

Brief information about the project

Name of the project	AP25795689 Development of environmentally friendly inhibitors for corrosion protection of steel structures in the oil and gas industry
Relevance	The relevance of the project is обусловлена высоким уровнем коррозионного разрушения стальных конструкций widely used in the oil and gas industry, as well as the environmental limitations of conventional corrosion inhibitors. Most commonly used synthetic inhibitors (amines, phosphonates, imidazolines) are characterized by toxicity, low biodegradability, and adverse environmental impact, necessitating the development of safer alternatives. In this regard, the development of environmentally friendly and efficient inhibitors based on natural components is of particular importance. The project proposes the use of natural substances such as tannin, chitosan, and bentonite, which exhibit high adsorption capacity and are capable of forming protective films on metal surfaces, effectively inhibiting corrosion processes. The resulting composite inhibitors are expected to demonstrate a synergistic effect, ensuring high efficiency and stability in aggressive environments (acidic solutions and seawater – 3.5% NaCl). The inhibitory performance will be evaluated on different steel grades using gravimetric and electrochemical methods, allowing validation of their applicability under real industrial conditions. Thus, the implementation of this project will contribute to solving one of the key challenges of the oil and gas industry – corrosion mitigation through environmentally friendly technologies in accordance with the principles of green chemistry.
Purpose	The aim of the project is to develop environmentally friendly corrosion inhibitors for the protection of steel structures and to study their anticorrosion properties in acidic solutions.
Objectives	The following objectives are set within the project: • To synthesize environmentally friendly chemically modified biopolymers and heterocyclic organic compounds exhibiting high corrosion protection efficiency for steel. • To investigate the anticorrosion properties of the obtained inhibitors on steel samples and to perform morphological analysis of the adsorption films formed during the inhibition process. • To determine the protective properties and mechanism of action of the synthesized inhibitors on the steel surface.

Expected and achieved results	Environmentally friendly inhibitors are synthesized through the modification of natural biopolymers and heterocyclic organic compounds. The anticorrosion properties of the obtained inhibitors for steel samples are evaluated in 3.5% NaCl and acidic media using gravimetric and electrochemical methods, along with morphological analysis of the formed adsorption films. The protective properties of the synthesized inhibitors on the surface of steel samples are determined. As a result of the project, at least two (2) publications are planned in journals ranked within the top three quartiles by impact factor in the Web of Science database or with a CiteScore of at least the 50th percentile in the Scopus database.
Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles	Project Scientific Supervisor: Beisenova Gulmira Sembaykyzy, PhD ORCID: 0000-0002-6751-9451 Scopus Author ID: 57207202159 Web of Science ResearcherID: D-5783-2015 Project Scientific Consultant: Argimbayeva Akmaral, Candidate of Chemical Sciences, Associate Professor ResearcherID: AAQ-3743-2020 ORCID: 0000-0002-2467-8241 Scopus Author ID: 56436828200
Usage	Inhibitors based on chitosan–bentonite–tannin effectively suppress the internal corrosion of steel. They form a protective film on the inner surfaces of pipelines transporting oil, gas, and formation water; slow down corrosion processes occurring in the presence of CO₂ and H₂S; and reduce metal loss during long-term operation. They demonstrate particularly high efficiency in aggressive environments such as saline water and acidic media.
Priority compared to real-world alternatives	Advantages compared to existing analogues: environmental safety; high adsorption capacity; synergistic effect of the composite; stability in aggressive environments; economic efficiency; technological versatility.
List of publications with links to them	1. G.S. Beisenova, B.D. Burkitbayeva, A.M. Argimbayeva, G.S. Rakhimbay, N.N. Esaly. <i>The effect of temperature on the degree of purity of indium during its electrorefining. Chemical Journal of Kazakhstan</i>, 2018. 2. G.S. Beisenova, B.D. Burkitbayeva, A.M. Argimbayeva, G.S. Rakhimbay. <i>Optimization of technological parameters of crude indium electrorefining. Vestnik KazNITU</i>, 2018, No. 4.

	3. Zh.Zh. Myktybay, G.S. Beisenova. <i>Sorption purification of electrolyte in the electrochemical refining of indium.</i> In: Proceedings of the International Conference of Students and Young Scientists “Farabi Alemi”, Almaty, April 9–10, 2018, p. 203. 4. G. Beisenova, B. Burkitbayeva, A. Argimbayeva, G. Rakhimbay, F. Vacandio. <i>Sorption Properties of Chitosan in the Refining of Rough Indium.</i> Eurasian Chemical-Technological Journal, 2018, Vol. 20, No. 3, pp. 235–241. 5. Kh. Avchukir, G.S. Beisenova, M. Nauryzbayev, B. Burkitbayeva, A. Argimbayeva, F. Vacandio, G.S. Rakhimbay. <i>The kinetics of indium electroreduction from chloride solutions.</i> Russian Journal of Electrochemistry, 2018, Vol. 54, No. 12, pp. 1096–1103. 6. <i>Study of a microelectrode manufactured of a new material – kovar, and a mercury-film electrode based on this material.</i> News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, 2019. https://doi.org/10.32014/2019.2518-170X.158
Patents	