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Optimization of the design and material of the loosening drum during cotton primary processing

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Abstract: The article discusses the improvement of a cylindrical loosening drum design for loosening and cleaning cotton raw materials, which is applied to the working surfaces of technological equipment in cotton processing plants. It focuses on enhancing the quality of cotton fiber cleaning and reducing seed damage by using a coating made of heterogeneous composite polymer material based on thermosetting plastic on the pegs of the peg drum. Furthermore, it has been established that the application of heterocomposite materials as coatings for these pegs can extend the service life of the parts due to their wear-resistant properties. One of the main advantages of the proposed material is that the use of heterocomposite coatings simplifies the process of structural repair, thereby achieving economic efficiency.

Keywords: peg drum, heterocomposite, cotton fiber, polymer material, construction, head, compositions, structure

Paxtaga dastlabki ishlov berish jarayonida titish barabani konstruksiyasi va materialini optimallashtirish

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Annotatsiya: Maqolada paxtaga dastlabki ishlov berish zavodlarining texnologik jihozlari ishchi sirtlariga qo‘llaniladigan, paxta xom ashyosini titish va tozalash uchun silindrsimon titish barabani konstruksiyasini takomillashtirish hamda qoziqchali baraban qoziqchalariga reaktoplast asosidagi geterokompozit polimer materialdan olingan qoplamadan foydalanib, paxta tolasini tozalash sifatini oshirish va chigitlarining shikastlanishini kamaytirishga erishilganligi haqida so‘z boradi. Bundan tashqari geterokompozit materiallarning ushbu qoziqchalarga qoplama sifatida qo‘llanilishi, o‘zining yeyilishbardoshlik xossalari tufayli detallarning ish muddatini uzaytirishi mumkinligi aniqlangan. Geterokompozit qoplamalarni qo‘llash konstruksiyalarni ta’mirlash jarayonlarini yengillashtirishi va bu bilan iqtisodiy samaraborlikka erishishligi taklif etilayotgan materialning asosiy afzalliklaridan hisoblanadi.

Kalit so‘zlar: qoziqchali baraban, geterokompozit, paxta tolasi, polimer mateial, konstruksiya, kallak, tarkiblar, struktura

1. Kirish

Bizga ma’lumki, zamonaviy texnika-texnologiya, mashina va mexanizmlar, shu jumladan paxta sanoatida qo‘llaniladigan texnologik jihozlar talab qilingan ishchanlik va ekspluatatsion ishonchlilikka ega bo‘lishi, paxtani qayta ishlash texnologik jihozlarining ekspluatatsion ishonchliligini ta’minlashda ularning konstruksiyalarini takomillashtirish bilan bir qatorda yuqori samarali yangi geterokompozit polimer materiallarni maqsadli qo‘llash yechimi kutilayotgan dolzarb innovatsion ilmiy-texnik muammolar jumlasidan hisoblanadi[1-3]. Ayniqsa, jahon paxta tozalash sohasida chigitli paxtani mayda iflosliklardan tozalash texnikasi hamda texnologiyasini takomillashtirish bo‘yicha tadqiqotlar muhim o‘rin tutadi[4]. Chigitli paxtani mayda iflosliklardan tozalashning samarali texnologiyasi va qurilmalarini ishlab chiqish, yuqori samarali tarkibli qayishqoq elementli qoziqchali barabanlarni yaratish, geterokompozit polimer (GKP) materialdan qoplama qoplash hamda ishlash rejimlari parametrlarini muqobillashtirish hozirgi kunda zarur masalalardan biri hisoblanmoqda. Shuning uchun texnologik mashina va mexanizmlarning ishchi sirtlarida samarali mahalliy mineral to‘ldiruvchilar asosidagi GKP materiallar va ular asosida

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olingan qoplamalarni maqsadli qo‘llash bilan texnologik jihozlar ishonchliligini ta’minlash, ish unumdorligi va energiya tejamkorligini oshirish hamda paxtaning mexanik jarohatlanishini kamaytirish evaziga uning tabiiy sifatini saqlash dolzarb masala hisoblanadi[5].

Bu borada yurtimiz va chet el olimlari tomonidan ko‘plab ilmiy va amaliy tadqiqodlar olib borilgan. Olib borilgan tadqiqodlarning tahlili shuni ko‘rsatadiki, geterokompozit materiallarning uzoq muddat xizmat qilishligi qoplama yuzasi g‘adir-budirligidan tashqari uning sirtiga ta’sir qilayotgan kontaktdagi juftining bosim kuchiga ham bog‘liq bo‘lib, bosim ortishi bilan ishqalanish koefitsenti ham chiziqli ravishda ortadi[6].

2. Tadqiqot metodologiyasi

Paxta xom ashyosini titish va tozalash uchun silindrsimon titish barabanning qoziqchali ishchi qismlar uchun geterokompozit polimer materiallarni modifikatsiyalashning samarali turi sifatida mahalliy ashyo va energetik resurslardan ratsional foydalanish imkonini beradigan strukturalashtirish usullarining maqsadga muvofiqligi asoslangan[7-11]. Tadqiqotlar uchun geterokompozit qoplamalar namunalarini tayyorlashda termoreaktiv bog‘lovchi epoksid smolasi ED-20 asosidagi kompozitlar va to‘ldiruvchilar: mahalliy ashyolardan kaolin, texnik uglerod hamda ipakni qayta ishlash sanoat chiqindisi (IQICh) tanlab olindi (1-jadval).

1-jadval

Qoziqchali ishchi qismlar uchun qoplama sifatida geterokompozit polimer materiallarning tarkibi va xossalari

Qoplama uchun kompozitsiyalar tarkibi	Komponentlar tarkibi, massa qism
ED-20	100
DBF	10-12
PEPA	10-12
Angren kaolini AKF 78-10-15 m/q, AKS 30 – 7-10 m/q AKT 10 – 8-10 m/q	25-35
ITQCh chiqindisi	1,5-2,0
Texnik uglerod	4-5
Mikroqattiqlik N_m, MPa	212
Adgezion mustahkamlik (cho‘zilishda) σ_{ad}, MPa	28,2
Zarbiy qovushqoqlik σ_{ud}, Kj/sm^2	28,1

Olingan geterokompozit polimer qoplamning qattiqligini aniqlash uchun MET-UDA markali kombinatsiyalangan mikro qattiqlikni o‘lchash qurilmasidan foydalanildi (1-rasm).

1-rasm. MET-UDA kombinatsiyalangan mikro qattiqlikni o‘lchash uskunasining asosiy ko‘rinishi

Kombinatsiyalangan ta’sirli (ultratovush va dinamik) ko‘chma MET-UDA qattiqlik o‘lchagichi Brinnel (HB), Rokvell (HRC), Vikkers (HV), Shor "D" (HSD) shkalalariga ko‘ra turli vazn va xususiyatlarga ega bo‘lgan materiallarning tezkor qattiqligini o‘lchash, shuningdek, perlit sinfiga mansub uglerodli po‘latlardan tayyorlangan detallarning cho‘zilishga bo‘lgan mustahkamlik chegarasini aniqlash uchun mo‘ljallangan.

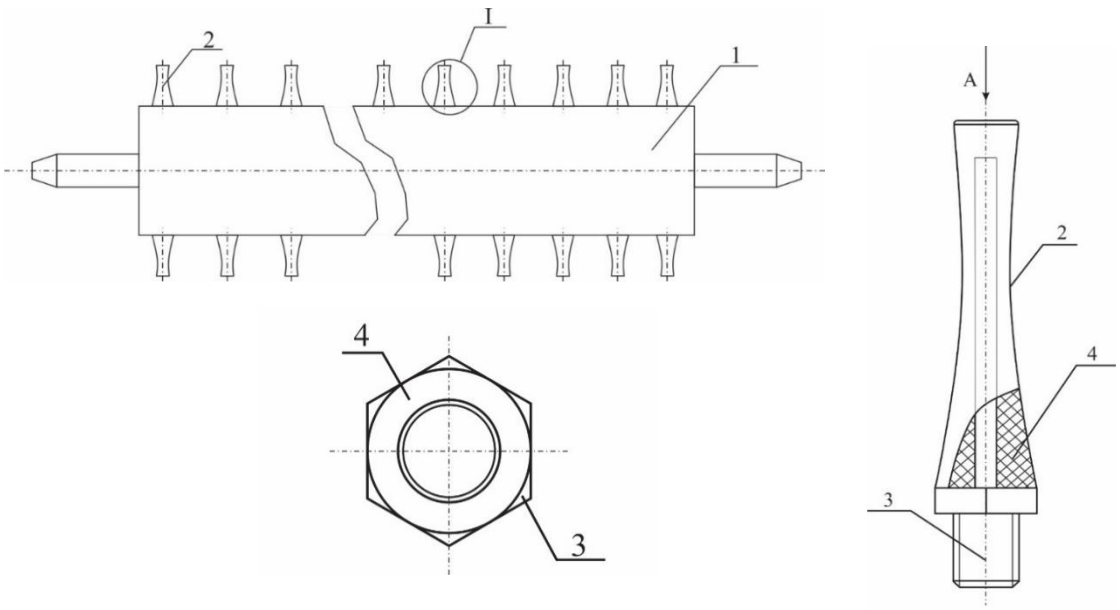
Dinamik va ultratovush usullarining birlashtirilishi turli xil materiallarni nazorat qilishda ushbu MET-UDA qurilmasidan foydalanishning ko‘p qirraligini ta’minlaydi.

Qoplamalar uchun muhim hisoblanadigan adgezion mustahkamlikni aniqlashda, avtomat Elcometr 510 jihozidan foydalanildi. Elcometer 510 avtomatik adgezimetri turli metall yoki nometal yuzalarga qoplangan qoplamalarning yopishqoqligini o‘lchash uchun mo‘ljallangan. Jihozning ishlash prinsipi qoplama materialini asos materialidan ajratish uchun zarur bo‘lgan kuchni o‘lchashga asoslangan. Adgezimetrning nasosining gidravlik bo‘lishligi barqaror natijalar olish uchun kuchlanishni bir tekisda qo‘yilishini ta’minlaydi. Bunda kuchlanish 0,1-1,4 MPa oralig‘ida sozlanishi mumkin. Ushbu juhozda olingan natijalarning nisbiy xatoligi ±1% dab oshmaydi.

Qoplama materialining zarbiy qovushqoqligini aniqlashda umumma’lum standart usullardan foydalanildi.

3. Tahlil va natijalar

Qayd etilgan muammo yechimlari paxta tozalash samarasini oshirish, paxta tolasining sifati va chigitining nisbiy ezilishini kamaytirish hamda texnologik jixozlar va chigitining shikastlanishini kamaytirish, shuningdek, paxta bo‘lakchalarining tozalash zonasida tormozlanishini kamaytirishdan iborat. Qo‘yilgan vazifa qoziqlar va paxta bo‘lakchalari orasidagi ishqalanishni kamaytirish orqali titutvchi baraban qoziqlari konstruksiyasini takomillashtirish orqali hal etiladi (3-rasm).



3-rasm. Qoziqchali baraban tuzilishi:
1-silindrsimon qoziqchali baraban, 2-titish qoziqchasi, 3-sterjenning rezbali biriktirish qismi, 4-qoziqcha kallagi (geterokompozit material qoplama)

Yuqoridagi rasmda tolali materialni tozalagichning tituvchi barabani plankali va ularga qoziqlar mahkamlangan silindrsimon gardishni o‘z ichiga olgan bo‘lib, bo‘ylama qatorlar bilan o‘rnatilgan. Qoziqlar baraban sirtiga mahkamlash uchun pastki uchida rezbali sterjenlardan tashkil topgan holda bajarilgan, ustki qismi yesa qoziq kallagi teshigiga presslangan. Bunda paxta tolasini tituvchi baraban qoziqchalari zarbaga va yeyilishga bardoshli geterokomozit materialdan tayyorlangan, ishchi qismi yesa qoziqning o‘rtasiga toraytirilgan egri chiziqli sirt bilan bajarilgan[12].

Geterokompozit polimer materiallar asosidagi paxtaga dastlabki ishlov berish mashina va mexanizmlar ishchi organlari qoziqchali detallarini olishning optimal parametrlari taklif etilgan hamda qoziqchali baraban ishchi organlari uchun geterokompozit polimer materiallar asosidagi butun quyma qoziqchali detal konstruksiyalari yaratilgan.

4. Xulosa

Paxtaga dastlabki ishlov berish jarayonida titish barabanining ishchi qismlariga geterokompozit polimer materiallardan qoplama sifatida foydalanish hisobiga paxta tolasi hamda chigitininig shikastlanishini kamaytirish, shuningdek, paxta bo‘lakchalarining tozalash qismida to‘htalish va uchilishlarni kamaytirishga erishildi.

Geterokompozit polimer materiallardan qoziqchali barabanning ishchi qismlarigan qoplamalar sifatida qo‘llash orqali paxtaning mexanik jarohatlanishini 1,6-1,8 marta kamaytirishga erishildi. Mahalliy xomashyo va ishlab chiqarish chiqindilaridan antifriksion va antifriksion-yeyilishbardoshli geterokompozit termoreaktiv materiallar olishning samarali texnologiyasi ishlab chiqildi va paxtaga dastlabki ishlov berish texnologik jihozlarining jumladan titish barabani konstruksiyasi va materialini optimallashtirilib ishlash muddatini korroziya va yeyilishdan saqlash evaziga 25-30% ga oshirishga erishildi.

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