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## ISOLATION AND IDENTIFICATION OF BACTERIAL STRAINS (PSEUDOMONAS SPP., BACILLUS SPP.) ACCELERATING POLYETHYLENE DEGRADATION FROM LOCAL SITES

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**Abstract.** The article analyses current methodological approaches to the isolation and identification of bacterial strains of the genera *Pseudomonas* spp. and *Bacillus* spp. involved in the biological degradation of polyethylene (PE) waste from locally contaminated sites — landfills, soils around polymer enterprises and wastewater. The analysis is based on international studies published between 2018 and 2025, together with screening results obtained in Uzbekistan. According to the literature, when polyethylene is supplied as the sole carbon source in mineral salt medium (MSM), strains achieved weight losses of 1.14–52.0 % over 30–112 days of incubation. The highest values were recorded for *Bacillus siamensis* (52.0 %; 60 days), *Bacillus cereus* A5,a (35.72 %; 16 weeks) and *Pseudomonas balearica* PDI-17 (19.90 %; 30 days) on UV-pretreated polyethylene. UV pretreatment increased degradation efficiency by a factor of 4.2–9.3. Alongside Gram staining and biochemical tests, MALDI-TOF MS, 16S rRNA gene sequencing and PCR detection of the *alkB* (alkane hydroxylase) gene were shown to be highly effective for strain identification. A five-stage methodological scheme adapted to the arid and saline soils of Uzbekistan is proposed.

**Keywords:** polyethylene, biodegradation, *Pseudomonas* spp., *Bacillus* spp., mineral salt medium, 16S rRNA, *alkB* gene, MALDI-TOF MS, bioremediation, landfill.

**Annotatsiya.** Maqolada mahalliy polietilen (PE) bilan ifloslangan hududlardan — chiqindi poligonlari, polimer korxonalari atrofida tuproqlar va oqova suvlardan — ajratib olingan hamda polietilen chiqindilarining biologik parchalanishida ishtirok etuvchi *Pseudomonas* spp. va *Bacillus* spp. avlodlariga mansub bakterial shtammlarni ajratish va identifikatsiya qilishning zamonaviy metodik yondashuvlari tahlil qilingan. Tahlil 2018–2025-yillarda e'lon qilingan xalqaro tadqiqotlar hamda O'zbekistonda olingan skrining natijalariga asoslangan. Adabiyotlar ma'lumotlariga ko'ra, polietilen mineral tuzlar muhitida (MSM) yagona uglerod manbai sifatida berilganda, bakterial shtammlar 30–112 kunlik inkubatsiya davomida uning massasini 1,14–52,0 % gacha kamaytirgan. Eng yuqori ko'rsatkichlar *Bacillus siamensis* shtammida 52,0 %



(60 kun), *Bacillus cereus* A5,a shtammida 35,72 % (16 hafta) va ultrabinafsha (UV) nurlanish bilan oldindan ishlov berilgan polietilenda *Pseudomonas balearica* PDI-17 shtammida 19,90 % (30 kun) qayd etilgan. UV bilan oldindan ishlov berish biodegradatsiya samaradorligini 4,2–9,3 baravar oshirgan. Gram bo'yicha bo'yash va biokimyoviy testlar bilan bir qatorda, MALDI-TOF MS, 16S rRNK genini sekvenslash hamda *alkB* (alkan gidroksilaza) genini PCR yordamida aniqlash shtamlarni identifikatsiya qilishda yuqori samaradorlikka ega ekani ko'rsatilgan. O'zbekistonning qurg'oqchil va sho'rlangan tuproqlari sharoitiga moslashtirilgan besh bosqichli metodik sxema taklif etilgan.

**Kalit so'zlar:** polietilen, biodegradatsiya, *Pseudomonas* spp., *Bacillus* spp., mineral tuzlar muhiti, 16S rRNK, *alkB* geni, MALDI-TOF MS, bioremediatsiya, chiqindi poligoni.

**Аннотация.** В статье проанализированы современные методические подходы к выделению и идентификации бактериальных штаммов родов *Pseudomonas* spp. и *Bacillus* spp., участвующих в биологической деструкции полиэтиленовых (ПЭ) отходов, из локально загрязнённых полиэтиленом участков — полигонов твёрдых бытовых отходов, почв вблизи предприятий полимерной промышленности и сточных вод. Анализ основан на международных исследованиях, опубликованных в период с 2018 по 2025 год, а также на результатах скрининга, проведённого в Узбекистане. Согласно литературным данным, при использовании полиэтилена в качестве единственного источника углерода в минеральной солевой среде (MSM) штаммы обеспечивали снижение его массы на 1,14–52,0 % в течение 30–112 суток инкубации. Наиболее высокие показатели были зарегистрированы для *Bacillus siamensis* — 52,0 % за 60 суток, *Bacillus cereus* A5,a — 35,72 % за 16 недель и *Pseudomonas balearica* PDI-17 — 19,90 % за 30 суток при использовании полиэтилена, предварительно обработанного ультрафиолетовым (УФ) излучением. Предварительная УФ-обработка повышала эффективность биодеструкции в 4,2–9,3 раза. Наряду с окрашиванием по Граму и биохимическими тестами, MALDI-TOF MS, секвенирование гена 16S rPHK и ПЦР-детекция гена *alkB* (алкангидроксилазы) продемонстрировали высокую эффективность для идентификации бактериальных штаммов. Предложена пятиэтапная методическая схема, адаптированная к условиям аридных и засоленных почв Узбекистана.

**Ключевые слова:** полиэтилен, биodeградация, *Pseudomonas* spp., *Bacillus* spp., минеральная солевая среда, 16S rPHK, ген *alkB*, MALDI-TOF MS, биоремедиация, полигон отходов.

## INTRODUCTION

Plastics have become an integral part of the global economy, with global production reaching nearly 430 million tons in 2024, growing at an average annual rate of 4.8% since 2009 [9]. In Europe, this figure stands at 54.6 million tons, accounting for 12% of global production [10]. The largest share of produced polymers belongs to polyethylene (PE), specifically its low-density (LDPE) and high-density (HDPE) modifications. Because polyethylene consists of a hydrocarbon chain with a high



molecular weight, hydrophobic properties, and a lack of hydrolyzable functional groups, it persists in natural conditions without degradation for decades [1, 3].

In the Republic of Uzbekistan, approximately 10.2 million tons of municipal solid waste are generated annually, with over 10% (about 1.05 million tons) consisting of plastic waste. Currently, the 116 processing enterprises operating in the country have the capacity to recycle only about 130,000 tons of plastic per year, which accounts for 6.6% of the total volume [11]. The remaining portion is land filled or accumulates uncontrolled. This situation causes environmental hazards such as a decrease in soil fertility and pollution of groundwater. Traditional methods of plastic waste disposal—incineration and landfilling—are associated with the emission of toxic gases into the air and long-term secondary pollution, respectively [1]. Therefore, in recent years, the biological degradation (biodegradation) of polymers using microorganisms has been widely studied as a low-cost, energy-efficient, and environmentally safe alternative [3, 4].

The microbiological degradation of polyethylene is a multi-stage process. Initially, bacteria form a biofilm on the polymer surface; under the influence of abiotic factors (UV radiation, high temperatures), carbonyl, carboxyl, and hydroxyl groups are formed on the polymer surface, reducing hydrophobicity and facilitating microbial attack. In the next stage, the alkane monooxygenase (AlkB) enzyme hydroxylates the terminal methyl group of the hydrocarbon chain, converting it into the corresponding alcohol; the resulting alcohol is sequentially oxidized to an aldehyde and a fatty acid, entering the intracellular beta-oxidation pathway [8]. The *alkB1* and *alkB2* genes involved in this process have been identified in the genome of *Pseudomonas aeruginosa* and are used as molecular markers in selecting polyethylene-degrading strains [1, 8]. In addition, extracellular enzymes such as laccase, peroxidase, protease, and esterase also participate in the cleavage of the polymer chain [1, 5].

To date, numerous strains belonging to the genera *Bacillus* spp., *Pseudomonas* spp., *Brevibacillus*, *Acinetobacter*, *Rhodococcus*, *Lysinibacillus*, and *Enterobacter* with polyethylene-degrading properties have been described [1, 2, 6, 7]. They are mainly isolated from soils where plastic waste has accumulated for a long time, because in such areas, microbiocenoses capable of utilizing the polymer as a carbon source have formed as a result of natural selection [3, 4]. Initial work in this direction has also begun in Uzbekistan: at the Institute of Microbiology of the Academy of Sciences of the Republic of Uzbekistan, the activity of *Pseudomonas putida*, *P. aeruginosa*, *Rahnella aquatilis*, *Enterobacter cloacae*, and *E. ludwigii* strains against LDPE, HDPE, PET, and polyvinylpyrrolidone was screened using UV spectrophotometry; it was found that the *E. cloacae* strain produced 13.99 times more organic compounds upon incubation with HDPE compared to the control [6]. At the same time, systematic research on targeted isolation and molecular-level identification of polyethylene-degrading strains belonging specifically to the genera *Pseudomonas* and *Bacillus* from the dry, saline, and high-temperature soils of our country is still insufficient. "The purpose of this article is to isolate and identify strains of *Pseudomonas* spp. and *Bacillus* spp. that accelerate polyethylene degradation from locally polluted areas, and to develop a methodological scheme applicable under the conditions of Uzbekistan."



## MATERIALS AND METHODS.

The study is of an analytical and methodological nature, utilizing as primary sources six key experimental articles published in international peer-reviewed journals between 2018 and 2025, alongside the results of screening conducted in Uzbekistan [1–7]. The selection of sources was guided by the following criteria: (a) strains must have been isolated from naturally polluted environments (landfills, soil, waste water); (b) the degradation of polyethylene (LDPE, HDPE, or general PE) must have been evaluated quantitatively—via gravimetric analysis or clear zone diameter; (c) strains must have been identified using at least biochemical or molecular methods. For comparative analysis, the following indicators were extracted from each source: strain name, isolation source, studied polymer type, incubation period and conditions, weight loss percentage, and identification method. The weight loss indicator was calculated across all sources based on the following general formula [1, 5]:  $\text{Weight loss (\%)} = [(\text{Initial weight} - \text{Final weight}) / \text{Initial weight}] \times 100$ . To ensure comparability, various polymer types (LDPE, HDPE, general PE) and differing incubation periods were designated separately, as these factors significantly influence the results and comparing them without consideration could lead to erroneous conclusions. Graphical analysis and diagrams were prepared in the Python 3.9 (Matplotlib 3.9) programming environment.

Additionally, based on the analyzed sources, a five-stage methodological scheme adapted for the conditions of Uzbekistan—comprising sampling and enrichment, strain isolation, screening, identification, and optimization stages—was formulated and described below.

## RESULTS AND DISCUSSION.

**1. Sampling sites and enrichment stage.** In all analyzed sources, effective strains were isolated from areas subjected to long-term plastic waste exposure: from the Adama (Ethiopia) landfill [1], municipal landfills in Owerri (Nigeria) [2], agricultural soils in Morogoro (Tanzania) [3], dumpsites in Alimosho district, Lagos (Nigeria) [4], and the Dandora (Kenya) landfill [7]. This pattern serves as an important criterion in selecting sampling points under local conditions: soil layers buried with polyethylene waste, landfills, soil around polymer recycling enterprises, and wastewater are recommended as the most promising objects.

At the enrichment stage, the soil sample is placed in a mineral salt medium (MSM) along with pieces of polyethylene film pre-treated with UV rays. In the Ethiopian study, the composition of the carbon-free basal medium was as follows (g/l):  $\text{KH}_2\text{PO}_4$  — 0.7;  $\text{K}_2\text{HPO}_4$  — 0.7;  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  — 0.7;  $\text{NH}_4\text{NO}_3$  — 1.0, and trace elements; samples were incubated at 37 °C for over 14 days [1]. Under such conditions, since polyethylene is the sole carbon source, only microorganisms capable of utilizing it multiply, meaning the selection process occurs automatically.

**2. Strain isolation and primary screening.** Samples taken from the enriched medium are inoculated onto nutrient agar or selective media. For the isolation of the genus *Bacillus*, thermal treatment of the sample at 80 °C for 10 minutes (to eliminate vegetative cells while preserving endospores) is considered an effective method. Colonies with distinct morphologies are purified through repeated subculturing to



obtain pure cultures [1, 4]. Primary screening is carried out using two methods. The first is observing the formation of a clear zone around the colony on mineral agar supplemented with powdered polyethylene. In the Tanzanian study, bacterial isolates formed zones with diameters of 19.3–47.5 mm in 17 days, actinomycetes 25.9–32.2 mm, and fungi 30.0–66.3 mm in 13 days [3]. The second method is monitoring the increase in optical density (OD600) in a liquid medium: in the Nigerian study, OD600 increased from 0.12 to 0.84 for *B. siamensis* and from 0.11 to 0.67 for *B. pumilus* within 60 days, whereas it remained unchanged (0.11) in the control medium [2].

**3. Polyethylene degradation efficiency.** The main results reported in the analyzed sources are summarized in Table 1. Polyethylene degradation indicators of strains isolated from locally polluted areas (generalized literature data)

**Strain Isolation site Polymer Period Weight loss, % Identification method Source**

| STRAIN                                       | ISOLATION SITE  | POLYMER        | PERIOD   | WEIGHT LOSS, % | IDENTIFICATION METHOD        | SOURCE |
|----------------------------------------------|-----------------|----------------|----------|----------------|------------------------------|--------|
| <i>Bacillus siamensis</i>                    | Owerri, Nigeria | LDPE           | 60 days  | 52,0           | 16S rDNK                     | [2]    |
| <i>Bacillus pumilus</i>                      | Owerri, Nigeria | LDPE           | 60 days  | 26,0           | 16S rDNK                     | [2]    |
| <i>Bacillus coagulans</i>                    | Owerri, Nigeria | LDPE           | 60 days  | 18,0           | 16S rDNK                     | [2]    |
| <i>Bacillus subtilis</i>                     | Owerri, Nigeria | LDPE           | 60 days  | 18,0           | 16S rDNK                     | [2]    |
| <i>Bacillus cereus</i> A5,a                  | Dandora, Kenia  | PE             | 16 week  | 35,72 ± 4,01   | 16S rRNA                     | [7]    |
| <i>Brevibacillus borstelensis</i> B2,2       | Dandora, Kenia  | PE             | 16 weeks | 20,28 ± 2,30   | 16S rRNA                     | [7]    |
| <i>Pseudomonas balearica</i> PDI-17          | Adama, Efiopia  | PE + UV        | 30 days  | 19,90          | MALDI-TOF MS, 16S rRNA, alkB | [1]    |
| <i>Pseudomonas aeruginosa</i> PDI-1          | Adama, Efiopia  | PE + UV        | 30 days  | 17,96          | MALDI-TOF MS, 16S rRNA, alkB | [1]    |
| <i>Bacillus subtilis</i> PDI-33              | Adama, Efiopia  | PE + UV        | 30 days  | 13,75          | MALDI-TOF MS                 | [1]    |
| <i>Bacillus sp.</i> PDI-21                   | Adama, Efiopia  | PE + UV        | 30 days  | 8,63           | 16S rRNA                     | [1]    |
| <i>Acinetobacter kookii</i> PDI-42           | Adama, Efiopia  | PE + UV        | 30 days  | 6,77           | MALDI-TOF MS                 | [1]    |
| <i>Bacillus subtilis</i> PDI-27              | Adama, Efiopia  | PE + UV        | 30 dayss | 4,79           | MALDI-TOF MS                 | [1]    |
| <i>Pseudomonas balearica</i> PDI-17          | Adama, Efiopia  | PE (ishlovsiz) | 30 days  | 4,25           | MALDI-TOF MS, 16S rRNA       | [1]    |
| <i>Bacillus subtilis</i>                     | Kafrelsheikh,   | HDPE           | 30 days  | 3,80           | Biochemical, SDS-PAGE        | [5]    |
| <i>Bacillus cereus</i>                       | Kafrelsheikh,   | HDPE           | 30 days  | 2,20           | Biochemical, SDS-PAGE        | [5]    |
| <i>Bacillus sp.</i> , <i>Micrococcus sp.</i> | Lagos, Nigeria  | PE / PS        | 6 weeks  | 25,0–31,2      | Biochemical tests            | [4]    |

Note: PE + UV — variant where polyethylene was pre-treated with ultraviolet radiation prior to the experiment. PS — polystyrene. Indicators are presented based on gravimetric analysis results from respective sources. As can be seen from the data in Table 1, the bacterial degradation rate of polyethylene varies across a very wide range—from 2.20% to 52.0%. This difference is explained by three main factors: the type of polymer (LDPE degrades much easier than HDPE due to its lower crystallinity



and higher degree of branching), the incubation period, and whether the polymer was pre-treated or not. For instance, while the *B. subtilis* strain provided an 18.0% weight loss upon 60 days of incubation with LDPE [2], this figure was only 3.80% in a 30-day experiment with HDPE [5].

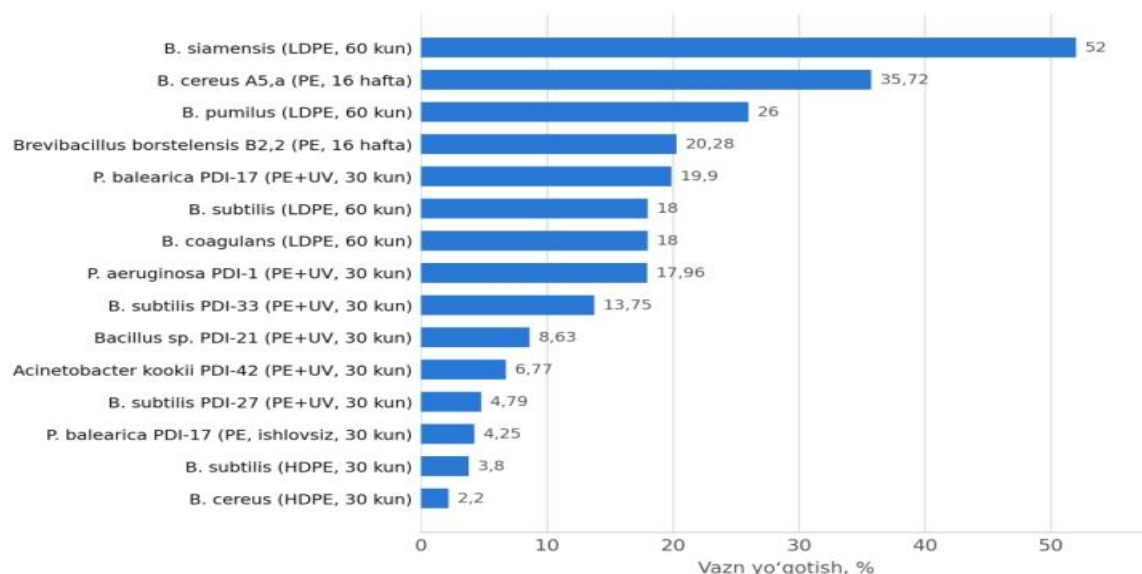


Figure 1. Degradation efficiency of polyethylene (weight loss, %) by *Pseudomonas* and *Bacillus* strains reported in literature sources [1, 2, 5, 7].

#### 4. Effect of pre-treatment on degradation efficiency.

The main factor limiting the biodegradation of polyethylene is the absence of polar groups on its surface that enzymes can attack. Under the influence of UV rays (365 nm) or thermal treatment (70 °C), carbonyl groups form on the polymer surface, reducing hydrophobicity and enhancing microbial adhesion [1]. The Ethiopian study provided a quantitative evaluation of this effect: after one month of incubation, weight loss in non-UV-treated polyethylene was 1.14–4.25%, whereas with UV treatment, this figure increased to 4.79–19.90% (Figure 2) [1].

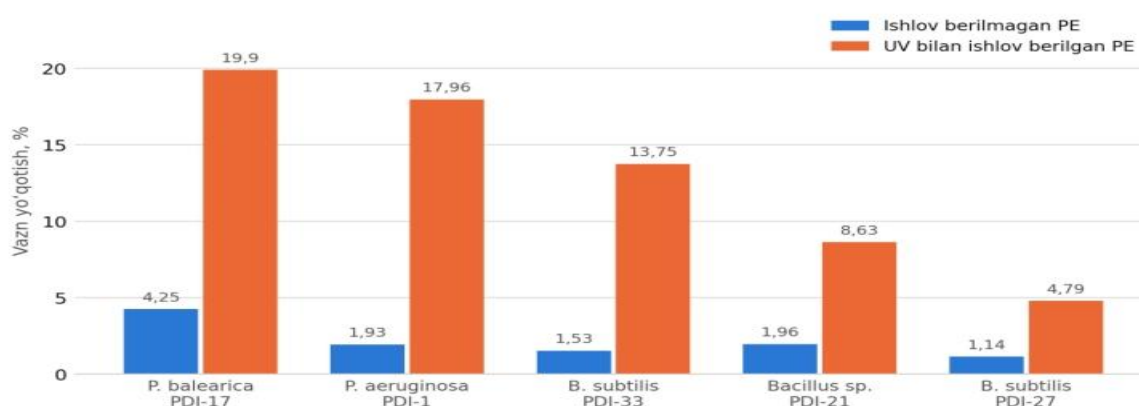


Figure 2. Effect of pre-treatment of polyethylene with UV radiation on bacterial degradation efficiency (using strains from Adama, Ethiopia as an example) [1].

According to calculations, UV pre-treatment increased the efficiency by 9.3-fold for the *P. aeruginosa* PDI-1 strain, 9.0-fold for the *B. subtilis* PDI-33 strain, 4.4-fold for the *Bacillus* sp. PDI-21 strain, and 4.7-fold for the *P. balearica* PDI-17 strain. This result demonstrates the necessity of incorporating the photo-oxidative pre-treatment



stage as a mandatory element in bioremediation technologies developed under local conditions. Uzbekistan's climatic conditions, characterized by a high number of sunny days, allow this stage to be implemented cost-effectively through natural insolation.

**5. Strain identification methods.** In the analyzed sources, the identification stage was carried out at three successive levels. The first level is morphological and biochemical characterization: Gram staining, studying colony morphology, catalase, oxidase, indole, citrate tests, and carbohydrate fermentation properties [1, 4]. The second level is MALDI-TOF mass spectrometry, where the mass spectrum of cellular proteins is compared with a database; a score of  $\geq 2.0$  is accepted as reliable identification at the species level [1]. The third level is molecular identification: amplification of the 16S rRNA gene using universal primers (8F — AGAGTTTGATCCTGGCTCAG and 1492R — TACGGTTACCTTGTTACGACTT), sequencing, and comparison with sequences in the database using the BLAST algorithm [1, 2, 7].

An approach of particular importance is the identification of functional genes. In the Ethiopian study, PCR was performed for the *alkB* (alkane hydroxylase) gene, and it was found that *Pseudomonas aeruginosa* PDI-1, *P. aeruginosa* PDI-2, *P. balearica* PDI-17, PDI-11, and *P. balearica* PDI-39 strains tested positive for this gene; whereas the gene was not detected in *Bacillus cereus* PDI-8, *B. subtilis* PDI-27, and *Acinetobacter kookii* PDI-42 strains [1]. Importantly, the strains that tested positive for the *alkB* gene exhibited the highest weight loss rates. This indicates that the *alkB* gene can be used as a reliable molecular marker for the rapid selection of polyethylene-degrading strains. In practical work, it is recommended to use the test set presented in Table 2 for the initial differentiation of the genera *Pseudomonas* and *Bacillus*.

| Criterion / test                     | <i>Pseudomonas</i> spp.                       | <i>Bacillus</i> spp.                                 |
|--------------------------------------|-----------------------------------------------|------------------------------------------------------|
| <b>Gram staining</b>                 | Negative (–), straight rod                    | Positive (+), large rod                              |
| <b>Endospore formation</b>           | Absent                                        | Present                                              |
| <b>Catalase</b>                      | Positive (+)                                  | Positive (+)                                         |
| <b>Oxidase</b>                       | Positive (+)                                  | Usually negative (–)                                 |
| <b>Motility</b>                      | Via polar flagellum                           | Peritrix xivchinlar hisobiga                         |
| <b>Pigment production</b>            | Fluorescent pigments (pyoverdine, pyocyanin ) | Usually non-pigmented                                |
| <b>Response to glucose (OF test)</b> | Oxidative                                     | Fermentative or oxidative                            |
| <b>Selection method</b>              | King A va King B media                        | Thermal treatment of the sample 80 °C for 10 minutes |
| <b>Optimal growth temperature</b>    | 25–37 °C                                      | 30–45 °C                                             |
| <b>Optimal pH (PE medium )</b>       | 7,2 (grows in the 5,5–8,5 range )             | 7,2 (grows in the 5,5–8,5 range )                    |
| <b>Key molekular marker</b>          | alkB1, alkB2 genes ; 16S rRNA                 | 16S rRNA;                                            |
| <b>Extracellular enzymes</b>         | Protease , lipase                             | Protease , amylase, esterase                         |

Note: The table is compiled based on experimental data from sources [1, 4] and general bacteriological methodology.



**6. Optimal conditions and use of consortia.** Optimizing cultivation conditions is required to increase degradation efficiency. In the Ethiopian study, optimization was carried out for three leading strains regarding pH (5.5; 7.2; 8.5), temperature (25; 30; 37 °C), and polyethylene concentration (0.05; 0.1; 0.5% w/v) [1]. The highest dry cell mass and optical density values were recorded at pH 7.2; the *P. balearica* PDI-17 strain showed the highest OD600 (0.208) at a 0.5% polyethylene concentration [1]. For strains isolated from saline soils, it is advisable to include a NaCl concentration resistance test among these parameters, as a significant portion of Uzbekistan's soils are saline to varying degrees.

Using a consortium instead of single strains is a promising approach: the combined application of *Pseudomonas* and *Bacillus* strains with different enzymatic systems ensures the sequential breakdown of the polymer chain. High activity of fungi has also been noted: in the Kenyan study, the *Aspergillus oryzae* A5.1 strain achieved a weight loss of  $36.4 \pm 5.53\%$  in 16 weeks, and it was emphasized that fungi are generally more efficient degraders than bacteria [7]. In the Tanzanian study, *Phoma* sp. and *Aspergillus* sp. formed clear zones of 66.3 mm and 61.1 mm, respectively [3]. Therefore, testing mixed bacterial-fungal consortia in future research is recommended.

**7. Proposed methodological scheme for the conditions of Uzbekistan.** Based on the analysis results, the following five-stage scheme is proposed: Stage 1 — sampling and enrichment. Samples are collected from a depth of 0–20 cm from municipal solid waste landfills, soils around polymer processing enterprises, and wastewaters in Tashkent, Samarkand, Bukhara, and the Fergana Valley. Samples are placed in an MSM medium containing pieces of polyethylene film pre-treated with UV radiation, and incubated at 37 °C with shaking at 100–150 rpm for 30–60 days. Stage 2 — isolation. Inoculation from the enriched medium is carried out onto Nutrient Agar and King B media (for *Pseudomonas*); for *Bacillus*, the sample is subjected to thermal treatment at 80 °C for 10 minutes. Colonies are purified through repeated subculturing to obtain pure cultures.

Stage 3 — screening. Pure cultures are evaluated based on clear zone formation on mineral agar supplemented with powdered polyethylene and the increase in OD600 in liquid MSM medium. The 5–10 most active isolates are selected for the next stage. Stage 4 — identification. Morphological and biochemical characterization (Table 2), followed by 16S rRNA gene sequencing and BLAST analysis; MALDI-TOF MS when available. The functional potential is confirmed by PCR targeting the *alkB* gene. Stage 5 — efficiency evaluation and optimization. Gravimetric analysis at 30, 60, and 90 days; identification of new functional groups via FT-IR spectroscopy; observation of cracks and pores on the polymer surface using SEM. Optimization is carried out regarding pH, temperature, polymer concentration, and NaCl levels. The advantage of this scheme is that it begins with relatively inexpensive steps achievable within standard microbiological laboratory capabilities (enrichment, screening, gravimetry), while reserving expensive instrumental methods (MALDI-TOF MS, sequencing, SEM, FT-IR) exclusively for the most promising isolates. This increases research efficiency under conditions of limited resources.



## CONCLUSION

1. The analyzed sources indicate that strains capable of degrading polyethylene are mainly isolated from areas subjected to long-term plastic waste exposure—landfills, soils around polymer enterprises, and wastewaters. Using polyethylene as the sole carbon source in a mineral salt medium is the most effective selection method.
2. According to literature data, strains belonging to the genera *Pseudomonas* and *Bacillus* provide a weight loss ranging from 1.14% to 52.0% during 30–112 days of incubation. The highest rates were recorded for *B. siamensis* (52.0%; LDPE, 60 days), *B. cereus* A5,a (35.72%; PE, 16 weeks), and *P. balearica* PDI-17 (19.90%; PE + UV, 30 days) strains.
3. Pre-treatment of polyethylene with UV radiation increases degradation efficiency by 4.2- to 9.3-fold. Therefore, the photo-oxidative pre-treatment stage should be considered a mandatory element in bioremediation technologies.
4. A three-tier approach in strain identification—morphological-biochemical characterization, MALDI-TOF MS, and 16S rRNA gene sequencing—yields the most reliable results. The presence of the *alkB* (alkane hydroxylase) gene is associated with high degradation activity of the strain, allowing it to be used as a molecular marker for rapid screening.
5. Considering that over 1 million tons of plastic waste are generated annually in Uzbekistan and the recycling capacity accounts for only 6.6%, isolating salt- and high-temperature-tolerant polyethylene-degrading strains from local soils and creating a consortium based on them is an urgent scientific and practical task. The proposed five-stage methodological scheme can serve as a basis for organizing these efforts systematically.

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