy intellekt tezkor yordamchi bo‘la oladi. Biroq ilmiy, huquqiy, tibbiy va badiiy matnlarda post-tahrir majburiy bosqich sifatida qaralishi kerak.

TAHLIL VA MUHOKAMA

Sun‘iy intellekt tarjimasida lingvistik muammolarning asosiy sababi til birliklarining kontekstga bog‘liqligidir. Har bir so‘z alohida olinganda bir nechta ma’noga ega bo‘lishi mumkin. Inson tarjimoni so‘zning ma’nosini matnning umumiy mazmuni, muallif pozitsiyasi, janr talabi va kommunikativ vaziyatga qarab tanlaydi. AI esa ko‘p hollarda mavjud ma’lumotlar bazasidagi ehtimoliy moslikka tayanadi. Natijada, tarjima tashqi tomondan ravon ko‘rinsa ham, ichki mazmun jihatidan xato bo‘lishi mumkin.

Birinchi muammo — **semantik noaniqlik**. Masalan, ingliz tilidagi *charge* so‘zi “ayblov”, “to‘lov”, “zaryad”, “mas’uliyat” kabi turli ma’nolarda qo‘llanadi. AI bunday birlikni noto‘g‘ri kontekstda tarjima qilsa, butun gapning mazmuni o‘zgaradi. Xuddi shunday, rus tilidagi “organ” so‘zi kontekstga qarab “organ”, “idora”, “tashkilot” yoki “a’zo” ma’nosida bo‘lishi mumkin. Bu holatda tarjimonning sohaviy bilimi zarur.

Ikkinchi muammo — **frazeologik birliklar tarjimasi**. Frazeologizmlar bevosita so‘zlar yig‘indisi emas, balki madaniy va tarixiy tajriba mahsulidir. AI ayrim iboralarni



tanisa-da, kam qo‘llanadigan, dialektal, badiiy yoki kontekstual iboralarni so‘zma-so‘z tarjima qilishi mumkin. Bu esa matnning estetik ta‘sirini pasaytiradi.

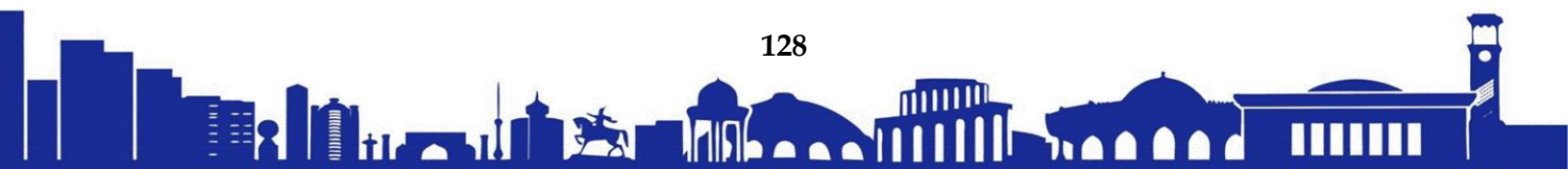
Uchinchi muammo — **terminologik izchillik**. Ilmiy va texnik matnlarda bir terminning maqola davomida bir xil tarjima qilinishi shart. Masalan, *artificial intelligence* bir joyda “sun’iy intellekt”, boshqa joyda “sun’iy aql”, yana boshqa joyda “aqlli texnologiya” tarzida tarjima qilinsa, ilmiy matnning aniqligi buziladi. Shu sababli AI tarjimasida terminlar bazasi va glossariy bilan ishlash muhim.

To‘rtinchi muammo — **stilistik neytrallashuv**. AI ko‘p hollarda matnni silliq, standart va neytral shaklga keltiradi. Bu rasmiy yoki texnik matnlarda foydali bo‘lishi mumkin, lekin badiiy matnda muallifning individual uslubi, obrazli ifodasi, ritmi va emotsional kuchi yo‘qoladi. Masalan, badiiy matndagi kinoya, piching, yumor yoki kesatiq AI tomonidan oddiy axborot sifatida tarjima qilinishi mumkin.

Beshinchi muammo — **madaniy konnotatsiya yo‘qolishi**. Tarjima jarayonida ayrim birliklar faqat lug‘aviy ma‘noni emas, balki milliy mentalitet, tarixiy xotira, urf-odat va ijtimoiy munosabatlarni ham ifodalaydi. Masalan, o‘zbek tilidagi “oq fотиha”, “andisha”, “or-nomus”, “mahalla”, “duo”, “hurmat” kabi birliklar kontekstga qarab izohli tarjimani talab qiladi. AI bunday birliklarni oddiy ekvivalent bilan almashtirsa, matnning madaniy qatlami kamayadi.

4-jadval. AI tarjimasini baholash uchun post-tahrir mezonlari

Mezon	Tekshiriladigan jihat	Post-tahrir savoli
Mazmuniy aniqlik	Asl fikr saqlanganmi?	Tarjima muallif aytmoqchi bo‘lgan fikrni to‘liq berdimi?
Terminologik izchillik	Termin bir xil qo‘llanganmi?	Bitta tushuncha turli joyda turlicha tarjima qilinmadimi?
Grammatik tabiiylik	Gap qurilishi o‘zbek tiliga mosmi?	Tarjima “mashina tili”ga o‘xshab qolmadimi?
Janrga moslik	Matn uslubi saqlanganmi?	Ilmiy matn ilmiy, badiiy matn badiiy ohangda chiqdimi?



Mezon	Tekshiriladigan jihat	Post-tahrir savoli
Pragmatik ta'sir	Auditoriyaga moslik bormi?	Tarjima o'quvchida asl matndagi ta'sirni uyg'otadimi?
Madaniy moslik	Milliy-madaniy birliklar to'g'ri berilganmi?	Izoh, moslashtirish yoki ekvivalent kerakmi?

Muhokama natijasida shuni aytish mumkinki, AI tarjimasining eng maqbul modeli “to‘liq avtomatik tarjima” emas, balki “inson + sun’iy intellekt + post-tahrir” modelidir. Bunda AI dastlabki tarjima variantini yaratadi, inson tarjimoni esa matnni semantik, terminologik va stilistik jihatdan qayta ishlaydi. Bu yondashuv tezlik va sifat o‘rtasidagi muvozanatni ta’minlaydi.

XULOSA

Sun’iy intellekt tarjima jarayonini tezlashtirgan va ko‘p tilli kommunikatsiya imkoniyatlarini kengaytirgan muhim texnologik vositadir. Biroq tarjima sifati faqat grammatik to‘g‘rilik bilan belgilanmaydi. Unda mazmun, uslub, kontekst, terminologiya, madaniy ma’no va pragmatik ta’sir ham muhim o‘rin tutadi.

Tadqiqot natijalari quyidagi xulosalarni beradi:

birinchidan, AI tarjimasi oddiy axborot matnlarida samarali bo‘lishi mumkin, ammo murakkab ilmiy, huquqiy, tibbiy va badiiy matnlarda mustaqil yakuniy tarjima sifatida yetarli emas;

ikkinchidan, AI tarjimasida eng ko‘p uchraydigan muammolar semantik noaniqlik, frazeologik xatolik, terminologik izchillikning buzilishi va stilistik neytrallashuv bilan bog‘liq;

uchinchidan, o‘zbek tiliga tarjima jarayonida morfologik boylik, so‘z tartibi, hurmat shakllari, madaniy birliklar va janr talablari alohida e’tibor talab qiladi;

to‘rtinchidan, AI tarjimasining sifatini oshirish uchun post-tahrir, terminologik glossariy, kontekstual tekshiruv va inson ekspertizasi zarur;

beshinchidan, kelajak tarjimonining vazifasi faqat matnni tarjima qilish emas, balki AI yaratgan matnni baholash, tahrir qilish, madaniy moslashtirish va uslubiy mukammallashtirishdan iborat bo‘ladi.

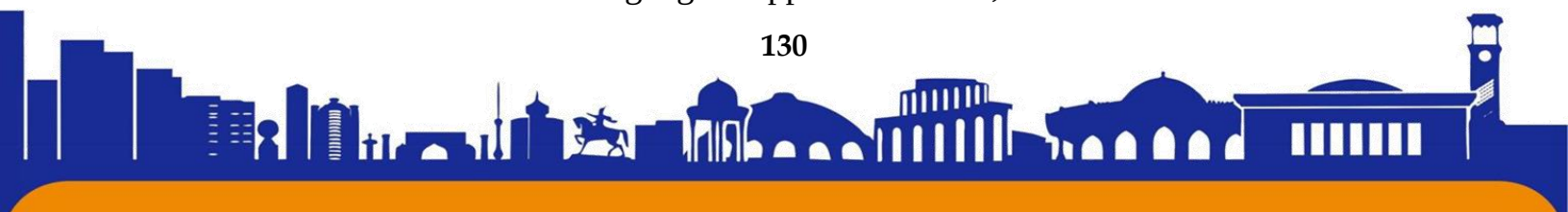
Shunday qilib, sun’iy intellekt tarjimonni to‘liq almashtiruvchi vosita emas, balki



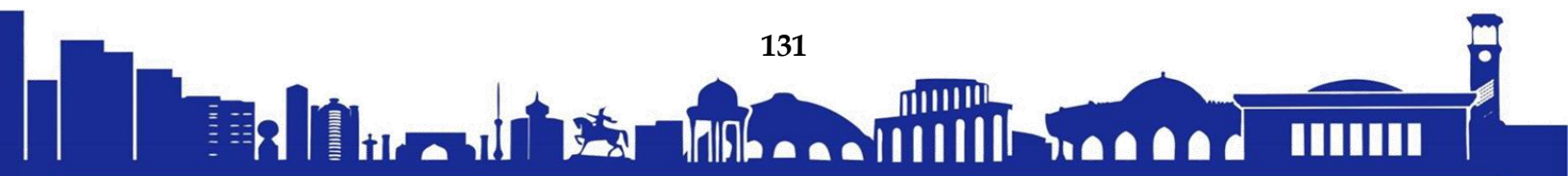
uning ishini tezlashtiruvchi va qo'llab-quvvatlovchi texnologik yordamchi sifatida baholanishi lozim. Eng samarali tarjima modeli inson tafakkuri, lingvistik kompetensiya va sun'iy intellekt imkoniyatlarining uyg'unlashuvi orqali shakllanadi.

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ЎТА ХАВФЛИ ЮЎУМЛИ КАСАЛЛИКЛАР: ТУРЛАРИ ВА ХУСУСИЯТЛАРИ

Термиз иқтисодиёт ва сервис университети тиббиёт факультети талабаси

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профилактик фанлар кафедраси ўқитувчиси

Бўриев Муҳаммадали Ғайрат ўғли

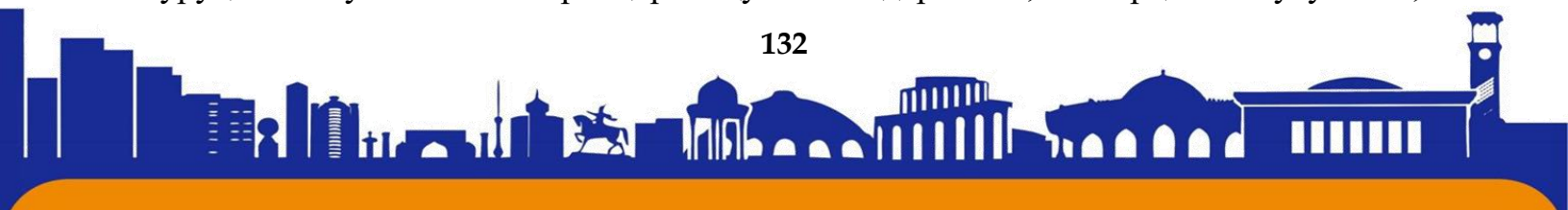
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Аннотация Мазкур мақолада ўта хавфли юқумли касалликларнинг таснифи, этиологик хусусиятлари, эпидемиологик тарқалиш йўллари, клиник кечими, диагностика принциплари ҳамда профилактика ва қарши кураш чоралари ёритилган. Бактериал (ўлат, вабо, куйдирги) ва вирусли (чин чечак, Эбола, сариқ безгак, КВГЛ) этиологияли касалликларнинг қиёсий таҳлили келтирилган, замонавий шароитда ушбу касалликларнинг тарқалиш хавфи ва уларга қарши тайёргарлик масалалари кўриб чиқилган.

Калит сўзлар: ўта хавфли юқумли касалликлар, эпидемиология, карантин инфекциялари, ўлат, вабо, чин чечак, геморрагик иситмалар, профилактика, вакцинация.

Кириш Юқумли касалликлар инсоният тарихи давомида энг катта талофатларга сабаб бўлган омиллардан бири ҳисобланади. Уларнинг орасида алоҳида гуруҳни ўта хавфли юқумли касалликлар (ЎХЮК) ташкил этади. Бу гуруҳга мансуб касалликлар юқори юқумлилиқ даражаси, тез тарқалиш хусусияти,



оғир клиник кечиши ва юқори ўлим кўрсаткичи билан тавсифланади. Жаҳон саломатлик ташкилоти (ЖСТ) маълумотларига кўра, ўта хавфли инфекциялар нафақат алоҳида мамлакатлар, балки бутун дунё аҳолиси саломатлигига жиддий таҳдид солувчи омил сифатида қаралади.

Тарихий жараёнда ўлат, вабо, чин чечак каби касалликлар бутун қитъаларни қамраб олган пандемияларга сабаб бўлган. Замонавий тиббиёт ва эпидемиология ютуқлари туфайли бу касалликларнинг кўпчилиги назорат қилинадиган даражага етказилган бўлса-да, глобаллашув жараёни, аҳоли миграцияси ва иқлим ўзгариши натижасида янги ва қайталанувчи хавфлар сақланиб қолмоқда. Шу сабабли ўта хавфли юқумли касалликларнинг турлари, эпидемиологик хусусиятлари ва уларга қарши кураш чораларини ўрганиш долзарб тиббий-ижтимоий вазифа ҳисобланади.

Мазкур мақолада ўта хавфли юқумли касалликларнинг таснифи, асосий қўзғатувчилари, тарқалиш йўллари, клиник хусусиятлари, диагностика принциплари ҳамда профилактика ва қарши кураш чоралари кенг ёритилади.

Ўта хавфли юқумли касалликлар тушунчаси ва таснифи

Ўта хавфли юқумли касалликлар деганда юқори контагиозлик (юқувчанлик), қисқа инкубация даври, тез тарқалиш қобилияти ва юқори леталлик даражасига эга бўлган инфекцион касалликлар тушунилади. Бундай касалликлар миллий ва халқаро санитар-эпидемиологик қоидалар асосида қатъий назоратга олинади, чунки уларнинг тарқалиши маҳаллий эпидемиядан жаҳон пандемиясига айланиши мумкин.

Ўта хавфли юқумли касалликларни умумий тарзда қуйидаги мезонлар бўйича таснифлаш мумкин:

Қўзғатувчисининг табиатига кўра — бактериал (ўлат, вабо, куйдирги), вирусли (чин чечак, Эбола, Марбург, сарик безгак), риккетсиозли ва паразитар касалликлар;

Юқиш йўлига кўра — ҳаво-томчи, фекал-орал, контакт, трансмиссив (ҳашаротлар орқали) ва зоонозли (ҳайвонлардан юқувчи) касалликлар;

Эпидемик хавф даражасига кўра — карантин (конвенцион) касалликлар ва маҳаллий ўта хавфли касалликлар.

Карантин касалликлар гуруҳига ўлат, вабо, чин чечак, сариқ безгак ва геморрагик иситмаларнинг айрим турлари киради. Бу касалликлар бўйича Халқаро тиббий-санитар қоидалар (ХТСК) асосида давлатлар ўртасида маълумот алмашиш ва қарши чора-тадбирларни мувофиқлаштириш мажбурийдир.

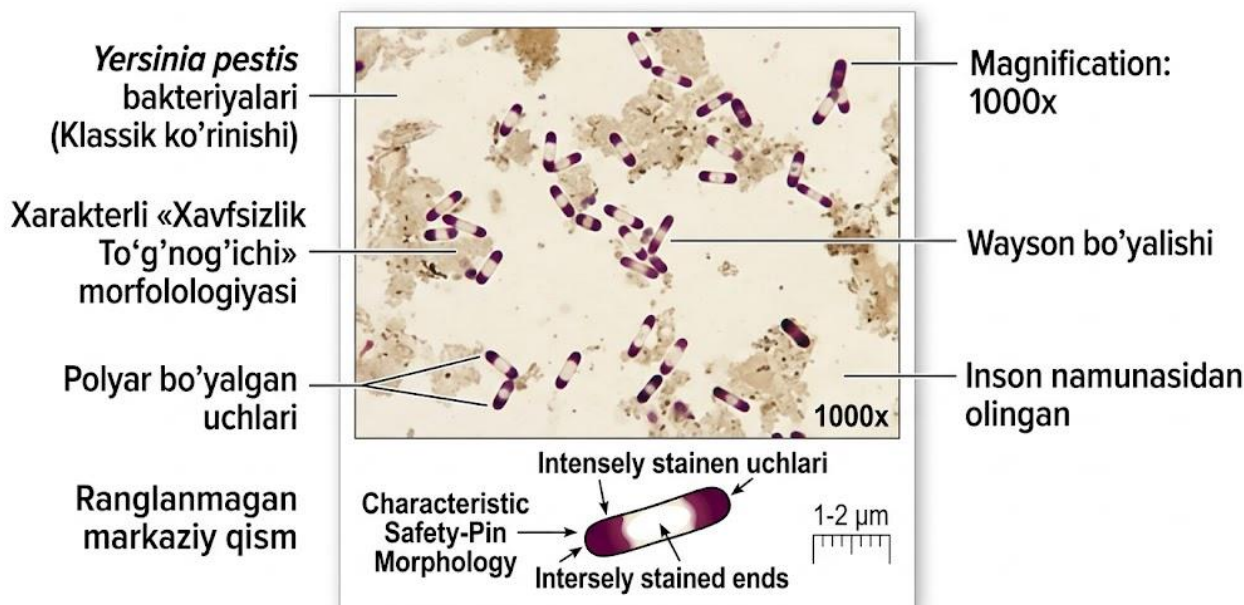
Бактериал этиологияли ўта хавфли касалликлар

Ўлат (тоун)

Ўлат — *Yersinia pestis* бактерияси қўзғатувчи, ўткир зоонозли инфекция ҳисобланади. Касаллик кемирувчилар орасида сақланиб, бурғалар орқали инсонга юқади. Бубон, ўпка ва септик шакллари мавжуд бўлиб, даволанмаган ҳолатда ўпка шакли деярли барча ҳолларда ўлим билан тугайди. Тарихда «Қора ўлат» номи билан машҳур бўлган XIV асрдаги пандемия Европа аҳолисининг катта қисмини қурбон қилган.

Бубон шаклида қўлтиқ ости, чов ва бўйин соҳасидаги лимфа тугунлари кескин катталашиб, оғриқли ҳолатга келади, тана ҳарорати юқори даражага кўтарилади. Ўпка шакли эса ҳаво-томчи йўли орқали бемордан-беморга бевосита юқиш хусусиятига эга бўлгани сабабли энг хавфли клиник кўриниш ҳисобланади ва тезкор антибактериал даво бошланмаса, бир неча кун ичида ўлимга олиб келиши мумкин. Шу сабабли ўлат касаллигига шубҳа туғилган барча ҳолатларда бемор зудлик билан изоляция қилиниши ва эпидемиологик хизматга хабар берилиши шарт.

Vabo qo'zg'atuvchisi – *Yersinia pestis* bakteriyalarining mikroskopik ko'rinishi

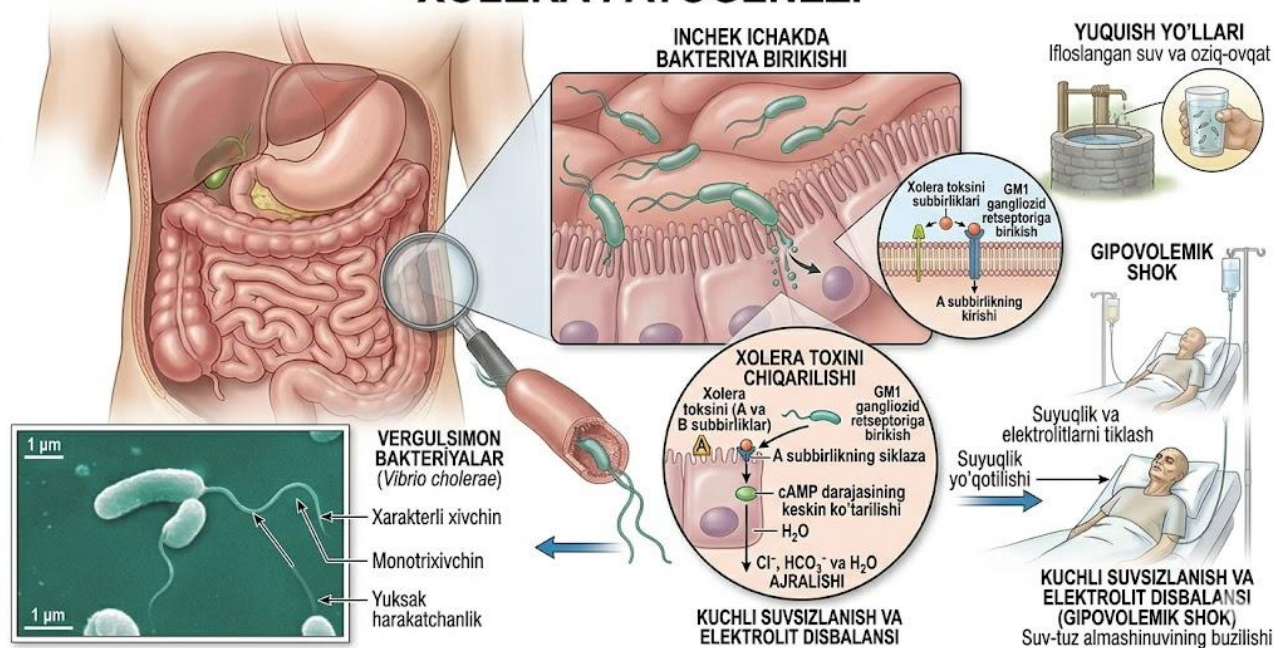


Вабо (холера)

Вабо — *Vibrio cholerae* бактерияси қўзғатган, асосан ифлос сув ва озиқ-овқат орқали юқувчи ўткир ичак инфекцияси. Касалликнинг асосий хавфи кучли суяқ ич кетиши натижасида юзага келадиган тезкор дегидратация ва электролит мувозанатининг бузилишидир. Тоза ичимлик суви ва санитария шароитлари йўлга қўйилмаган ҳудудларда вабо эпидемиялари тез-тез қайд этилади.

Касалликнинг инкубация даври бир неча соатдан беш кунгача давом этиши мумкин, бу эса касаллик манбасини аниқлашни мураккаблаштиради. Беморда «гуруч сувига» ўхшаш суяқ ахлат, тинимсиз қусиш ва тезкор суяқлик йўқотиш кузатилади, бу эса даволанмаган ҳолатда соатлар ичида гиповолемик шок ва ўлимга олиб келиши мумкин. Даволашнинг асосий усули йўқотилган суяқлик ва электролитларни қайта тиклашдан иборат бўлиб, бу борада оғизга ёки тери ости йўли билан суяқлик қуйиш муҳим аҳамиятга эга.

XOLERA PATOGENEZI

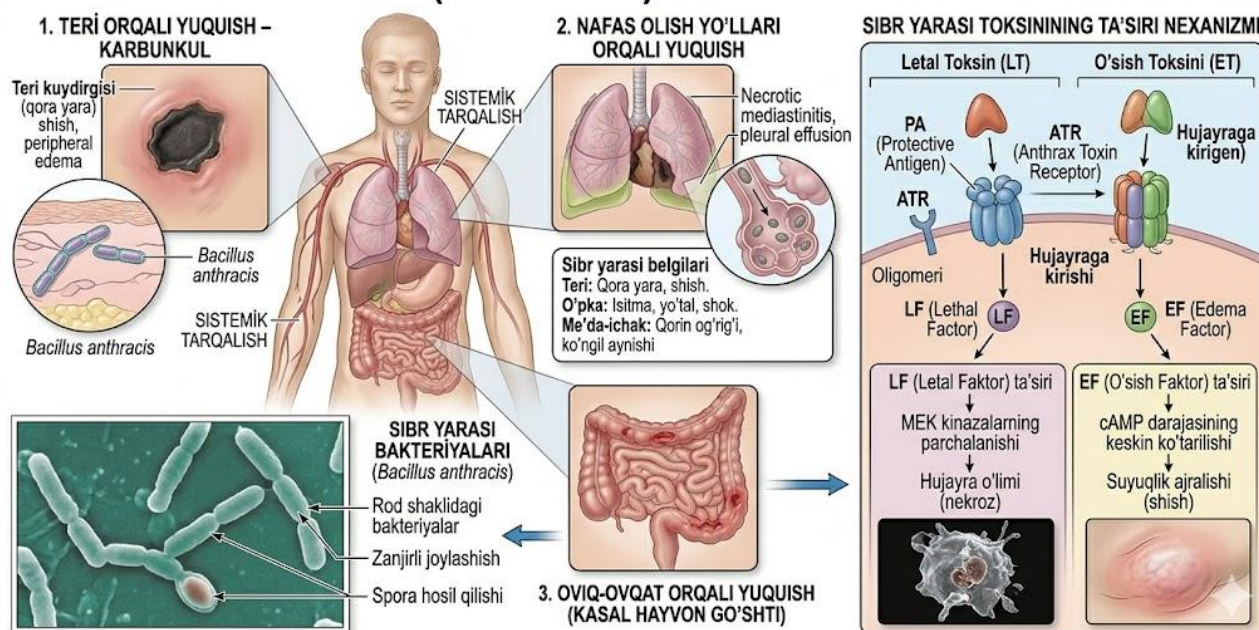


Куйдирги (сибир ярасига)

Куйдирги — *Bacillus anthracis* бактерияси қўзғатган зоонозли касаллик бўлиб, тери, ўпка ва ичак шаклларида намоён бўлади. Бактерия спора ҳосил қилиш хусусиятига эга бўлгани сабабли муҳитда узок муддат сақланиб қолади ва бу хусусияти уни биологик хавф омили сифатида ҳам қаралишига сабаб бўлади.

Тери шакли энг кўп учрайдиган ва нисбатан енгил кечадиган тур ҳисобланади, унда зарарланган тери қисмида қора қуйқа билан қопланган яра ҳосил бўлади. Ўпка шакли эса спора зарраларининг нафас йўли орқали юқиши натижасида юзага келиб, оғир интоксикация ва нафас етишмовчилиги билан кечади ҳамда юқори ўлим даражасига эга. Ичак шакли ифлосланган гўшт маҳсулотларини истеъмол қилиш орқали юзага келиши мумкин. Касаллик ҳайвонларда кенг тарқалган ҳудудларда чорвачилик соҳасида ветеринар-санитар назоратни кучайтириш муҳим профилактик аҳамиятга эга.

SIBR YARASI (KUYDIRGI) PATOGENEZI ODAMDA



Вирусли этиологияли ўта хавфли касалликлар

Чин чечак (вариола)

Чин чечак Variola virusи кўзғатган, юқори контагиозликка эга бўлган касаллик бўлиб, оммавий эмлаш дастурлари натижасида 1980 йилда табиий шароитда тўлиқ йўқотилган деб эълон қилинган. Шунга қарамай, вирус намуналарининг лабораторияларда сақланиши потенциал биологик хавф сифатида баҳоланади ва бу борада қатъий назорат сақланиб қолмоқда.

Касаллик юқори иситма, бош ва бел соҳасидаги кучли оғриқлар билан бошланиб, кейинчалик бутун танада пуфакчали тошма пайдо бўлиши билан давом этади. Тошмалар бир хил ривожланиш босқичида бўлиши чин чечакни сувчечакдан фарқлайдиган муҳим белги ҳисобланади. Жаҳон саломатлик ташкилотининг кўп йиллик оммавий эмлаш дастури туфайли касалликнинг табиий тарқалиши бутунлай тўхтатилган бўлса-да, у тарихда биологик хавфсизлик соҳасидаги энг муҳим мисоллардан бири сифатида ўрганилади.

Эбола ва Марбург геморрагик иситмалари

Эбола ва Марбург вируслари қўзгатган геморрагик иситмалар марказий ва ғарбий Африка ҳудудларида даврий равишда қайд этиладиган ўта хавфли касалликлар ҳисобланади. Касаллик беморнинг биологик суюқликлари билан тўғридан-тўғри контакт орқали юқади, оғир геморрагик синдром, кўп аъзоли етишмовчилик ва юқори ўлим даражаси билан кечади.

Касалликнинг дастлабки босқичида юқори иситма, кучли заифлик, мускул ва бўғим оғриқлари кузатилади, кейинчалик қусиш, ич кетиши ва баъзи ҳолларда ички ва тери остки қон кетишлар ривожланади. Бемор билан бевосита контактда бўлган шахслар, шу жумладан тиббиёт ходимлари юқори хавф гуруҳига киради, шу сабабли беморларни парвариш қилишда юқори даражадаги шахсий ҳимоя воситаларидан фойдаланиш мажбурийдир. Сўнгги йилларда Эбола вирусига қарши айрим вакциналарнинг ишлаб чиқиши эпидемияларни назорат қилиш борасида муҳим қадам бўлди.

Сариқ безгак

Сариқ безгак — *Aedes* туркумидаги чивинлар орқали юқувчи вирусли касаллик бўлиб, жигар тўқимасининг зарарланиши, сариқлик ва геморрагик аломатлар билан намоён бўлади. Касалликка қарши самарали вакцина мавжуд бўлиб, эндемик ҳудудларга саёҳат қилувчилар учун эмлаш тавсия этилади.

Касалликнинг енгил кечувчи бошланғич босқичидан сўнг, айрим беморларда токсик босқич ривожланиб, унда жигар ва буйрак фаолияти бузилиши, тери ва қўз оқининг сарғайиши ҳамда геморрагик аломатлар кузатилади. Бу босқичда ўлим даражаси сезиларли даражада ошади. *Aedes* туркумидаги чивинларнинг тарқалиш ареали кенгайиб бориши натижасида сариқ безгак эндемик бўлмаган ҳудудларга ҳам кириб бориш хавфи мавжуд, шу сабабли вакцинация дастурлари ва чивинларга қарши кураш чоралари алоҳида аҳамиятга эга.

Эпидемиологик хусусиятлари ва тарқалиш йўллари

Ўта хавфли юқумли касалликларнинг эпидемиологик хусусиятлари уларнинг қўзғатувчиси турига боғлиқ ҳолда фарқланади. Умумий жиҳатдан қуйидаги юқиш йўллари ажратилади: ҳаво-томчи йўли (чин чечак каби респиратор инфекцияларда), фекал-орал йўл (вабо каби ичак инфекцияларида), контакт йўли (қон ва биологик



суюқликлар орқали юқувчи геморрагик иситмаларда) ҳамда трансмиссив йўл (бурга, чивин ва канг каби ҳашаротлар орқали юқувчи касалликларда).

Бундай касалликларнинг тарқалишига табиий ва ижтимоий омиллар сезиларли таъсир кўрсатади. Иқлим ўзгариши натижасида ҳашаротларнинг тарқалиш ареали кенгайиши, аҳоли миграцияси, шаҳарлашиш жараёнлари ва халқаро транспорт алоқаларининг кучайиши инфекцияларнинг геогафик чегаралардан тезроқ ўтишига имкон яратади. Шунингдек, санитария-гигиена шароитларининг паст даражада бўлиши, тоза ичимлик сувига чекланган имконият ва тиббий хизмат кўрсатиш тизимининг сустлиги эндемик ҳудудларда эпидемия хавфини янада оширади.

Шунингдек, ушбу касалликларнинг тарқалишида ижтимоий-иқтисодий омиллар ҳам муҳим рол ўйнайди. Камбағал ва қашшоқлик даражаси юқори бўлган ҳудудларда озиқ-овқат хавфсизлигининг пастлиги, тиббий хизматларга чекланган имконият ва аҳолининг кўп турар жойларда зичлашиб яшаши инфекцияларнинг тезроқ тарқалишига шароит яратади. Бундан ташқари, табиий офатлар, қуроли можаролар ва аҳолининг мажбурий кўчирилиши натижасида юзага келадиган санитария инфратузилмасининг бузилиши ҳам эпидемия хавфини сезиларли даражада оширади.

Клиник хусусиятлари умумий тавсифи

Ўта хавфли юқумли касалликлар учун умумий клиник аломатлар сирасига юқори тана ҳарорати, умумий заҳарланиш синдроми, баъзи ҳолларда геморрагик тошмалар, лимфа тугунларининг катталашиши ҳамда ички аъзолар фаолиятининг бузилиши киради. Касалликнинг оғирлик даражаси кўп жиҳатдан кўзғатувчининг патогенлик хусусиятлари, инфекциянинг юққан йўли ва беморнинг иммун ҳолатига боғлиқ бўлади.

Инкубация даврининг қисқалиги ҳамда дастлабки аломатларнинг бошқа оддий касалликлар билан ўхшашлиги диагностикани мураккаблаштиради. Шу сабабли эпидемиологик анамнез (беморнинг эндемик ҳудудга саёҳати, ҳайвонлар билан контакти, касал инсон билан алоқаси) аниқлаш дастлабки ташхис қўйишда муҳим аҳамият касб этади.

Бундан ташқари, кўпгина ўта хавфли касалликларда касалликнинг кечиши уч асосий босқичга бўлинади: бошланғич (продромал) босқич, авж олиш босқичи ва натижа (тузалиш ёки асоратлар) босқичи. Бошланғич босқичда умумий заҳарланиш аломатлари устунлик қилади ва бу даврда аниқ ташхис қўйиш мураккаб бўлади, чунки клиник кўриниш кўпгина бошқа юқумли касалликлар билан ўхшаш бўлади. Авж олиш босқичида касалликка хос махсус аломатлар (геморрагик тошмалар, лимфаденопатия, сариклик ва ҳоказо) намоён бўлади ҳамда айнан шу даврда асосий ташхис ва даволаш чора-тадбирлари амалга оширилиши лозим. Натижа босқичида бемор аста-секин тузалишга ўтиши ёки, аксинча, кўп аъзоли етишмовчилик каби оғир асоратлар ривожланиши мумкин.

Диагностика принциплари

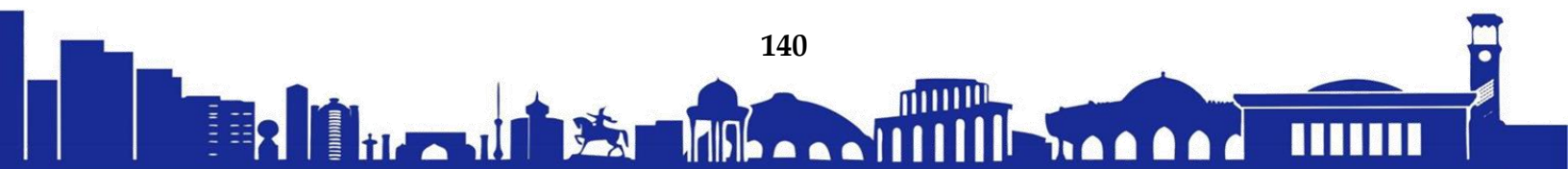
Ўта хавфли юқумли касалликлар диагностикаси клиник, эпидемиологик ва лаборатор усулларнинг уйғунлигига асосланади. Лаборатор диагностикада бактериологик ва вирусологик усуллар, серологик текширишлар (антитела титрини аниқлаш) ҳамда полимераз занжир реакцияси (ПЗР) каби молекуляр-генетик усуллар қўлланилади. Шубҳали ҳолатларда намуналар билан ишлаш фақат юқори ҳимоя даражасига эга махсус лабораторияларда амалга оширилиши шарт, чунки бу инфекциялар тадқиқотчилар учун ҳам жиддий хавф туғдиради.

Тезкор диагностика тест-тизимларининг жорий этилиши, айниқса геморрагик иситмалар ва вабо каби тез тарқалувчи касалликлар бўйича, эпидемияни дастлабки босқичда аниқлаш ва тарқалишининг олдини олишда ҳал қилувчи аҳамиятга эга.

Профилактика ва қарши кураш чоралари

Ташкилий-маъмурий чоралар

Ўта хавфли юқумли касалликларга қарши курашда дастлабки чора — касаллик манбасини аниқлаш ва уни изоляция қилишдир. Карантин режими, беморларни алоҳида тиббий муассасаларда даволаш, контактда бўлган шахсларни кузатиш ҳамда зарур ҳолларда маҳаллий ёки минтақавий карантин эълон қилиш каби тадбирлар амалга оширилади. Халқаро тиббий-санитар қоидаларига мувофиқ,

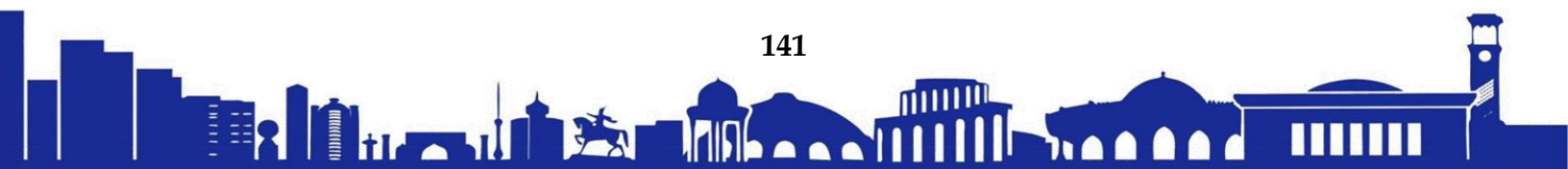


давлатлар ўта хавфли касаллик ҳолатлари ҳақида Жаҳон саломатлик ташкилотига ўз вақтида хабар бериши шарт.

Ўта хавфли юқумли касалликларнинг қиёсий жадвали

Қуйидаги жадвалда айрим ўта хавфли юқумли касалликларнинг қўзғатувчиси, юқиш йўли ва асосий хусусиятлари қиёсий тарзда келтирилган:

Касаллик	Қўзғатувчиси	Юқиш йўли	Асосий хусусиятлари
Ўлат (тоун)	<i>Yersinia pestis</i> (бактерия)	Бурга чақиши, ҳаво-томчи, контакт	Юқори леталлик, лимфа тугунлари шиши, ўпка шакли тез тарқалади
Вабо (холера)	<i>Vibrio cholerae</i> (бактерия)	Ифлос сув ва озик-овқат орқали	Кучли суюқ ич кетиши, тезкор дегидратация хавфи
Куйдирги (сибир ярасига)	<i>Bacillus anthracis</i> (бактерия)	Касал ҳайвонлар, тери орқали, нафас йўли	Тери, ўпка ва ичак шакллари мавжуд, спора ҳосил қилади
Чин чечак (вариола)	<i>Variola virus</i>	Ҳаво-томчи, контакт йўли	Ҳозирда табиатда йўқотилган, лаборатория хавфи сақланади
Эбола вируси иситмаси	<i>Ebolavirus</i>	Биологик суюқликлар орқали контакт	Геморрагик синдром, юқори ўлим даражаси
Сариқ безгак	Сариқ безгак вируси	<i>Aedes</i> турдаги чивин чақиши	Жигар зарарланиши, сариқлик, геморрагик аломатлар



Замонавий дунёда ўта хавфли касалликларнинг тутган ўрни

Глобаллашув жараёнининг тезлашиши, халқаро туризм ва савдо алоқаларининг кенгайиши натижасида ўта хавфли юқумли касалликларнинг бир минтақадан иккинчисига ўтиш эҳтимоли сезиларли даражада ошган. Ҳаво йўлларидаги юк ва йўловчилар оқимининг кучайиши туфайли аввал маҳаллий чегараланган ҳудудда қайд этилган касаллик бир неча кун ичида бошқа қитъаларга тарқалиши мумкин. Бундай шароитда халқаро ҳамкорлик, ягона эпидемиологик кузатув тизими ва ахборот алмашиш механизмларининг самарали ишлаши муҳим аҳамият касб этади.

Шунингдек, иқлим ўзгариши натижасида ҳарорат режимининг ўзгариши трансмиссив касалликларни тарқатувчи ҳашаротларнинг (чивин, канг, бурга) ареалини кенгайтиради. Бу эса олдин фақат тропик ва субтропик минтақаларда учрайдиган касалликларнинг бошқа минтақаларда ҳам пайдо бўлиш хавфини оширади. Шу боис эпидемиологик хизматлар томонидан доимий мониторинг ва хавф баҳолаш тизимларини юритиш зарурати ортиб бормоқда.

Биологик хавфсизлик нуқтаи назаридан, ўта хавфли қўзғатувчиларнинг лаборатория шароитида нотўғри сақланиши ёки улардан ёмон ниятли мақсадларда фойдаланилиши эҳтимоли алоҳида хавф омили сифатида қаралади. Шу сабабли юқори хавф даражасига эга биологик материаллар билан ишлаш қатъий халқаро ва миллий назорат остида амалга оширилади.

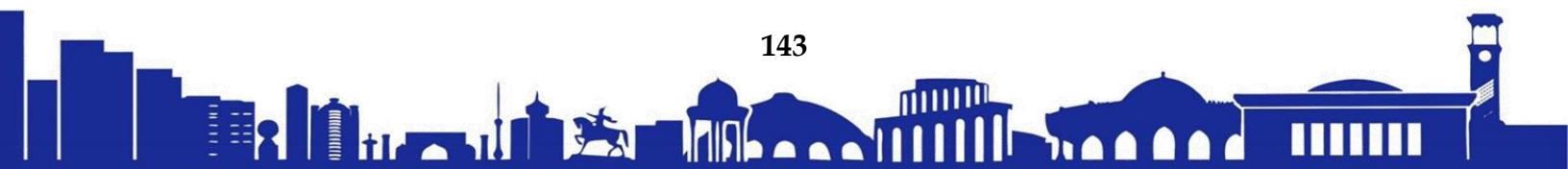
Хулоса Хулоса қилиб айтганда, ўта хавфли юқумли касалликлар инсоният саломатлигига доимий таҳдид солувчи муҳим тиббий-эпидемиологик муаммо ҳисобланади. Уларнинг турлари бактериял ва вирусли қўзғатувчилар орқали юзага келиб, юқори контагиозлик, тез тарқалиш ва оғир клиник кечими билан тавсифланади. Бу касалликларга қарши самарали кураш олиб бориш учун эрта диагностика, тезкор изоляция чоралари, халқаро ҳамкорлик ҳамда аҳоли орасида профилактик маърифий ишларни кучайтириш зарур.

Замонавий тиббиёт ютуқлари, вакцинация дастурлари ва лаборатор диагностика усуллариининг такомиллашуви туфайли кўпгина ўта хавфли касалликларнинг тарқалиши назоратга олинган бўлса-да, янги патогенларнинг

пайдо бўлиши ва иқлим ўзгариши каби омиллар сабабли эпидемиологик хушёрликни сақлаб қолиш доимий вазифа бўлиб қолмоқда.

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CHARACTERIZATION OF SYNTHESIZED SILICA GEL FOR MOISTURE ADSORPTION BASED ON DTA-TGA AND BET ANALYSIS

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ANNOTATION.

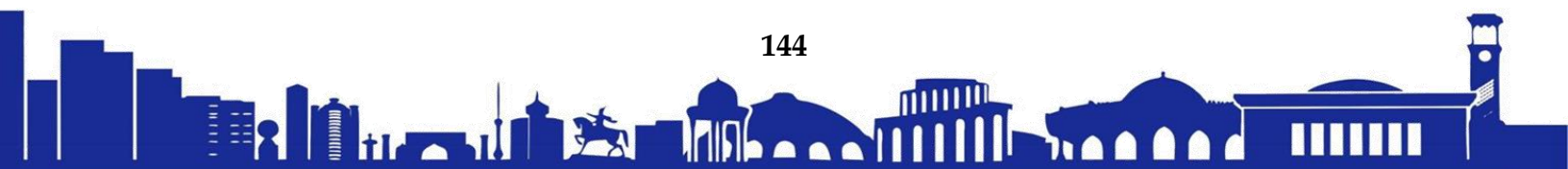
This study presents the synthesis of silica gel under laboratory conditions using the sol–gel method based on sodium silicate (Na_2SiO_3) and sulfuric acid (H_2SO_4), along with a comprehensive investigation of its physicochemical properties. The synthesis process included gel formation, aging, washing, and controlled drying under different regimes to evaluate their influence on the material characteristics.

Thermal behavior and stability of the obtained samples were analyzed using DTA–TGA methods. The results revealed that mass loss in the temperature range of 40–150 °C corresponds to the removal of physically adsorbed water. Sample 2.2 Y demonstrated a higher moisture adsorption capacity (14.49%) and more developed porous structure, whereas sample 2.1 Y exhibited superior thermal stability due to the presence of structurally bound hydroxyl groups.

BET analysis showed that the synthesized silica gel possesses a specific surface area of 203.7 m^2/g and a total pore volume of 0.21 cm^3/g . The pore size distribution is predominantly within the range of 1.7–2.0 nm, indicating a mesoporous structure. Additionally, the presence of micropores was confirmed by t-method and HK analysis, contributing to enhanced adsorption properties.

The obtained results demonstrate that the synthesized silica gel has a well-developed porous structure and can be effectively applied as an adsorbent and desiccant material in various industrial processes.

KEYWORDS:



Silica gel; Sol-gel synthesis; BET analysis; Mesoporous structure; Adsorption; DTA-TGA; Porous materials; Desiccant

Kirish.

Silica gel is a highly porous amorphous silicon dioxide obtained by the sol-gel method, which absorbs moisture through physical adsorption. It is a stable, renewable and effective desiccant material widely used for humidity control in various industries.[1]

Silica gel is divided into groups A, B and C. Type A is mainly used for drying gases and protecting products from moisture. Type B is used for adsorbing liquids, controlling humidity and as a catalyst carrier. Type C is widely used in industrial gas drying, oil purification, pharmaceutical processes and other technological processes [2].

When silica gel types are modified with amines, their sorption capacity towards CO₂ increases. Silica gels modified with hydroxyethyl carbamate significantly increase CO₂ sorption due to the presence of amino acids. Optimal modification at 30% HEC doubles the sorption capacity, demonstrating high efficiency and stability, which makes these sorbents promising for CO₂ capture [3].

The addition of nano silica significantly enhances the strength and durability of concrete by promoting pozzolanic reactions and increasing C-S-H gel formation. Optimal nano silica content improves mechanical performance while reducing cement consumption, demonstrating its strong potential for advanced concrete applications [4].

Sol-gel methods are important in the preparation of hybrid and mesoporous materials such as SBA-15. Such materials are promising for adsorption and environmental applications due to their high surface area and functionalization potential. However, the development of simple and inexpensive laboratory protocols for their synthesis is an urgent challenge [5].

A microfluidic HPLC-mimicking system using silica gel-C18 was successfully applied for cyclotide separation. The method enables rapid, low-cost, and efficient separation of cyclotides, demonstrating strong potential for drug discovery applications [6].

Silica gel (SiO₂) is widely used as a sorbent, desiccant, and catalyst support. In Russia, the demand for it is high, and domestic production is insufficient, so it is imported in large quantities. Therefore, it is important to develop high-quality silica gel production based on local raw materials [7].



Materials.

Liquid glass (Na_2SiO_3), Sulfuric acid (H_2SO_4)

Methods.

DTA (Differential Thermal Analysis) — to determine the processes of heat absorption or release when a substance is heated.

TGA (Thermogravimetric Analysis) — to see how the mass of a substance changes with temperature.

BET (Brunauer–Emmett–Teller) method — for calculating the total surface area of a material by adsorption of a gas (usually nitrogen, N_2).

Experimental part.

In laboratory conditions, gelation was observed as a result of the interaction of liquid glass and sulfuric acid, and the resulting gel was washed and dried after a certain time.

In this case, sodium silicate and water were dissolved in a ratio of 1:4, 1:6, and the system was constantly stirred. Then, a diluted sulfuric acid solution was slowly added to it dropwise until a weakly acidic environment was formed. After the gel was formed, the stirring was stopped and the gel was allowed to rest for 12-24 hours. After the time was up, the gel was washed several times to remove the sodium sulfate salt formed in the system and filtered. The resulting gel was dehydrated at a temperature of 180-200 °C for 2 hours.

Drying process.

The samples were designated as 2.1 Y and 2.2 Y. During the drying process, both samples were dried in different ways. The temperature of both samples was increased to 180-200 °C for drying, and sample 2.1 Y was held at this temperature for 2 hours and then slowly cooled. Sample 2.2 Y was held at this temperature for 2 hours at 180-200 °C and then suddenly cooled. and the obtained samples were sent for testing.

When we examined the obtained samples through DTA–TGA analysis, the following results were obtained.

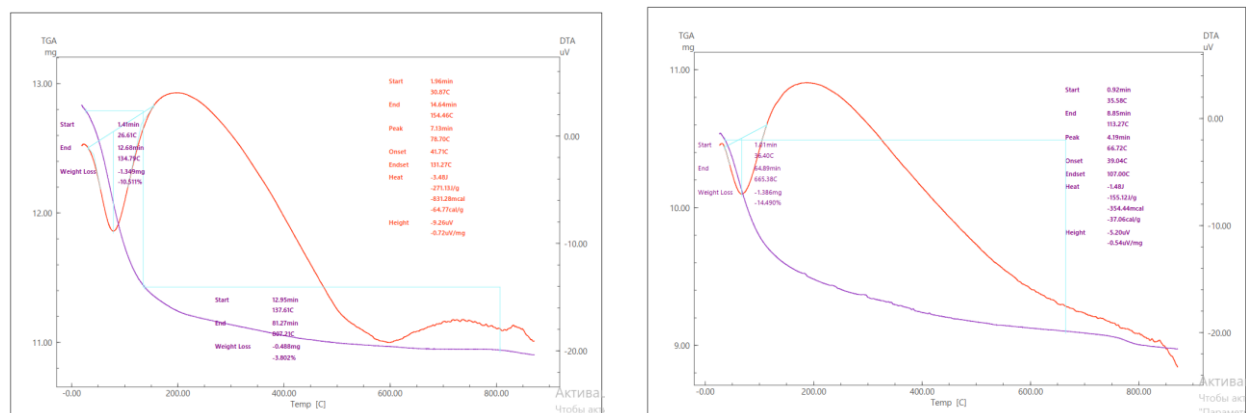


Figure 1. TGA–DTA results for the silica gel sample (2.1 Y and 2.2 Y).

TGA–DTA analysis of the synthesized silica gel samples showed that the mass loss in the range of 40–150 °C was due to the release of adsorbed water. Sample 2.2 Y had a high moisture absorption capacity (14.49%) and exhibited a developed porous structure. In sample 2.1 Y, the decomposition of structural hydroxyl groups was observed in an additional step, which revealed its high thermal stability. The results obtained confirm the high efficiency of silica gels as adsorbents.

Table 1. Comparative analysis of samples

Parameter	2.2 Y	2.1 Y
Moisture loss	High (14.49%)	Moderate (10.5%)
Peak temperature	66.7 °C	78.7 °C
Structural stability	Lower	Higher
Porosity	Very good	Good
Adsorption capacity	Very high	High

The BET analysis results of the synthesized silica gel sample are as follows. According to the results of BET analysis, the synthesized silica gel sample has a specific surface area of 203.7 m²/g, which indicates its well-developed pore structure. The total pore volume is 0.21 sm³/g. The pore sizes are mainly in the range of 1.7–2.0 nm, indicating that the material has a mesoporous structure. According to the results of the t-method and HK methods, the sample also contains micropores, which further enhances its adsorption properties.



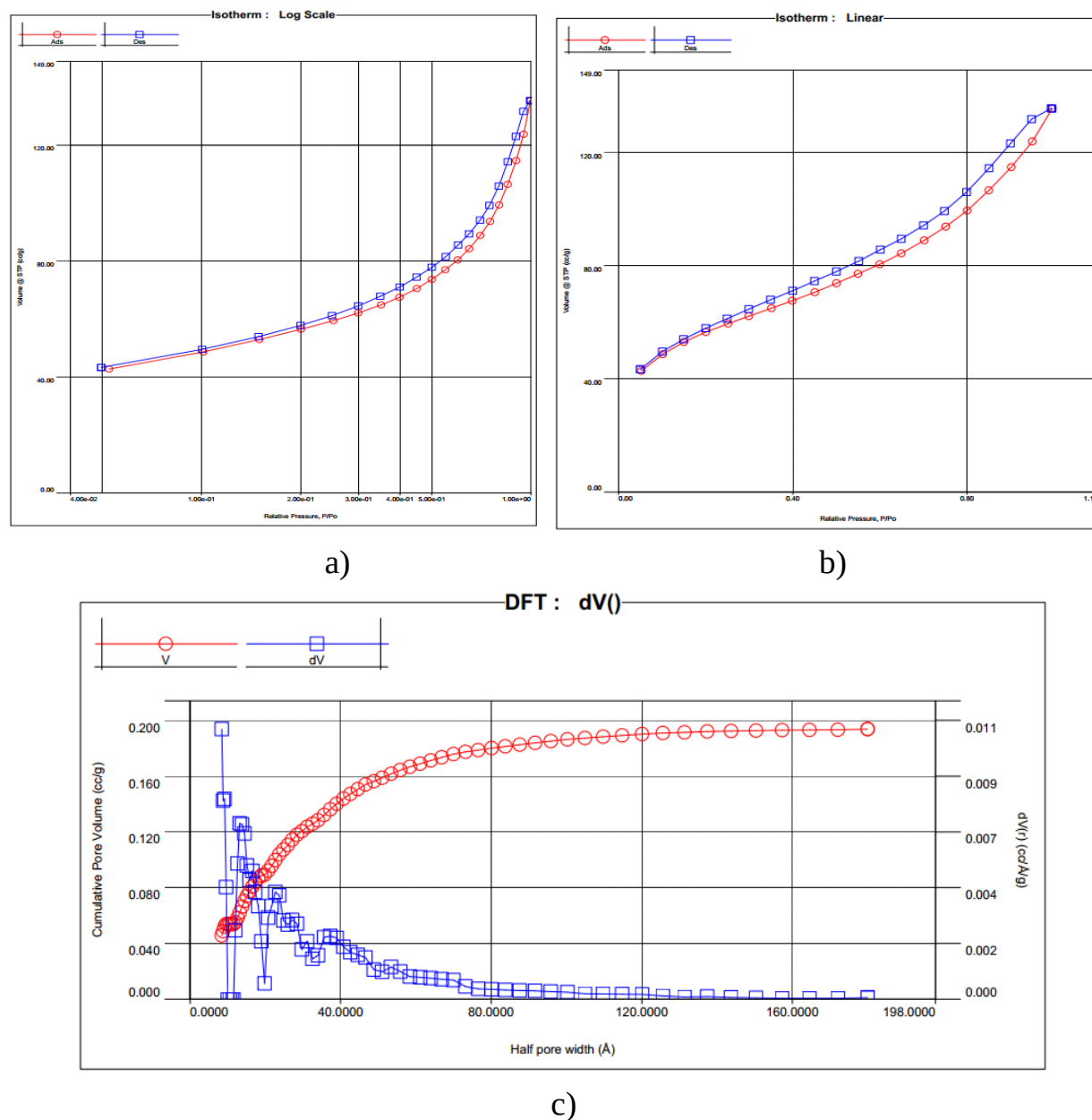
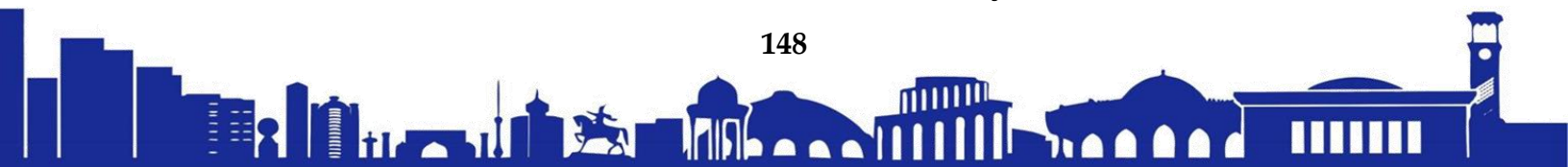


Figure 2. a), b) and c) - BET analysis results of the synthesized silica gel.

BET and pore structure analysis were performed according to the classical BET theory and IUPAC recommendations [8–10], and interpreted using modern approaches for porous materials [11–13].

CONCLUSION.

In this study, silica gel was successfully synthesized via a sol–gel method using sodium silicate and sulfuric acid under controlled laboratory conditions. The influence of



drying regimes on the structural and adsorption properties of the material was clearly demonstrated.

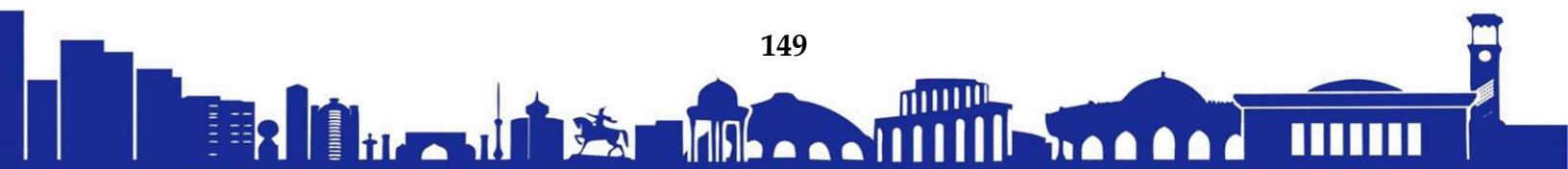
Thermal analysis confirmed that the synthesized samples exhibit typical dehydration behavior, with physically adsorbed water removed at low temperatures. The comparison of samples showed that rapid cooling enhances porosity and adsorption capacity, while slow cooling improves thermal stability.

BET analysis indicated that the silica gel possesses a relatively high specific surface area ($203.7 \text{ m}^2/\text{g}$) and a well-developed pore structure with both mesopores and micropores. The dominant pore size in the range of 1.7–2.0 nm confirms the mesoporous nature of the material, which is favorable for adsorption applications.

Overall, the synthesized silica gel demonstrates promising characteristics for use as an effective adsorbent in gas drying, moisture control, and environmental applications. Further modification (e.g., amine functionalization) could significantly enhance its performance for selective gas adsorption, particularly CO_2 capture.

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HUQUQIY TARTIBGA SOLISHNING IJTIMOIIY ZARURIYATI VA O‘ZIGA XOS XUSUSIYATLARI

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Annotatsiya: Ushbu maqolada jamiyat hayotini barqarorlashtirish va ijtimoiy munosabatlarni tizimlashtirishda huquqiy tartibga solishning ob‘ektiv zaruriyati hamda uning o‘ziga xos dogmatik, funksional xususiyatlari fundamental-nazariy jihatdan tadqiq etiladi. Muallif ijtimoiy tartib, qonun ustuvorligi va davlat irodasining huquqiy normalarda aks etish mexanizmlarini tahlil qilgan. Shuningdek, huquqning boshqa ijtimoiy regulyatorlardan farqli jihatlari va uning jamiyat taraqqiyotidagi transformatsion roli ilmiy nuqtai nazardan yoritib berilgan.

Kalit so‘zlar: huquqiy tartibga solish, ijtimoiy zaruriyat, ijtimoiy munosabatlar, huquqiy norma, davlat majburlovi, huquqiy tizim, qonun ustuvorligi.

Abstract: This article examines the objective necessity of legal regulation and its specific dogmatic and functional characteristics in stabilizing social life and systematizing social relations from a fundamental-theoretical perspective. The author analyzes the mechanisms of social order, the rule of law, and the reflection of state will in legal norms. Furthermore, the distinctive features of law from other social regulators and its transformational role in societal development are highlighted from a scientific point of view.

Keywords: legal regulation, social necessity, social relations, legal norm, state enforcement, legal system, rule of law.

Kirish

Insoniyat sivilizatsiyasi rivojlanishining hozirgi bosqichida jamiyat murakkab, ko‘p qirrali va dinamik tarzda o‘zgaruvchan tizim sifatida namoyon bo‘ladi. Bunday sharoitda

turli ijtimoiy guruhlar, individlar va institutlar o'rtasidagi manfaatlar to'qnashuvini muvozanatga keltirish, ijtimoiy adolat hamda barqarorlikni ta'minlash eng dolzarb vazifalardan biridir. Jamiyatni boshqarish va undagi tartibni saqlash qadimdan turli sotsial regulyatorlar (axloq, urf-odatlar, diniy normalar) orqali amalga oshirib kelingan bo'lsa-da, ularning hech biri davlat miqyosida umummajburiy xarakterga ega bo'lgan huquq kabi universal samara bera olmaydi.

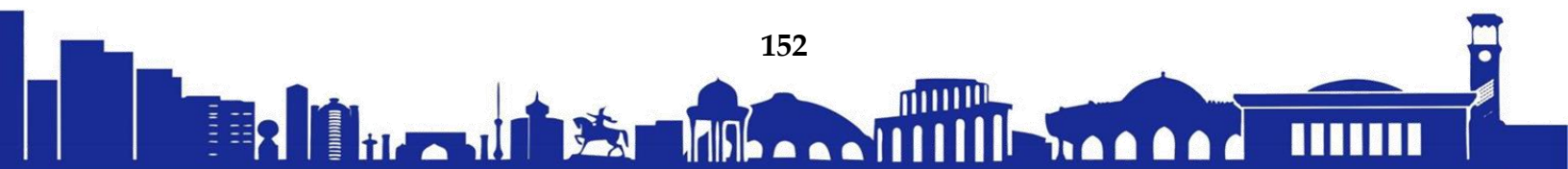
Huquqiy tartibga solish sotsial ehtiyojlarning qonuniyatli mahsuli bo'lib, u ijtimoiy munosabatlarni ongli va maqsadli ravishda muayyan qolipga solishga xizmat qiladi. Ushbu maqolaning maqsadi – huquqiy tartibga solishning nima sababdan ijtimoiy zaruriyatga aylanganini asoslash va uning o'ziga xos tizimli-funksional xususiyatlarini ilmiy-nazariy jihatdan ochib berishdan iborat. Ilmiy Konseptualizatsiya Ilmiy maqolaning kirish qismi shunchaki mavzuga kirish so'zi emas, balki tadqiqotning dolzarbligini ilmiy asoslash hamda muammoning qo'yilishidir. Bu qismda huquqiy tartibga solishning ijtimoiy zaruriyatini o'rganish nima uchun hozirgi davrda muhim ahamiyat kasb etayotgani sotsial, iqtisodiy va siyosiy omillar orqali ko'rsatiladi.

Kirish qismining tarkibiy elementlari va ularning kengaytirilgan bayoni: Mavzuning dolzarbligi: Globallashuv, raqamlashtirish va ijtimoiy munosabatlarning virtual makonga ko'chishi sharoitida an'anaviy huquqiy normalar inqirozga yuz tutmoqda. Yangi turdagi ijtimoiy munosabatlarni (masalan, sun'iy intellekt, raqamli iqtisodiyot, bioetika) tartibga solish ehtiyoji huquqiy tartibga solishning ob'ektiv (ijtimoiy) zaruriyatini yangitdan baholashni talab etadi. Muammoning qo'yilishi: Jamiyat tabiati tabiatan xaos va tartibsizlikka (anarxiyaga) moyil. Kuchlilarning kuchsizlar ustidan hukmronligi, resurslar taqchilligi va manfaatlar to'qnashuvi doimiy ijtimoiy portlashlar xavfini tug'diradi. Kirish qismida aynan mana shu sotsial ziddiyatlarni bartaraf etishda huquqning o'rnatilishi muqarrar ekanligi muammo qilib qo'yiladi.

Metodologik asos: Maqolada tizimli yondashuv, qiyosiy-huquqiy tahlil, sotsiologik va silsilaviy metodlardan foydalanilganligi qayd etiladi.

Asosiy Qism

Huquqiy Tartibga Solishning Ijtimoiy Zaruriyati

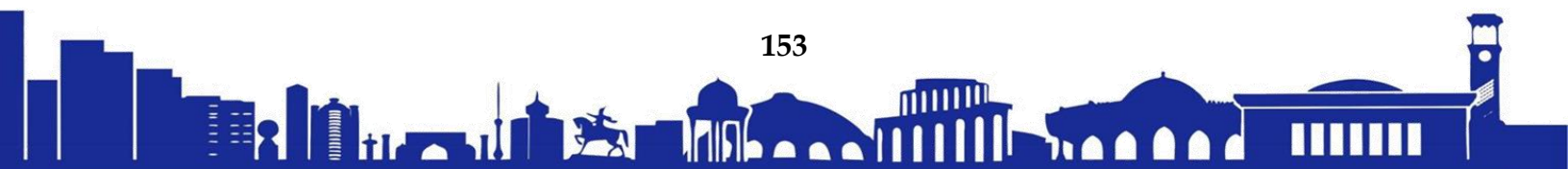


Huquqiy tartibga solishning ijtimoiy zaruriyati eng avvalo jamiyatning o'zini o'zi saqlash va rivojlantirish ehtiyojidan kelib chiqadi. Nemis sotsiologi va huquqshunosi Maks Veber ta'kidlaganidek, ratsional jamiyat faqatgina oldindan prognoz qilib bo'ladigan va qat'iy qoidalarga asoslangan tartib doirasidagina yashay oladi. Ijtimoiy zaruriyatni belgilovchi asosiy omillar quyidagilardan iborat: Manfaatlarni to'qnashuvini hal etish (Konfliktlar menejmenti): Jamiyatda cheklangan resurslar, iqtisodiy va ijtimoiy statuslar tufayli doimo ziddiyatlar yuzaga keladi. Huquq ushbu ziddiyatlarni kuch ishlatish yo'li bilan emas, balki konsensus va qonuniy protseduralar orqali hal etishning yagona legitim vositasidir. Ijtimoiy intizom va barqarorlik: Huquqiy tartibga solish sub'ektlarning xulq-atvor chegaralarini belgilaydi. Bu orqali jamiyatda anarxiya va xaosning oldi olinadi. Inson huquq va erkinliklarini kafolatlash: Jamiyatda kuchlilarning kuchsizlar ustidan mutlaq hukmronligini cheklash, har bir shaxsning daxlsizligini ta'minlash faqatgina davlat tomonidan tan olingan huquqiy normalar orqali kafolatlanadi. Huquqiy Tartibga Solishning O'ziga Xos Xususiyatlari: Huquqiy tartibga solish boshqa sotsial regulyatorlardan (masalan, axloq yoki korporativ normalardan) o'zining unikal tabiati bilan ajralib turadi. Ilmiy adabiyotlarda uning quyidagi o'ziga xos mezonlari ajratib ko'rsatiladi:

Umummajburiylik: Huquqiy normalar muayyan hududdagi barcha jismoniy va yuridik shaxslar, shuningdek davlat organlarining o'zi uchun ham majburiydir. Axloq normalari faqat uni tan olgan guruhlar doirasida amal qilsa, huquq sub'ektning xohishidan qat'iy nazar imperativ xarakterga ega.

Normativlik va Rasmiy Aniqlik: Huquqiy tartibga solish rasmiy hujjatlarda (qonunlar, kodekslar, kodekslashtirilgan aktlar) aniq, bir xilda talqin qilinadigan shaklda mustahkamlanadi. Bu huquq sub'ektlariga o'z xatti-harakatlarining oqibatlarini oldindan aniq bilish imkonini beradi.

Davlat majburlovi bilan ta'minlanganlik: Bu huquqning eng fundamental xususiyati hisoblanadi. Agar huquq normasi ixtiyoriy bajarilmasa, davlat o'zining maxsus apparati (sud, huquqni muhofaza qiluvchi organlar) orqali sanksiyalarni qo'llaydi va tartibni majburiy tiklaydi.



Tizimlilik va Prosedurallik: Huquqiy tartibga solish tarqoq qoidalar yig'indisi emas, u qat'iy ierarxiyaga ega bo'lgan ichki ziddiyatlarsiz tizimdir. Qolaversa, huquqni qo'llash va ijro etish har doim maxsus qonuniy protseduralar (misol uchun, sud jarayoni) asosida kechadi.

Fundamental Tahlil

Asosiy qism – bu maqolaning yadrosi bo'lib, unda kirishda qo'yilgan muammolar bevosita ilmiy dalillar, doktrinal qarashlar va huquqiy qonuniyatlar orqali isbotlanadi. Bu yerda mavzu ikki yirik yo'nalishga ajratiladi: ijtimoiy zaruriyat mexanizmi va huquqning spesifik (o'ziga xos) tabiati.

Asosiy qismni ilmiy boyitish uchun fundamental yo'nalishlar: Ijtimoiy Zaruriyatning Sotsiologik va Huquqiy Asoslari Huquq – bu davlat tomonidan o'ylab topilgan sun'iy mexanizm emas, balki jamiyatning ichki evolyutsiyasi mahsulidir.

Sotsial barqarorlik funksiyasi: Huquqiy tartibga solish jamiyat a'zolarining xulq-atvorini "oldindan prognoz qilib bo'ladigan" (predictable) holatga keltiradi. Agar huquq bo'lmasa, iqtisodiy shartnomalar, mulk daxlsizligi va shaxsiy xavfsizlik yo'qoladi. Konsensus va kompromis platformasi: Huquq turli ijtimoiy qatlamlar (ishchilar, tadbirkorlar, davlat apparati, etnik guruhlar) o'rtasidagi manfaatlarni muvozanatda ushlab turadi.

Huquqiy Tartibga Solishning O'ziga Xos Xususiyatlari (Dogmatik tahlil) Bu bo'limda huquqning boshqa regulyatorlardan (din, axloq, korporativ qoidalar) ustunlik jihatlari chuqur ilmiy tahlil qilinadi:

Institutsionallik va Formalizm: Axloq qoidalari inson ongida va vijdonida mavjud bo'lsa, huquqiy normalar rasmiy matnga, qat'iy strukturaga (gipoteza, dispozitsiya, sanksiya) ega bo'ladi.

Legitim Majburlov: Jamiyatdagi hech bir institut (oiladan tashqari) shaxsga nisbatan majburlov qo'llash huquqiga ega emas. Faqat davlatgina jismoniy, iqtisodiy va huquqiy sanksiyalar qo'llash monopoliyasiga ega va bu monopoliya huquqiy normalar orqali cheklanadi hamda amalga oshiriladi.



Xulosa

Xulosa qilib aytganda, huquqiy tartibga solish – bu shunchaki davlat tomonidan oʻrnatilgan taqiqlar majmuasi emas, balki jamiyatning evolyutsion rivojlanishi natijasida yuzaga kelgan eng oliy sotsial-madaniy qadriyatdir. Uning ijtimoiy zaruriyati jamiyatda adolat, xavfsizlik va barqarorlikni taʼminlash ehtiyojidan tugʻiladi. Huquqiy tartibga solishning davlat majburloviga tayanishi, rasmiy aniqligi va umummajburiyligi kabi oʻziga xos xususiyatlari uni boshqa barcha ijtimoiy normalardan ustun qoʻyadi va samaradorligini taʼminlaydi. Zamonaviy demokratik jamiyatda huquqiy tartibga solish mexanizmlarini doimiy ravishda takomillashtirish, qonun ijodkorligi sifatini oshirish davlat va jamiyat taraqqiyotining fundamental garovidir. Tadqiqot natijalari shuni koʻrsatadiki, huquqiy tartibga solish jamiyatni ongli boshqarishning eng mukammal va universal shaklidir. Uning ijtimoiy zaruriyati sotsial tizimning oʻzini oʻzi saqlash, manfaatlar toʻqnashuvini tinch yoʻl bilan hal etish hamda adolat mezonlarini oʻrnatish ehtiyojidan kelib chiqadi. Zamonaviy Global va Texnologik Transformatsiyalar Konteksti

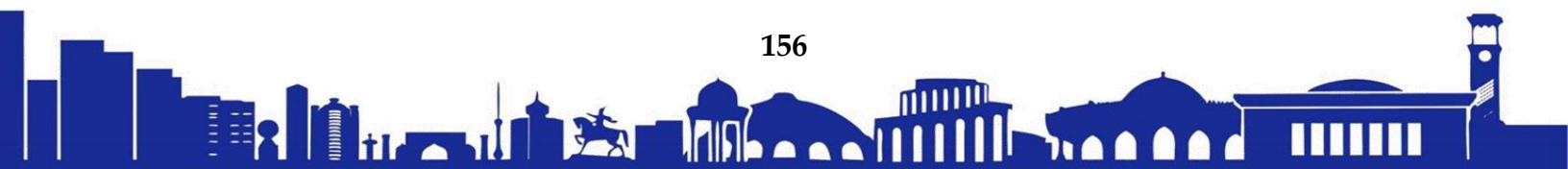
Bugungi kunda, yaʼni 21-asrning birinchi choragida, raqamli transformatsiyalar, sunʼiy intellekt tizimlari va biotexnologiyalar asrida huquqiy tartibga solishning ijtimoiy zaruriyati butunlay yangi sifat bosqichiga koʻtarildi. Endilikda huquq nafaqat real dunyodagi munosabatlarni, balki virtual makon (kiber-makon) va raqamli sotsiumni ham tartibga solishi, inson xavfsizligini kiber-tahdidlardan himoya qilishi shart. Bu esa huquqiy normalarning moslanuvchanligi (adaptivligi) va dinamizmini oshirishni taqozo etadi. Huquqiy tartibga solishning formal aniqligi, tizimlilik va davlat majburlovi bilan taʼminlanganligi kabi oʻziga xos xususiyatlari uni boshqa sotsial regulyatorlardan ajratib turuvchi fundamental mezonlardir. Zamonaviy sharoitda huquq tizimining samaradorligi uning qanchalik qatʼiyligida emas, balki jamiyatdagi shiddatli oʻzgarishlarga (raqamlashtirish, globallashtirish) qanchalik tez va adolatli moslasha olishida namoyon boʻladi. Demokratik taraqqiyot yoʻlidan borayotgan davlatlarda huquqiy tartibga solish mexanizmlarini doimiy modernizatsiya qilish, inson qadrini huquqning bosh mezoniga aylantirish barqaror rivojlanishning eng bosh shartidir.

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YANGI O‘ZBEKISTONDA IJTIMOIIY MUNOSABATLARNI HUQUQIY TARTIBGA SOLISHNING SIFATI HAMDA SAMARASINI OSHIRISH MASALALARI

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Pardayev Akmal Yo‘ldoshovich

Annotatsiya: Ushbu maqolada Yangi O‘zbekistonda amalga oshirilayotgan demokratik islohotlar sharoitida ijtimoiy munosabatlarni huquqiy tartibga solishning sifati va samaradorligini oshirish masalalari ilmiy-nazariy jihatdan tahlil qilingan. Muallif qonunchilik tizimini modernizatsiya qilish, qonun ijodkorligi jarayoniga raqamli texnologiyalarni joriy etish hamda huquq normalarining jamiyat hayotidagi amaliy ta’sirini baholash mexanizmlarini takomillashtirish muammolarini tadqiq etadi. Maqolada huquqiy tartibga solish samaradorligini yuksaltirishga qaratilgan ilmiy taklif va tavsiyalar ishlab chiqilgan.

Kalit so‘zlar: huquqiy tartibga solish, qonunchilik sifati, Yangi O‘zbekiston, huquqiy monitoring, raqamlashtirish, qonun ijodkorligi, ijtimoiy munosabatlar.

Abstract: This article provides a scientific and theoretical analysis of improving the quality and efficiency of legal regulation of social relations in the context of democratic reforms implemented in New Uzbekistan. The author examines the problems of modernizing the legislative system, introducing digital technologies into the lawmaking process, and improving mechanisms for assessing the practical impact of legal norms on society. The article develops scientific proposals and recommendations aimed at increasing the effectiveness of legal regulation.

Keywords: legal regulation, quality of legislation, New Uzbekistan, legal monitoring, digitalization, lawmaking, social relations.

Kirish

Yangi O'zbekistonni rivojlantirishning hozirgi bosqichida davlat va jamiyat hayotining barcha sohalarini tubdan modernizatsiya qilish jarayonlari kechmoqda. Mazkur islohotlarning muvaffaqiyati to'g'ridan-to'g'ri ijtimoiy munosabatlarni huquqiy tartibga solishning sifati va uning amaliyotdagi samarasiga bog'liqdir. Yangilangan Konstitutsiyamizda mustahkamlangan "Inson qadri uchun" tamoyili huquq ijodkorligi va huquqni qo'llash amaliyoti oldiga mutlaqo yangi vazifalarni qo'ymoqda. Bugungi kunda ijtimoiy munosabatlarning dinamik rivojlanishi, iqtisodiyot va ijtimoiy sohalarning raqamlashishi qonunchilik tizimidan nafaqat barqarorlikni, balki moslanuvchanlik (fleksibillik)ni ham talab etmoqda. Biroq, qonun hujjatlarining ko'pligi, ulardagi blanketli (havolaki) normalarning mavjudligi va ba'zan ijro mexanizmlarining mukammal emasligi huquqiy tartibga solishning samarasiga salbiy ta'sir ko'rsatmoqda. Shu bois, ijtimoiy munosabatlarni tartibga solishning sifati va mezonlarini ilmiy nuqtai nazardan tadqiq etish dolzarb ahamiyat kasb etadi. XXI asrning birinchi choragida jahon miqyosida kechayotgan global transformatsiyalar, iqtisodiy tizimlarning raqamlashtirilishi va ijtimoiy munosabatlarning keskin dinamizatsiyalashuvi davlat huquqiy siyosatining fundamental asoslarini qayta ko'rib chiqishni taqozo etmoqda. Zamonaviy yuridik fanning eng markaziy muammolaridan biri — bu jamiyatda yuzaga keladigan yangi subyektiv munosabatlarni huquqiy tartibga solishning optimal korrelyatsiyasini (mutanosibligini) topish hamda qonunchilikning ijtimoiy samaradorligini ta'minlash hisoblanadi.

Yangi O'zbekistonni rivojlantirishning hozirgi bosqichida davlat, jamiyat va shaxs o'rtasidagi munosabatlarni sifat jihatidan yangi bosqichga olib chiqish davlat siyosatining ustuvor yo'nalishiga aylandi. Yangilangan O'zbekiston Respublikasi Konstitutsiyasida mustahkamlangan "inson — jamiyat — davlat" hamda "Inson qadri uchun" tamoyillari huquq ijodkorligi va huquqni qo'llash amaliyoti mantiqini tubdan o'zgartirdi. Endilikda huquqiy tartibga solish mexanizmi shunchaki davlat irodasini majburlash vositasi emas, balki ijtimoiy adolat, iqtisodiy barqarorlik va inson huquqlarini kafolatlovchi strategik instrument vazifasini bajarishi lozim.

Asosiy qism

Huquqiy tartibga solish sifati tushunchasi va uning mezonlari Ilmiy-nazariy jihatdan huquqiy tartibga solish sifati — bu qonunchilik hujjatlarining jamiyat ehtiyojlariga mosligi, ichki ziddiyatlardan xoliligi, tushunish va qo'llash uchun qulayligi hamda ko'zlangan ijtimoiy-iqtisodiy natijani bera olish xususiyatidir. Yangi O'zbekistonda ushbu sifatni ta'minlash uchun quyidagi mezonlar ustuvor etib belgilanmoqda:

Ijtimoiy adekvatlik: Qonunning jamiyatdagi real talab va istaklarni aks ettirishi.

Sistematilik: Yangi qonun hujjatlarining mavjud huquqiy tizimga ziddiyatsiz integratsiyalashuvi.

Mantiqiy-lingvistik aniqlik: Normalarning turlicha talqin qilinishiga yo'l qo'ymaydigan darajada aniq bayon etilishi.

Qonun ijodkorligi jarayonini modernizatsiya qilish Bugungi kunda qonunchilik sifati bevosita qonun loyihalarini tayyorlash bosqichiga bog'liq. Yangi O'zbekistonda "aqlli qonunchilik" (smart regulation) konsepsiyasini joriy etish muhim ahamiyatga ega. Buning uchun:

Tartibga solish ta'sirini baholash (**TSTB**) tizimi barcha darajadagi normativ-huquqiy hujjatlar loyihalari uchun majburiy xarakterga ega bo'lishi lozim. Bu qonun qabul qilinishidan oldin uning tadbirkorlik subyektlari va fuqarolarga olib keladigan iqtisodiy hamda ijtimoiy xarajatlarini hisoblash imkonini beradi. Shuningdek, jamoatchilik muhokamasi institutini (masalan, regulation.gov.uz portali orqali) yanada faollashtirish va kelib tushgan takliflarni ilmiy-statistik tahlil qilish mexanizmlarini kuchaytirish zarur.

Huquqiy monitoring va qonun hujjatlari ijrosining samaradorligi Huquqiy tartibga solishning samarasi faqat qonun qabul qilish bilan o'lchanmaydi. Eng muhim bog'in — bu huquqni qo'llash amaliyotidir. Qonunlarning hayotda qay darajada ishlayotganini aniqlash uchun huquqiy monitoring instituti tizimli yo'lga qo'yilishi kerak. Hozirgi vaqtda qonunchilikda ijro mexanizmlarining yo'qligi yoki idoraviy manfaatlar tufayli qonun normalarining cheklanishi holatlari kuzatiladi. Huquqiy tartibga solish samarasini oshirish uchun har bir qonun hujjati tarkibida uning ijrosi uchun mas'ul organ, moliyalashtirish manbasi va aniq monitoring indikatorlari ko'rsatilishi shart. Huquqiy tartibga solish sifati tushunchasining ilmiy-nazariy interpretatsiyasi



Huquqshunoslik doktrinasida ijtimoiy munosabatlarni huquqiy tartibga solish mexanizmi **(HTSM)** murakkab va ko'p bosqichli tizim bo'lib, uning fundamental asosi normativ-huquqiy hujjatlarning sifati bilan belgilanadi. Huquqiy tartibga solish sifati — bu shunchaki qonun matnining grammatik yoki yuridik-texnik jihatdan to'g'ri shakllantirilganligi emas, balki qonun normalarining jamiyatdagi real obyektiv qonuniyatlar va transformatsiyalarga adekvatligi (mosligi) hisoblanadi. Yuridik fanda huquqiy tartibga solish sifatini baholashning uchta konseptual mezon ajratib ko'rsatiladi:

Ijtimoiy-siyosiy mezon: Qonunning jamiyatdagi ijtimoiy qatlamlar manfaatlarini muvozanatda saqlay olishi, inson huquqlari va qadr-qimmatini himoya qilishga yo'naltirilganligi.

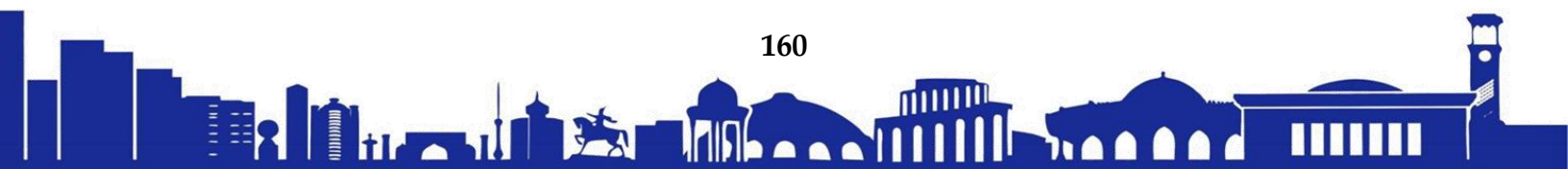
Tizimli-strukturaviy mezon: Yangi qonun hujjatlarining amaldagi milliy huquq tizimi, eng avvalo, yangilangan Konstitutsiya prinsiplari bilan vertikal va gorizontall kolliziyasiz (ziddiyatsiz) integratsiyalashuvi.

Funksional-amaliy mezon: Huquqiy normaning ijro etilish mexanizmi aniqligi, uning tushunarli bayon etilganligi va jamiyat hayotida kutilgan samarani bera olish qobiliyati. Yangi O'zbekistonda huquqiy tartibga solish siyosati klassik "davlat imperativi" (majburlash) modelidan "ijtimoiy hamkorlik va rag'batlantirish" modeliga o'tmoqda. Bu esa qonun hujjatlarining sifati faqat uning taqiqlovchi kuchi bilan emas, balki ijtimoiy munosabatlarni rivojlantirishga xizmat qiluvchi "dispozitivlik va rag'bat" (tanlash imkoniyati) salmog'i bilan o'lchanishini anglatadi.

Xulosala

Yangi O'zbekistonda ijtimoiy munosabatlarni huquqiy tartibga solishning sifati hamda samarasini oshirish yuzasidan olib borilgan ilmiy tahlillar asosida quyidagi xulosalarga kelindi:

Kodifikatsiyalash jarayonini jadallashtirish: Tarqoq holatda bo'lgan va bir-birini takrorlovchi qonunosti hujjatlarini tizimlashtirish, tarmoq kodekslarini (masalan, Ekologiya, Tadbirkorlik, Ijtimoiy ta'minot kodekslari) qabul qilish orqali qonunchilik bazasini ixchamlashtirish zarur.



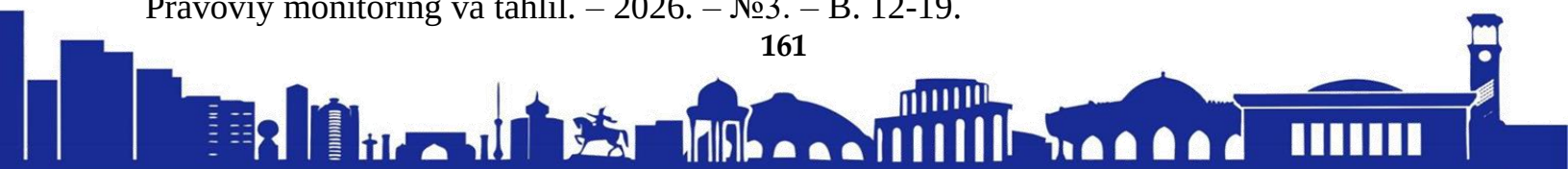
"To'g'ridan-to'g'ri ishlaydigan" qonunlar ulushini oshirish: Qonunlarda havolaki normalar miqdorini kamaytirish, ijro etuvchi hokimiyat organlarining qonun mazmunini o'zgartiruvchi idoraviy hujjatlar qabul qilish amaliyotiga chek qo'yish lozim.

Raqamli qonun ijodkorligi: Qonun loyihalarini tayyorlash, ekspertizadan o'tkazish va jamoatchilik fikrini o'rganish jarayonlariga sun'iy intellekt texnologiyalarini joriy etish, korrupsiyogen omillarni avtomatik aniqlash tizimini yaratish.

Huquqiy madaniyat va inklyuzivlik: Qonun loyihalarini ishlab chiqishda aholining barcha qatlamlari, ayniqsa, fuqarolik jamiyati institutlari va ilmiy doiralar ishtirokini kafolatlovchi mexanizmlarni huquqiy mustahkamlash. Milliy huquq tizimidagi eng dolzarb muammolardan biri — tarqoq va ko'p sonli qonunosti hujjatlarining mavjudligidir. Ijtimoiy munosabatlarni barqaror tartibga solish uchun tarmoq va sohalar bo'yicha yiriklashtirilgan, to'g'ridan-to'g'ri amal qiluvchi kodekslarni (masalan, Tadbirkorlik kodeksi, Ijtimoiy ta'minot kodeksi, Ekologiya kodeksi) qabul qilish jarayonini jadallashtirish zarur. Bu huquq tizimidagi kolliziyalar (ziddiyatlar) sonini keskin kamaytiradi va fuqarolar uchun qonunlarni tushunishni osonlashtiradi.

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YOSH QIZLARDA BIRLAMCHI DISMENOREYA MUAMMOSI VA UNING TIBBIY-IJTIMOY JIHATLARI

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ANNOTATSIYA

Ushbu ilmiy maqolada zamonaviy ginekologiya va yoshlar tibbiyotining eng ko'p tarqalgan hamda dolzarb muammolaridan biri — o'smir va yosh qizlarda birlamchi dismenoreya (og'riqli hayz ko'rish) sindromi hamda uning keng qamrovli tibbiy-ijtimoiy oqibatlari atroflicha o'rganilgan. Tadqiqot doirasida Central Asian Medical University 1-kursida tahsil oluvchi 68 nafar talaba qizlar o'rtasida anonim va ixtiyoriy so'rovnoma o'tkazildi. Statistika tahlil natijalari shuni ko'rsatdiki, qizlarning 73.5% qismida u yoki bu darajada dismenoreya simptomlari muntazam kuzatiladi. Ularning aksariyati professional shifokor ko'rigiga murojaat qilmasdan, dorixonalardan o'zboshimchalik bilan turli guruhdagi og'riqsizlantiruvchi dori vositalarini qabul qilishi aniqlandi. Maqolada dismenoreyaning patofiziologik kelib chiqish mexanizmlari, prostaglandinlar disbalansi va ushbu patologiya yosh avlod hayot sifatiga, o'quv jarayoniga hamda psixologik statusiga salbiy ta'siri chuqur tahlil qilingan.

Tayanch tushunchalar: ginekologiya, birlamchi dismenoreya, yosh qizlar, prostaglandinlar, og'riq sindromi, hayot sifati, so'rovnoma, reproduktiv salomatlik, nosteroid yallig'lanishga qarshi vositalar.

АННОТАЦИЯ

В данной научной статье изучена одна из самых распространенных и актуальных проблем в современной гинекологии — первичная дисменорея (болезненные менструации) у молодых девушек и ее комплексные медико-социальные последствия. В рамках исследования был проведен анонимный опрос среди 68 студенток 1-го курса Central Asian Medical University. Результаты показали, что у 73.5% девушек в той или иной степени регулярно наблюдаются симптомы дисменореи. Было обнаружено, что большинство из них принимают различные обезболивающие препараты самостоятельно, не обращаясь к квалифицированному врачу. В статье анализируются патофизиологические механизмы возникновения дисменореи, дисбаланс простагландинов и ее негативное влияние на качество жизни, учебный процесс и психологический статус девушек.

Ключевые слова: гинекология, первичная дисменорея, молодые девушки, простагландины, болевой синдром, качество жизни, опросник, репродуктивное здоровье, НПВС.

ABSTRACT

This scientific article addresses one of the most prevalent and urgent issues in modern gynecology — primary dysmenorrhea (painful menstruation) among adolescent and young women, along with its comprehensive medico-social consequences. Within the scope of the study, an anonymous and voluntary survey was conducted among 68 first-year female students at Central Asian Medical University. The findings indicated that 73.5% of the students experience dysmenorrhea symptoms to various degrees on a regular basis. It was revealed that the vast majority of them take various analgesics autonomously without consulting a physician. The article provides a deep analysis of the pathophysiological mechanisms of dysmenorrhea, prostaglandin imbalance, and its overall negative impact on the quality of life, academic performance, and psychological well-being of young women.

Keywords: gynecology, primary dysmenorrhea, young women, prostaglandins, pain syndrome, quality of life, questionnaire, reproductive health, NSAIDs.

1. KIRISH (INTRODUCTION)

Zamonaviy ginekologiya va o'smirlar tibbiyotida yosh qizlarning reproduktiv salomatligini muhofaza qilish global miqyosdagi eng muhim vazifalardan biri hisoblanadi. Ginekologiya amaliyotida o'smir qizlar va yosh ayollar o'rtasida eng ko'p uchraydigan, ularning kundalik faoliyatini cheklab qo'yadigan yetakchi muammolardan biri bu — birlamchi dismenoreyadir. Birlamchi dismenoreya (algodismenoreya) — bu kichik chanoq a'zolarida hech qanday organik patologiya (o'sma, kistalar, yallig'lanish jarayonlari, rivojlanish anomaliyalari) bo'lmagan holda, hayz davrining o'ta kuchli, sanchiqsimon yoki simillovchi og'riqlar bilan kechishidir.

Jahon sog'liqni saqlash tashkiloti (JSST) va xalqaro ginekologik assotsiatsiyalar ma'lumotlariga ko'ra, o'smir qizlar orasida dismenoreyaning tarqalish ko'rsatkichi 50% dan 90% gacha bo'lgan juda keng diapazonni tashkil etadi. Bu holat patofiziologik jihatdan organizmda, xususan bachadonning ichki shilliq qavati (endometriy)da prostaglandinlar (asosan PGF2 α va PGE2) moddasining ortiqcha sintezlanishi va ajralishi bilan uzviy bog'liq. Prostaglandinlarning yuqori konsentratsiyasi bachadon miometriy qavatining kuchli, tartibsiz qisqarishiga, tomirlar spazmiga va natijada to'qimalar ishemiyasiga (kislorod ochligiga) olib keladi. Aynan shu ishemiya kuchli og'riq reseptorlarini qo'zg'atuvchi asosiy omil hisoblanadi.

Ushbu muammo yosh qizlarning nafaqat jismoniy holatiga, balki ularning oliy ta'lim muassasalaridagi o'qish faoliyatiga, psixologik kayfiyatiga (depressiya, xavotirlanish), emotsional barqarorligiga va umumiy ijtimoiy hayotiga ham o'ta salbiy ta'sir ko'rsatadi. Ko'p hollarda qizlar va ularning ota-onalari buni "tabiiy, o'tib ketadigan holat" deb hisoblab, shifokor ginekologga murojaat qilishmaydi. Ushbu holat dori vositalarini nazoratsiz qabul qilishga va muammoning surunkali tus olishiga zamin yaratadi. Shu sababli, ushbu muammoni tibbiyot yo'nalishida tahsil olayotgan talaba qizlar misolida o'rganish va tahlil qilish o'ta dolzarb ahamiyat kasb etadi.

2. METODOLOGIYA (MATERIALS AND METHODS)

Tadqiqotimiz Central Asian Medical University (CAMU) Davolash ishi yo'nalishi 1-kurs talaba qizlari o'rtasida 2026-yilning bahor oylarida o'tkazildi. Tadqiqotda ishtirok etish to'liq ixtiyoriy va anonim xarakterga ega bo'lib, unda 17 yoshdan 20 yoshgacha bo'lgan

(oʻrtacha yosh — 18.4 ± 0.6) 68 nafar qiz ishtirok etdi. Maʼlumotlarni yigʻish maqsadida maxsus ishlab chiqilgan, xalqaro ginekologik soʻrovnoma (Visual Analog Scale - VAS va hayot sifatini baholash testlari) asosida tayyorlangan anonim soʻrovnoma toʻldirildi.

Soʻrovnoma quyidagi koʻrsatkichlarni aniqlashga qaratilgan savollar bloki oʻrin oldi:

- Hayz siklining davomiyligi, muntazamligi va menarxe (birinchi hayz) yoshi;
- Ogʻriq sindromining intensivligi (1 dan 10 gacha boʻlgan Vizual-Analogik Shkala (VAS) boʻyicha: 1-3 ball — yengil, 4-6 ball — oʻrtacha, 7-10 ball — kuchli ogʻriq);
- Ogʻriqqa hamrohlik qiluvchi vegetativ va nevrologik simptomlar (koʻngil aynishi, qusish, bosh ogʻrigʻi, diareya, holsizlik, umumiy zombi holati);
- Ogʻriq qoldirish maqsadida qoʻllaniladigan farmakologik vositalar va ularni qabul qilish chastotasi;
- Ginekolog shifokor qabulida boʻlganlik holati va tibbiy madaniyat darajasi.

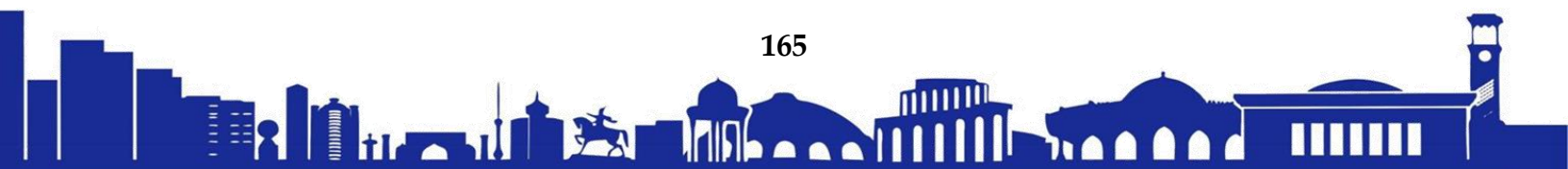
Olingan barcha empirik maʼlumotlar variatsion statistika usullari yordamida dasturiy paketlarda foizlar va nisbiy qiymatlar hisobida qayta ishlandi hamda tahlil qilindi.

3. NATIJALAR (RESULTS)

Oʻtkazilgan sotsiologik-tibbiy soʻrovnoma natijalarining chuqur tahlili shuni koʻrsatdiki, 68 nafar respondent qizlardan 50 nafarida (73.5%) hayz sikli davomida muntazam yoki vaqti-vaqti bilan yaqqol namoyon boʻluvchi ogʻriq sindromi (dismenoreya) kuzatiladi. Ogʻriq intensivligini VAS shkalasi boʻyicha baholaganda, qizlarning 24%ida yengil darajadagi ogʻriqlar, 40%ida oʻrtacha jadallikdagi ogʻriqlar va 36%ida (18 nafar qizda) chidab boʻlmas darajadagi oʻta kuchli ogʻriqlar qayd etildi. Kuchli ogʻriqlar kuzatiladigan qizlar hayzning dastlabki 1-2 kunida oʻquv jarayoniga mutlaqo qatnasha olmasliklarini yoki darslarda diqqatni jamlash qobiliyati keskin pasayib ketishini bildirishgan.

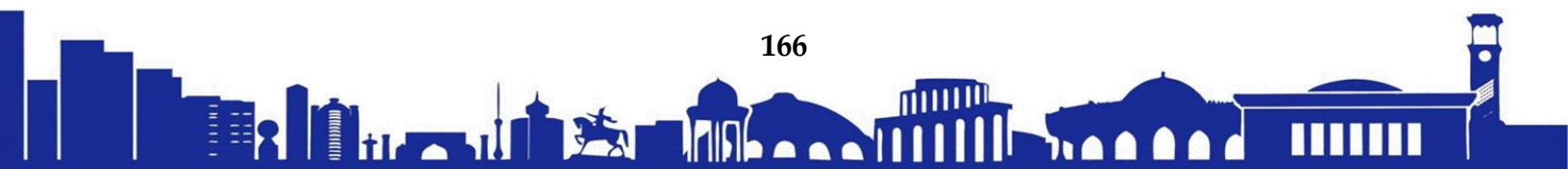
1-jadval: Dismenoreya paytida kuzatiladigan qoʻshimcha simptomlar:

№	Kuzatiladigan hamroh va qoʻshimcha simptomlar	Bemorlar soni (n=50)	Foiz hisobida (%)



1	Kayfiyatning keskin o'zgarishi, emotsional labillik (asabiylashish)	41	82.0%
2	Umumiy holsizlik, asteniya va tez charchash	38	76.0%
3	Sefalgiya (bosh og'rig'i) va vertigo (bosh aylanishi)	22	44.0%
4	Dispeptik buzilishlar (ko'ngil aynishi yoki qayt qilish)	12	24.0%

Tadqiqot davomida eng tashvishli va achinarli holat qizlarning tibbiy yordam olishga bo'lgan yondashuvda aniqlandi. Og'riqli hayz ko'rishdan muntazam aziyat chekuvchi qizlarning 84% (42 nafar qiz) hayoti davomida biror marta ham ushbu muammo yuzasidan malakali ginekolog ko'rigidan va instrumental (masalan, kichik chanoq a'zolari UTIdan) tekshiruvlaridan o'tmaganliklarini ta'kidlashdi. Buning o'rniga, ular og'riq xuruj qilgan paytda dorixonalardan shifokor reseptisiz, o'zboshimchalik bilan turli xil og'riqsizlantiruvchi vositalarni (asosan nosteroid yallig'lanishga qarshi vositalar — ketoprofen, ibuprofen, nimesulid va spazmolitiklar) sotib olib, nazoratsiz va tizimsiz ravishda qabul qilishlarini bayon etishgan.



4. MUHOKAMA (DISCUSSION)

Olingan natijalar ko'rsatib turibdiki, yosh talaba qizlar orasida birlamchi dismenoreya muammosi juda yuqori epidemiologik ko'rsatkichga ega bo'lsa-da, ularning ushbu kasallikka nisbatan tibbiy savodxonligi va madaniyati qoniqarsiz darajadadir. Akademik manbalar (Berek & Novak, 2023; Proctor & Farquhar, 2024) tasdiqlashicha, dismenoreyani davolashda nosteroid yallig'lanishga qarshi dori vositalarini (NYQV) o'zboshimchalik bilan va uzoq muddat tartibsiz ichish me'da-ichak trakti shilliq qavatining shikastlanishiga (gastrit, eroziv-yarali patologiyalar), jigar va buyraklarga toksik ta'sir ko'rsatishiga olib kelishi mumkin.

Butdan tashqari, shifokor ko'rigidan qochish ginekologik kasalliklarning yashirin (latent) kechishiga, xususan, keyinchalik bepustlik va surunkali og'riq sindromiga sabab bo'luvchi ikkilamchi dismenoreya yoki endometrioz kabi xavfli patologiyalarning vaqtida aniqlanmay qolishiga zamin yaratadi. Tibbiyot oliygohi talabalari bo'lgan qizlar orasida ham bu ko'rsatkichning yuqoriligi jamiyatda akusherlik va ginekologik madaniyatni o'smirlik davridanoq shakllantirish zarurligini ko'rsatadi. Yosh qizlarga hayz davridagi patologik kuchli og'riqlar sabrsizlik bilan chidab yuriladigan normal holat emas, balki ginekolog-endokrinolog nazoratida differensial diagnostika qilinib, patogenetik davolanishi shart bo'lgan klinik holat ekanligini anglatish zarur.

5. XULOSA (CONCLUSION)

1. Central Asian Medical University 1-kurs talaba qizlarining mutloq ko'pchiligi (73.5%) birlamchi dismenoreyadan aziyat chekadi. Ushbu sindrom ularning nafaqat jismoniy konfortini buzadi, balki darslarni mukammal o'zlashtirishiga, kognitiv funksiyalariga va ijtimoiy adaptatsiyasiga jiddiy to'sqinlik qiladi.
2. Yosh qizlar o'rtasida reproduktiv salomatlik va ginekologik madaniyatni oshirish bo'yicha keng qamrovli tushuntirish ishlarini olib borish lozim. Ularga o'zboshimchalik bilan farmakologik dori ichishning tizimli zararli asoratlarini uqtirish, ta'lim muassasalarida profilaktik skrining tekshiruvlarini va o'z vaqtida professional ginekolog maslahatini tizimli tashkil etish dolzarb ijtimoiy-tibbiy zaruriyat hisoblanadi.

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