

Brief information about the project

Name of the project	AR14871512 “Microbial multifunctional exopolysaccharides: biochemical characteristics, production methods and prospects for use in the oil industry”
Relevance	The project is aimed at isolating microbial exopolysaccharides produced by mucus-forming bacteria and representatives of the genus <i>Sphingomonas</i> , isolated from soils, rhizosphere and plant tissues growing in the foothill and foothill plains of the Trans-Ili Alatau, selecting strains of gellan gum producers. Optimal conditions for cultivating producers of gellan-like exopolysaccharides and surfactants will be determined to ensure maximum product yield in laboratory and pilot-industrial conditions using cheap raw materials, waste from a corn syrup plant. Under model conditions, the possibility of increasing production will be assessed by creating high-strength gel “plugs” of gellan-like exopolysaccharides in the washed out zones of the formation, as well as using gellan-like exopolysaccharides in the bioremediation of oil-contaminated soils.
Purpose	Obtaining multifunctional gellan-like biopolymers, characterizing their basic physicochemical and biological properties, as well as assessing the prospects for using biopolymers in oil production and bioremediation of oil-contaminated ecosystems.
Objectives	<ol style="list-style-type: none">1) Isolation of mucus-forming bacteria from soils, rhizosphere and plant tissues growing in the foothill and foothill plains of the Trans-Ili Alatau.2) Selection of conditions for cultivating bacteria that produce gellan-like exopolysaccharides and surfactants with emulsifying properties.3. Selection of the composition of the nutrient medium using waste from starch factories to maximize the yield of gellan-like exopolysaccharides and surfactants and test their use in the processes of oil production and bioremediation of oil-contaminated soils.
Expected and achieved results	A collection of bacteria isolated from soils and plants of various families growing in the foothill and foothill plains of the Trans-Ili Alatau will be created, and isolates that actively form mucus and strains of the genus <i>Sphingomonas</i> will be selected. The isolates will be characterized for exopolysaccharide production and isolates with maximum exopolysaccharide production as well as phenotypic differences will be selected for further studies. Identification of the taxonomic affiliation of the selected strains will be performed by sequencing the nucleotide sequence of their 16S rRNA. All 16S rRNA sequences for the strains will be registered in the gene bank (NCBI). The most promising strains will be deposited in the Republican Collection of Microorganisms. A culture

	<p>medium will be selected for each promising strain. To obtain a cheaper and more effective nutrient medium, waste from starch factories will be chosen instead of commercial sugars, as the most accessible, effective carbon substrates. Gellan-like exopolysaccharides from glucose-containing waste will be purified and identified: determination of viscosity, molecular weight and molecular weight distribution. Experimental batches of gellan-like exopolysaccharides will be obtained using industrial fermenters FS 50 and FS 100. The properties of solutions and gels of gellan-like exopolysaccharides in reservoir conditions will be studied depending on the salt content, temperature, and pH of the environment. The possibilities of using gellan-like exopolysaccharide for oil recovery and bioremediation of oil-contaminated soils will be tested.</p>
<p>Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles</p>	<ol style="list-style-type: none"> 1. Mukasheva Togzhan Dzhangel'dievna, Doctor of Biological Sciences, Professor. h-index 6, AAR-4164-2020. ORCID iD: https://orcid.org/0000-0003-3275-7895, Scopus author ID: 56507331100, https://orcid.org/0000-0003-3275-7 2. Gusenov Iskander Shakhsavanovich, higher, PhD doctor Hirsch index – 4, Researcher ID- ABE-9545-2021, ORCID- 0000-0002-9820-7952 3. Berzhanova R.Zh. higher, candidate of biological sciences, associate professor h-index 6, Researcher ID Q-4292-2016, ORCID iD https://orcid.org/0000-0001-9251-4452, Scopus author ID: 56507457600 4. Tatykhanova Gulnur Sayranovna, higher, candidate of chemical sciences Hirsch index – 8, Researcher ID- N-6874-2017, ORCID- 0000-0003-4457-1705, Scopus Author ID – 23977007200
<p>List of publications with links to them</p>	<p>1. Kudaibergenov S.E., Tatykhanova G.S., Gizatullina N.N., Tuleyeva R.N., Kaldybekov D.B., Gussenov I.Sh., Berzhanova R.Zh., Mukasheva T.D., Vamvakaki M., Aseyev, V.O., Khutoryanskiy V.V. Anionic polysaccharide – gellan as perspective polymer for potential application in medicine and oil recovery: a MINI-REVIEW // Uzbekistan Journal of Polymers Vol. 2, Special Issue 2, (2023). P. 53 – 56.</p> <p>1. Iskander Sh. Gussenov, Ramza Zh. Berzhanova, Togzhan D. Mukasheva, Gulnur S. Tatykhanova, Bakyt A. Imanbayev, Marat S. Sagyndikov and Sarkyt E. Kudaibergenov Exploring Potential of Gellan Gum for Enhanced Oil Recovery. Mini-Review // Gels. 2023 Oct 29;9(11):858. doi: 10.3390/gels9110858</p> <p>Abstracts in international conferences – 4:</p> <ol style="list-style-type: none"> 1. Aisulu Zhunisizhan, Togzhan Mukasheva, Ramza Berzhanova, Gulshara Abay, Mariya Ahmetova, Alibek Kudabayev Search and identification of slime-forming bacteria – biopolymer producers // Fems 2023 Abstract

	<p>Book 10th Congress of European Microbiologists 9-13 July 2023 Hamburg, Germany P. 422.</p> <p>2. Aisulu Zhuniszhan, Togzhan Mukasheva, Ramza Berzhanova, Gulshara Abay, Mariya Ahmetova Evaluation of bioemulsifying activity in mucus – forming bacteria // Abstract book International symposium on microorganisms and the biosphere Microbios – 2023 dedicated to the 100 th Anniversary of the Republic of Turkiye June 15-166 Bishkek – Kyrgystan, 2023, p. 41.</p> <p>3. Tatykhanova, G.S., Gizatullina, N.N., Kudaibergenova, G., Berzhanova, R.Z., Mukasheva, T.D., Kudaibergenov, S.E. Comparative study of gellan gum from domestic raw materials of Kazakhstan and commercial gellan // Book of Abstracts TOP 11 International conference on Times of Polymers and Composites, June 11th – 15th 2023, Ischia. P. 103</p> <p>4. Жунисжан А.Ж., Бержанова Р.Ж., Абай Г., Кудабаяев А., Мукашева Т.Д., Оразалы А. Слизиобразующие бактерии – возможные продуценты поверхностно-активных веществ с эмульгирующими свойствами // Микробные биотехнологии: фундаментальные и прикладные аспекты: материалы XIII Междунар. науч. конф. Минск, 6 – 9 июня 2023 г. 186 – 189 с.</p>
Patents	-