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PHENOTYPIC DIVERSITY OF THE MICROBIOTA OF THE MEDICINAL KHOJAIPOK MINERAL LAKE

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Abstract: In this article, based on the physicochemical parameters of the highly mineralized and sulfur-rich Khojaipok lake located in the Kashkadarya region, pure cultures of microorganisms were isolated, and their phenotypic characteristics were analyzed.

Keywords: extremophilic microorganisms, halophiles, sulfur bacteria, salt lakes, biotechnology, microbiome, Khojaipok.

Introduction

In recent years, interest has significantly increased in natural sulfur-compound lakes, particularly the compounds found in medicinal and rejuvenating mineral waters originating from underground geothermal springs. The various health benefits and unique medicinal properties of these compounds have attracted the attention of both researchers and medical professionals. Sulfur compounds play a vital role in many biological processes; this is primarily explained by their active participation in metabolic processes and their function as vital signaling molecules within the body. Khojaipok lake, located in the Khojaipok village of the Dehkanabad district in the Kashkadarya region, is famous for its richness in minerals; its water contains sulfur (sulfides) and 42 types of microelements. The water and medicinal mud of this lake are widely used in the treatment of rheumatoid diseases, various skin diseases, and nervous system disorders. Studying the microbiota living in such a mineral-rich extreme ecosystem is highly relevant for fundamental science. The purpose of this study is to isolate pure bacterial isolates from the Khojaipok mineral lake and evaluate their phenotypic characteristics.

Materials and Methods

Water and sediment samples collected from Khojaipok lake during the winter and spring seasons were used as the object of study. The collected water samples were submitted for hydrochemical analysis. To isolate pure cultures of microorganisms, the samples were inoculated on various selective nutrient media (Halophilic agar, Marine agar, Starkey, HS, etc.) with a salt concentration ranging from 5% to 25%. The samples were incubated at a temperature of 25-37°C for 2-5 days. After incubation, isolates were separated from the samples using the serial dilution method. The morpho-cultural characteristics (colony color, shape, surface) and susceptibility to the Gram reaction of the isolates were tested. The cell shape, motility, and size of the isolates were evaluated using phase-contrast microscopy (ZEISS universal microscope).

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Results and Discussion

According to the results of the hydrochemical analysis, the pH of the water environment in Khojaipok lake was found to be 7.5, and the dry residue mass was 7.3 g/l. It was confirmed that this reservoir, which has a high amount of sulfate ions (4938 mg/l), is a calcium-magnesium-sulfate type lake with a salinity of up to 7%. As a result of the microbiological enrichment and inoculation processes, a total of 25 pure bacterial isolates were obtained from Khojaipok lake. Morpho-cultural analyses showed that the isolated cultures exhibit phenotypic diversity. Under the microscope, the cell shape of all 25 isolates was observed to be rod-shaped. The color of the formed colonies was highly diverse, displaying white, cream, light blue, dark cream, light brown, pink, and yellow pigments. It was determined that the surface of the colonies had a solid or mucous structure depending on the type of isolate. The occurrence of mucous colonies may be associated with the survival strategy of bacteria (secretion of exopolysaccharides) to protect themselves from dehydration in a mineral-sulfate environment. Gram staining analysis confirmed the active presence of both Gram-negative and Gram-positive bacterial isolates (e.g., X.T.10(1), X.T.10(2)) in the Khojaipok ecosystem.

Conclusion

The conducted research shows that Khojaipok lake, which possesses medicinal mineral properties, contains a highly rich and phenotypically diverse community of microorganisms. The distinct pigmentation and structural characteristics of the 25 pure isolates obtained indicate their strong adaptation to these specific extreme conditions. These local halotolerant bacteria will serve as a valuable raw material source for the development of new biologically active substances and biotechnological preparations in the future.

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