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# ISOLATION OF PHOSPHORUS MOBILIZING BACTERIA FROM SOILS IN THE CLIMATE CONDITIONS OF UZBEKISTAN AND THEIR IMPORTANCE

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**Abstract:** This study investigated the factors affecting the activity of phosphorus-mobilizing bacterial isolates isolated in the climatic conditions of Uzbekistan. One promising approach to improving phosphorus nutrition in agricultural crops is biological phosphate mobilization using soil microorganisms, which facilitates the conversion of poorly soluble phosphorus compounds from soil and fertilizers into forms accessible to higher plants. Field and laboratory studies explored the feasibility of using soil and glucose-ammonia extracts to isolate native soil microorganisms from rhizosphere soils in the Urgut district of the Samarkand region of Uzbekistan capable of effectively converting poorly soluble phosphates from soil and fertilizers into plant-available compounds. The study identified 94 strains of phosphate-mobilizing bacteria, 36 of which demonstrated the highest phosphorus mobilization.
**Key words:** phosphorus, biological phosphate mobilization, soil microorganisms, bacteria.

## INTRODUCTION.

The rapid growth of the world's population has led to the increase in agricultural costs and the consumption of renewable energy, environmental pollution and global warming, which are threatening agricultural areas and ecological life. Agricultural production must be managed sustainably and ecologically to have a positive impact on soil quality and plant health. This can be achieved by using agricultural technologies that minimize erosion, soil salinization, water pollution and other damages in accordance with the principles of ecological farming for soil and plant management.

Saline soils, which are very common in Uzbekistan, are low in phosphorus (P) that plants can absorb. The most common way to provide phosphorus available to plants in soils is through phosphorus fertilization. The use of these fertilizers in agriculture stimulates faster crop growth. However, the benefits of phosphorus fertilization are limited. Phosphorus fertilizers are mineral fertilizers: calcium and ammonium salts of phosphoric acid. They are produced from phosphate rocks and apatites. When agricultural crops are fertilized with phosphorus, plants cannot fully absorb them. In such a situation, the use of microorganisms is of great importance.

The main environmental impact described in the scientific literature is the increase in the content of radionuclides, fluorine, strontium, cadmium, lead and zinc in landscape components (Saet et al., 1990; Rutherford et al., 1994; Andersson et al., 1997; Bolívar et al., 1998; Nielsen et al., 1998; Sousa A., 2008; Dueñas et al., 2007). As mentioned above, when phosphorus fertilizers are applied to agricultural crops, if the plants cannot fully absorb these fertilizers, they remain in the soil in the form of insoluble complexes, which leads to environmental pollution. Among foreign authors, the issue of environmental pollution from the production of phosphorus fertilizers was considered by Saueia C.H.R. in his work. Betty M., Dutton M., Van Weers A.W., Nielsen S., Simmonds J., Bexon A. (2004). Impacts on water bodies are reviewed by Elbaz-Poulichet F., Braungardt C., Achterberg E., Morley N., Kossa. D., Beckers J.-M., Nomérange P., Cruzado A., Leblanc M. (2001). Possible ways to reduce emissions from the production of

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phosphorus fertilizers are discussed by Tayibi H., Choura M., López F.A., Alguacil F.J., López-Delgado A. (2009).
The aim of the study was to identify and evaluate indigenous soil phosphate-mobilizing microorganisms.

**MATERIALS AND METHOD.**

**Nutrient medium for the isolation and incubation of free phosphate-mobilizing bacteria.** To isolate pure cultures of free-living nitrogen-fixing and phosphate-mobilizing bacteria and use them in the research process, traditional microbiological methods and the following nutrient media were used:

isolates of phosphorus-mobilizing bacterium were tested for compatibility of growth by cross streak assay in nutrient agar medium. Nutrient agar medium was prepared and sterilized. The medium was poured into sterile Petri plates and allowed for solidification. To test the compatibility of phosphate solubilizing bacterium. isolates of nitrogen-fixing and phosphorus-mobilizing bacteria was streaked as a strip at one end of the plate and incubated for 24 hrs to form a thick growth [M. Jeya Bharathi., at all 2017].
**Potato agar (g/l):** wastewater – 1.0., potatoes – 200.0 agar – 20.0 pH 5-6 Sterilization 1 atm. (121 oC) – 20 min.
Tests for sample differences were used to determine the indicators of the impact of phosphorus fertilizer production on landscapes. Student and Fisher t-tests were used to calculate the difference measures.
The sample plots designated for the assessment of soil parameters were grouped according to three main criteria:
1. by soil classification section;
2. by distance to the production site;
3. by the nature and degree of anthropogenic disturbance.
Soil pH changes were determined by differences in acidity both in the areas adjacent to the landfill and in the sample plots, as well as statistically significant differences between the samples.

**RESULT AND DISCUSSION**

The research area was based on soil samples taken from field sites in the Urgut district of the Samarkand region. Microbiological fertilizers play an important role in reducing costs as environmentally friendly products and protecting natural resources. Implementing agricultural activities with low-cost and environmentally friendly practices is important for sustainability and food security in agriculture. The research area was conducted based on soil samples taken from field plots in the Urgut district of the Samarkand region. located in the southeastern part. It borders Bulungur district in the northeast through the Zarafshan River, Toylok in the north, Samarkand districts in the northwest and west, the Republic of Tajikistan in the east, and

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Kashkadarya region in the south. The area is 1120.3 km². (Fig. 1)
Figure 1. Map of the research area (Urgut district, Samarkand region, Uzbekistan).

Phosphorus-mobilizing bacteria (PMB) are microorganisms (e.g., members of the genera Bacillus, Pseudomonas) that convert unavailable phosphorus in the soil into a soluble form and


increase its uptake. They do this by releasing organic acids, lowering soil pH, chelating cations, and mineralizing organic phosphorus compounds with enzymes. An environmentally safe, highly effective, biological product based on live bacteria that mobilizes hard-to-access phosphorus from the soil and promotes increased crop yields. Growth stimulator.

During the study, 42 strains of *Bacillus subtilis* and 52 strains of *Bacillus megaterium* were isolated and purified. The next step was to select and characterize the isolated microorganisms. The most important selection criterion was their ability to mobilize phosphate from various insoluble compounds.

**Table 1.**

**Characteristics of the studied phosphate-mobilizing microorganisms**

| **Strain** | **Morphological and physiological-biochemical characteristics** |
|---|---|

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***Bacillus subtilis***

A species of Gram-positive, spore-forming, facultatively aerobic [4] soil bacteria. Originally described in 1835 by Ehrenberg as Vibrio subtilis, it was renamed Bacillus subtilis by Cohn in 1872. The species received the name "hay bacillus" because enrichment cultures of this microorganism are obtained from hay extract. It is a regular member of the microbiocenoses of soil, the intestines of animals, and humans, and is found in water and air. It produces several polypeptide antibiotics, as well as industrially produced enzymes (amylase, protease). A rod-shaped bacterium measuring 2–5 × 0.4–0.6 µm. Spores are oval, no larger than the cell, and located in the center. Flagella are peritrix and motile. Colonies are dry, finely wrinkled, velvety, and colorless or pink. The colony margin is wavy. It grows on meat peptone agar, meat peptone broth, as well as on media containing plant debris and simple synthetic nutrient media for heterotrophs. A chemoorganoheterotroph, it ammoniates proteins and breaks down starch and glycogen. It grows well at temperatures from 5 to 45°C. [Jana Beranová]

Bacillus subtilis strains are used in veterinary medicine, medicine, agriculture, and other industries. A number of Bacillus subtilis strains are used in medicine to produce pharmaceuticals and dietary supplements. For example, the well-known Russian-made drug "Sporobacterin," designed to combat intestinal microflora disorders, was developed using a Bacillus subtilis strain. [Khaitov R.M.]

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| | |
|---|---|
| ***Bacillus megaterium*** | A species of Gram-positive rod-shaped bacteria used in biofertilizers in agriculture and horticulture. It is one of the largest bacteria found in soil [Patricia S.*at.,al*]. Groups of this bacterium often occur in chains, where the cells are linked by polysaccharides on their cell walls. B. megaterium is able to survive in some extreme conditions, such as desert environments, by producing spores [ *Claudia Korneli.at.,al*]., [*S. H. Elwan, S. A. Z. Mahmoud*] This particular bacterium can also occasionally be found on common surfaces that come into contact.[ *Muhammad A. Khan, Fatima Anjum*]. The first discovered producer of the bioplastic polyhydroxybutyrate, with the latter content reaching up to 44% of the dry weight. [José M Luengo., at,all]., [S. Agarwal. 5.15 - Biodegradable Polyesters // Polymer Science: A Comprehensive Reference / Krzysztof Matyjaszewski, Martin Möller. — Amsterdam: Elsevier, 2012-01-01. — pp. 333–361.]. Bacteria of this species can rarely cause meningitis, wound infections, and be a source of bacteremia. |

The formation of "transparent halos" around colonies of phosphate-mobilizing microorganisms is a generally accepted criterion for the rapid selection of phosphate-mobilizing microorganisms and preliminary assessment of their activity. During the experiment, it was found that the use of soil extract hindered the subsequent detection of "transparent halos" around the colonies. Furthermore, when colonies isolated from the soil extract were re-cultured onto synthetic glucose-ammonium medium, some cultures failed to form colonies or demonstrated slow growth, which is due to the possible presence of growth factors and water-soluble phosphate in the soil extract. Therefore, its further use was abandoned. Thus, from the 94 previously isolated soil bacterial strains, we selected 36 isolates capable of mobilizing phosphate. Of these 36 strains, only 32 were isolated from agricultural (plateau) soil samples. To further narrow the range of cultures used in the study and select the most active phosphate-mobilizing microorganisms, we considered the use of the phosphate solubility index (the ratio of the diameter of the clear zone to the diameter of the microbial colony). For this purpose, the selected isolates were divided into two groups depending on the index values. The first group included microorganisms with a phosphate solubility index above 1.5.

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Figure 2. Isolation of phosphorus-mobilizing bacterial strains in liquid and solid nutrient media.

## CONCLUSION

Thus, relatively small fluctuations in non-phosphorus mobilization activity, which are an indirect indicator of the number of phosphorus-mobilizing microorganisms in the soil, may further confirm that the rate of phosphorus mobilization is limited not by the number of bacteria, but by their food sources and environmental factors. The dominance of many microorganisms, including phosphorus-mobilizing bacteria, is associated with the presence of significant bioenergetic resources in the arable soil layer, the presence of fertilizers, and the influence of climatic conditions on the maintenance of microbial activity (temperature), which has a positive effect on the microbial biocenosis.

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