TAXONOMIC POSITION OF COPPER-RESISTANT MICROORGANISMS OF THE EXTREME ECOSYSTEMS

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Contamination of ecosystems with metal compounds is a common environmental problem. Isolation of new metal-resistant microbial strains and development of environmental biotechnologies is a promising approach. The inefficiency of existing physicochemical and biological methods is caused by the lack of a distinct theoretical approach. Therefore, the aim of the work was to theoretically substantiate and experimentally confirm the possibility of copper resistant microorganism's isolation from extreme ecosystems and to determine their taxonomic position. The thermodynamic prognosis allows substantiating the existence of microorganisms in the presence of Cu^{2+} at super-high concentrations up to 1 M/L, as well as the pathways of its transformation by microorganisms. Microorganisms were grown in NA and NB media (HiMedia Laboratories Pvt. Ltd., India) in the concentration gradient of Cu^{2+} ions (100-63 546 ppm). Determination of the taxonomic position of microorganisms was performed based on their morphological-cultural and physiological-biochemical properties, as well as by the method of phylogenetic analysis of the nucleotide sequence of the 16S rRNA gene. The growth of microorganisms is possible if the redox potential of the system formed by the metal-oxidizer and its reduced form is contained in the zone of thermodynamic stability of water (+814…-414 mV). It was confirmed by 10 strains (9 bacterial and 1 yeast) of copper-resistant microorganisms isolation at 1 M/L Cu^{2+}. Isolate UKR1 from Kyiv region was identified as *Pseudomonas lactis*, isolate UKR2 from Kyiv region belonged to the *P. panacis* species, and two isolates from the Svalbard archipelago in Arctic and Galindez Island in Antarctica (UKR3 and UKR4) belonged to the *P. veronii* species. Bacterial isolate Cop101 («Atlantida» cave, clay, Ukraine) belonged to the species *Pantoea agglomerans*, and bacterial isolates Cop41 (copper contaminated soil, Ukraine), Cop99 («Optymistychna» cave, clay, Ukraine) and Cop102 (Ecuador, soil) were identified as *Bacillus velezensis*, *B. megaterium*, *B. mycoides* respectively. Isolate Cop98 (Dead Sea, sand) was identified as *Staphylococcus succinus.* Isolate UKR5 was isolated from the volcanic ash of Antarctica (Deception Island), which was able to grow at 63 546 ppm Cu^{2+} and belonged to *Rhodotorula mucilaginosa* species. All isolated strains were not only resistant to Cu^{2+} at super-high concentrations, but were able to interact with it (accumulate, immobilize and mobilize).

Thus, a wide biodiversity of copper-resistant microorganisms in the extreme ecosystems was shown. Thermodynamic positions about the possibility of the existence of microorganisms at super-high concentrations of Cu^{2+}, and the permissible pathways of their interaction with copper were experimentally confirmed. The industrially promising strains that can be used for the development of environmental biotechnologies were isolated.