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O‘ZBEKISTON SHAROITIDA XLORPIRIFOS INSEKTITSIDINING MIKROBLI PARCHALANISH JARAYONINI O‘RGANISH

Annotatsiya

Ushbu tadqiqotda mikrobli konsorsium asosida xlorpirifos pestitsidining parchalanish jarayoni o‘rganildi. Konsorsium quyidagi bakteriyalardan iborat: Pseudomonas sp., Bacillus sp. va Ochrobactrum sp. Dastlab, turli miqdorlardagi xlorpirifos pestitsidi qo‘shilgan ozuqa muhitlarida konsorsiumning chidamliligi o‘rganildi. Keyin GX-MS metodi yordamida tuproqdagi xlorpirifosning parchalanishi (50 mg/kg va 100 mg/kg) aniqlandi. Tadqiqotlar 28 kun mobaynida, steril tuproqlarda olib borildi. Mikroorganizmlar qo‘shilmagan xlorpirifosli steril tuproq nazorat sifatida xizmat qildi. Olingan natijalar quyidagicha: xlorpirifos 50 mg/kg boshlang‘ich konsentratsiyasida 91% gacha va 100 mg/kg da 81,6% gacha parchalandi.
Kalit so‘zlar: Pseudomonas sp., Bacillus sp., Ochrobactrum sp., pestitsid, xlorpirifos, bioparchalanish.

ИЗУЧЕНИЕ ПРОЦЕССА МИКРОБНОГО РАЗЛОЖЕНИЯ ИНСЕКТИЦИДА ХЛОРПИРИФОС В УСЛОВИЯХ УЗБЕКИСТАНА

Аннотация

В этом исследовании изучалась деградация органофосфатного пестицида хлорпирифоса на основе микробного консорциума. Консорциум состоит из следующих бактерии: Pseudomonas sp., Bacillus sp., и Ochrobactrum sp. Сначала была изучена устойчивость бактерий консорциума в среде с хлорпирифосом. Затем в течение 28 дней проводили определение разложения хлорпирифоса в почве с помощью ГХ-МС при концентрациях 50 мг/кг и 100 мг/кг. Исследования проводились на стерильной почве. Контролем служать стерильная почва с хлорпирифосом без консорциума. Полученные результаты следующие: разложился хлорпирифос при начальной концентратsiи 50 мг/кг до 91% и до 81,6% при 100 мг/кг.
Ключевые слова: *Pseudomonas* sp., *Bacillus* sp., и *Ochrobactrum* sp., пестицид, хлорпирифос, биоразложения.

STUDY OF THE PROCESS OF MICROBIAL DEGRADATION OF THE INSECTICIDE CHLORPYRIFOS IN THE CONDITIONS OF UZBEKISTAN

Annotation

This study examined the degradation of the organophosphate pesticide chlorpyrifos based on a microbial consortium. The consortium consists of the following bacteria: *Pseudomonas* sp., *Bacillus* sp. and *Ochrobactrum* sp. First, the resistance of the bacteria of the consortium in the medium with chlorpyrifos was studied. Degradation of chlorpyrifos in soil was then determined for 28 days by GC-MS at concentrations of 50 mg/kg and 100 mg/kg. The studies were carried out on sterile soil. Sterile soil with chlorpyrifos without consortium served as control. The results obtained are as follows: Chlorpyrifos decomposed at an initial concentration of 50 mg/kg up to 91% and up to 81.6% at 100 mg/kg.
Keywords: *Pseudomonas* sp., *Bacillus* sp., *Ochrobactrum* sp., pesticide, chlorpyrifos, biodegradation.

Kirish. Hozirgi kunda qishloq xo‘jalik maydonlarida pestitsidlardan foydalanish nafaqat maqsadli organizmlarga, balki atrof-muhitga tarqalib, suv va tuproqqa ham tushib undagi ko‘pchilik biologik mavjudotlarga salbiy ta’sir qilib, tuproq unumdorligini pasayib ketishiga olib keladi. Keying yillarda fosfoorganik pestitsidlar o‘zining yuqori samaradorligi tufayli xlororganik pestitsidlarning o‘rnini bosuvchi sifatida tobora ko‘proq foydalanib kelinmoqda.

Mavzuga oid adabiyotlar tahlili. Fosfororganik pestitsidlar juda zaharli birikmalar bo‘lib, ular hasharotlarda nerv sistemasi uchun zarur bo‘lgan atsetilxolinesteraza (AChE) fermentining faolligini ingibirlaydi [1]. Keng ta’sir doirasi va yuqori samaradorligi tufayli ular qishloq xo‘jaligi o‘simliklarining zararkunandalariga qarshi insektitsid sifatida ishlatiladi. [1,2,3]. Statistik ma’lumotlar shuni ko‘rsatadiki, fosfororganik pestitsidlar (OP) butun dunyo bo‘ylab ishlatiladigan pestitsidlar orasida birinchi o‘rinda turadi va barcha pestitsidlarning 38% ni tashkil qiladi [4]. Ushbu guruh insektitsidlari uchta fosfoefir bog‘larini o‘z ichiga oladi va shuning uchun ko‘pincha fosfotriefirlar deb ataladi [5]. Me’yoridan ortiq va keng miqyosda foydalanish [6,7,8], shuningdek, bunday o‘ta zaharli kimyoviy moddalarning atrof-muhitda to‘planishi tirik organizmlar uchun xavfli hisoblanadi [9,10,11].

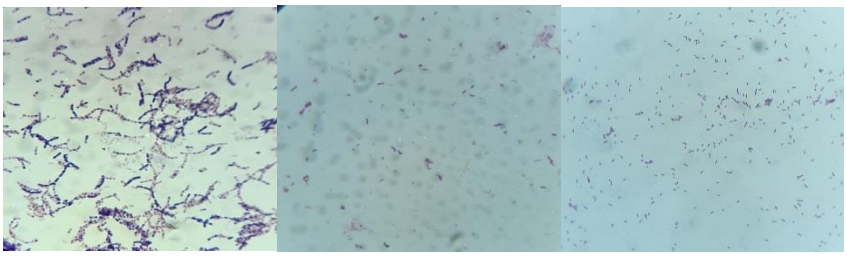
Xlorpirifos – fosfororganik insektitsid bo‘lib, 1960-yillardan buyon tijoriy maqsadlarda, ayniqsa paxta, sholizorlar, yaylovlar, sabzavot ekinlari va bog‘lardagi mevali ekinlarda kasalliklar keltirib chiqaruvchi zararkunandalarga qarshi kurashda qo‘llaniladi. Ushbu pestitsid o‘simliklarga qo‘llanilganda tuproqqa tushib, atrof-muhitga xavfli ta’sir ko‘rsatadi [12]. Ushbu

pestitsiddan ommaviy foydalanish suv va tuproqning ifloslanishiga va biogeokimyoviy sikllarning buzilishiga olib keladi [13]. Bundan tashqari, uning qoldiqlari turli xil ekologik tizimlarda ham topilgan [14]. Qo‘llaniladigan pestitsidning yuvilishi yer usti/yer osti suvlarining ifloslanishiga olib kelishi mumkin, bu esa oxir-oqibat biologik tizimlarga salbiy ta’sir ko‘rsatishiga olib keladi [15]. Shuning uchun ifloslangan muhitni erta aniqlash va keyinchalik dezinfeksiya va detoksifikatsiya qilish juda muhimdir. Xlorpirifosni zararsizlantirish uchun kimyoviy tozalash, bug‘lanish, fotodegradatsiya va yoqish kabi bir qancha usullar qo‘llanilishi mumkin [16]. Biroq, yuqoridagi usullar qimmat, samarasiz va har doim ham ekologik jihatdan qulay emas. Bioremediatsiya, mikroblarning ifloslantiruvchi moddalarni zararsizlantirish va parchalash potensialidan foydalanishni o‘z ichiga olgan usul, ifloslangan muhitni tozalashning samarali biotexnologik yondashuvi sifatida ko‘proq diqqatga sazovor [17]. Mikrobli degradatsiya bo‘yicha tadqiqotlar samarali va bioremediatsiya jarayonlarini ishlab chiqish uchun pestitsidlarni nazorat qiluvchi organlar tomonidan belgilangan standartlardan past konsentratsiyalarga zararsizlantirish uchun foydalidir [18]. Pestitsidlarning mikrobli parchalanishi ularning ekologik taqdirini nazorat qiladigan eng muhim jarayon sifatida tan olingan [19-20]. Turli bakteriyalardan tashkil topgan konsorsiumlardan foydalanish mikroblarning parchalanishi jarayonida bir turga qaraganda samaraliroqdir [6, 21].

Tadqiqot metodologiyasi. Tadqiqot Ob’ekti sifatida uzoq yillar mobaynida turli xil pestisidlar (xlorpirifos, sipermetrin) qo‘llanilgan fermer xo‘jaliklaridan keltirilgan tuproq namunalari, turli bakteriyalar Pseudomonas sp., Bacillus sp., va Ochrobactrum sp. dan tashkil topgan mikrob konsorsiumi, xlorpirifos pestitsidi xizmat qildi. Tuproq namunalari 10-15 sm chuqurlikdan olindi. Laboratoriya sharoitida tuproqdagi barcha ortiqcha mahsulotlar (toshlar, turli xil qoldiqlar) olib tashlandi va 2 mm diametrli elakdan o‘tkazildi va tadqiqot avvalida 30 daqiqa mobaynida 121°C haroratda sterilizatsiya qilindi. Xlorpirifos (97% tozalik) Xitoyning Pioneer international Ltd kompaniyasidan keltirilgan. Xlorpirifosni eritib olish uchun atsetondan foydalanildi. Tadqiqot ishida mikroorganizmlarni ekish va ajratib olishda quyidagi ozuqa muhitlaridan foydalanildi: GPA, GPB HiMedia Pvt Ltd Mumbai, Hindiston. Mineral tuzli ozuqa (pH 6,8-7,0), tarkibi (g/l) K2HPO4 -1,5; KH2PO4-0,5; NaCl 0,5; (NH4) 2SO4 - 0,5; MgSO4·7H2O va 1 ml mikroelementlar eritmasi.

Mikroorganizmlarni ajratib olish. 1 kg tuproq qo‘shimcha ravishda xlorpirifos bilan ifloslantirildi va mikroorganizmlar bilan boyitish maqsadida biogaz qurilmasi shlamidan 1:1 nisbatda qo‘shildi, so‘ngra bir oy davomida 30°C harorat ostida termostatda saqlandi. Bir oy o‘tgach, ozuqa bulyoni bo‘lgan Erlenmeyer kolbalariga (250 ml) 10 g tuproq qo‘shildi va maxsus aylantirgichda (150 ayl./daq., 30°C da) 48 soat davomida inkubatsiya qilindi. 5 kundan so‘ng, ushbu suspenziyani suyultirish metodi orqali ozuqa agarli Petri chashkalariga ekildi. Hosil bo‘lgan koloniyalarni va xlorpirifosni o‘z ichiga olgan mineral tuzlardan iborat ozuqa agarli Petri chashkalariga toza kultura ajratib olingunicha subkultivatsiya qilindi.

Tahlil va natijalar. Mikroorganizmlarning xlorpirifosga chidamliligini o‘rganish natijasida ma’lum bo‘ldiki, nazorat bilan solishtirganda, barcha mikroorganizmlar xlorpirifosli muhitda o‘sib, ko‘paya olmaydi. Umumiy bo‘lib 20 dan ortiq izolyatlar ajratib olindi. Izolyatlarning pestitsidga chidamliligini aniqlash uchun xlorpirifos konsentratsiyasini 100 mg/l ga oshirish orqali keyingi ishlar olib borildi. Boshqa izolyatlar bilan solishtirganda 3, 6, 9-sonli izolyatlar yaxshi natijalarni ko‘rsatdi va konsorsium yaratish uchun tanlab olindi. Tanlangan izolyatlarning morfologik va kultural xususiyatlari o‘rganildi (1-jadval). Tanlab olingan izolyatlarning sutkalik kulturalari rangli mikroskop yordamida kuzatildi (1-rasm). Morfo-kultural tadqiqot natijalari ushbu shtammlar Baciluss sp., Pseudomonas sp., Ochrobactrum sp. avlodiga tegishli bakteriyalar ekanligini ko‘rsatdi.



a b c

1-rasm. Ajratib olingan bakteriyalarning Gramm usulida bo‘yalishi:
a-*Bacillus sp.*, b-*Pseudomonas sp.*, c-*Ochrobactrum sp.*

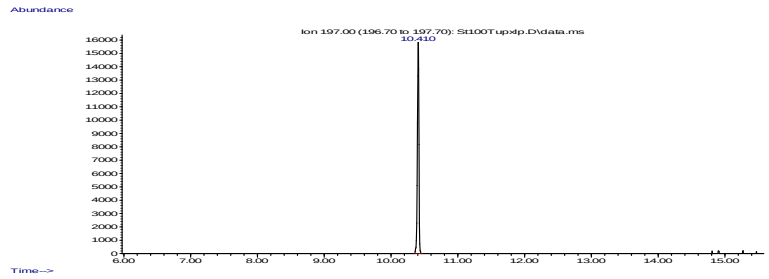
1- jadval

Ajratib olingan bakteriyalarning ayrim morfo-kultural va fiziolo-biokimyoviy xususiyatlari

Belgilari	**Shtammlar**		
	Ochrobactrum sp.	***Pseudomonas sp.***	***Bacillus sp.***
GPA ozuqasidagi koloniyalar morfologiyasi	Yumaloq, silliq, yaltiroq, qavariq, tiniq bo‘lmagan oq rangli koloniyalar d=2,0-2,5 mm.	Dumaloq, biroz qavariq, silliq, yaltiroq, qirrasi silliq, d=2-2,6 mm	Silliq qavariq, oq-kulrang yaltiroq koloniyalar d=3-4 mm
Gramm usulida bo‘yalishi	Manfiy	Manfiy	Musbat
Spora hosil qilishi	-	-	+
Kislorodga talabi	Aerob	Aerob	Aerob
Harorat, °C	30-35	30-37	30-37
pH	6,7-7,3	6,8-7,0	6,8-7,5
Oksidaza faolligi	Manfiy	Musbat	Musbat
Katalaza faolligi	Musbat	Musbat	Musbat
Jelatin gidrolizi	-	-	+

Ajratib olingan uchta bakteriyaning morfo-kultural va fiziologik-biokimyoviy xususiyatlarini o‘rganish natijasida xlorpirifosni parchalovchi bakterial konsorsium yaratildi.

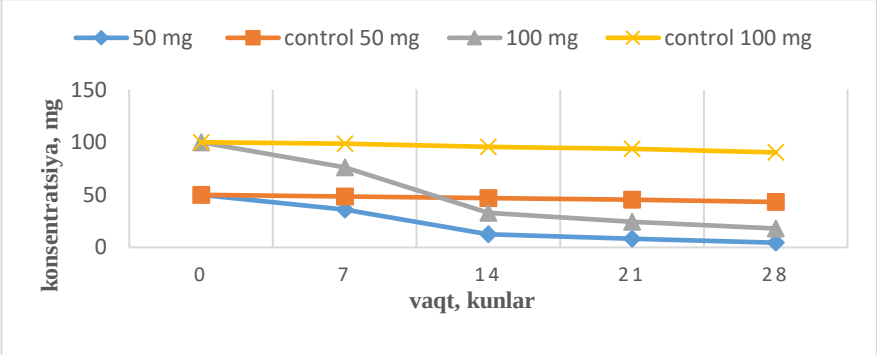
Tuproqda xlorpirifosni parchalanishini aniqlash. Xlorpirifosning biodegradatsiyasi bo‘yicha tadqiqotlar steril tuproqlarda olib borildi. Atseton asosidagi xlorpirifos (50 va 100 mg/kg tuproq) eritmalarini tayyorlagandan so‘ng, ular tuproqning kichik qismiga (umumiy tuproq massasining taxminan 20%) qo‘shiladi, tuproqni eritma bilan yaxshilab aralashtirgandan so‘ng, tuproqning qolgan qismi bilan aralashtiriladi. Shundan so‘ng 10^8 KOE / ml konsentratsiyada bakterial konsorsium qo‘shildi. Tajribalar 4 hafta davom etdi. Xromatografik tahlillar uchun har hafta tuproq namunalari olindi (2-rasm).



a

2-rasm. Xlorpirifosning dastlabki xromatogrammasi.

GX-MS tahlillari natijalari xlorpirifos konsentratsiyasi vaqt o‘tishi bilan kamayib borishini ko‘rsatdi va tajriba oxirida 4,5 mg ni (boshlang‘ich miqdor 50 mg/kg), parchalanish esa 91 % va 18,4 mg (2-rasm) gacha (dastlabki 100 mg/kg), parchalanish esa mos ravishda 81,6% ni tashkil qildi. Nazorat namunalarda esa xlorpirifos dastlabki miqdori deyarli o‘zgarmaganligi (90,3 mg/kg va 43,8 mg/kg) ma’lum bo‘ldi. Bu esa biz ishlab chiqqan bakterial konsorsium xlorpirifos pestitsididan yagona uglerod manbai sifatida foydalanganligidan dalolat beradi.



3-rasm. Xlorpirifosni mikrobli konsorsium yordamida parchalanish diagrammasi.

Xulosa va takliflar. Xulosa qilib aytganda, 50 va 100 mg/kg tuproq konsentratsiyasida steril tuproqlarda 28 kun ichida xlorpirifosni muvaffaqiyatli parchalagan bakterial konsorsiumning ahamiyatini ta’kidlash kerak. Parchalanish ulushi mos ravishda 91% va 81,6% ni tashkil etdi. Nazorat variantida esa xlorpirifosning dastlabki konsentratsiyasi deyarli kamaymadi.

Olingan ma’lumotlarga asoslanib, xlorpirifos bilan ifloslangan tuproqlardan ajratilgan shtammlardan hosil bo‘lgan bakterial konsorsium ushbu pestitsid bilan zararlangan tuproqlarda foydalanilganda xlorpirifosning parchalanishini tezlashtirish orqali tuproq unumdorligini yaxshilaydi, degan xulosaga kelish mumkin.

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