Brief information about the project

Name of the project	AP09058570 «The development of the electrochemical modification method of carbon sorbent to impart the required sorption properties»
Relevance	Currently there are many processes and commercialized technologies available for the removal of toxic substances from drinking water and industrial wastewater, such as chemical precipitation, adsorption, biosorption, ion exchange, reverse osmosis, membrane filtration, electrochemical treatment, coagulation and flocculation, solvent extraction, cathodic electrodeposition, cementation processes, etc. However, despite the ease of use, selectivity, low time consumption, etc., these methods have many disadvantages in the form of large capital investments, high energy and operating consumption, sludge release, as well as the selection of conditions and materials for selectivity process. The novelty of this project lies in endowing the surface of a carbon material with the required sorption properties by changing the acid-base properties of the surface after modification.
Purpose	Development of a method for electrochemical and chemical influence on carbon material to form a modified functional layer on its surface for carrying out a selective sorption process
Objectives	1) obtaining carbon materials based on plant and carbon-mineral raw materials; 2) carrying out modification of carbon materials under various conditions and studying its effect on surface properties; 3) manufacturing an electrolyzer to carry out the process in dynamics; 4) carrying out electrochemical modification while varying the electrolyte composition and modes for further study of the sorption of organic and inorganic substances.
Expected and achieved results	Carbon sorbents based on mineral and plant raw materials were obtained, and their physicochemical characteristics were studied. Electrochemical modifications of the resulting sorbents were carried out under different conditions in different electrolytes. It has been demonstrated that electrochemical oxidation of activated carbon sorbents leads to improved adsorption and morphological characteristics. An increase in the number of functional groups after anodic modification of activated carbon has a direct effect on the sorption properties. During the study, a new electrolyzer was developed and constructed for the modification of activated carbon sorbents.
Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles	Atchabarova Azhar aidarovna https://www.scopus.com/authid/detail.uri?authorId=56998822600 https://www.webofscience.com/wos/author/record/53537705 https://orcid.org/0000-0002-4600-2728 Abduakhytova Dinara Aktaykyzy https://www.scopus.com/authid/detail.uri?authorId=57344630000 https://www.webofscience.com/wos/author/record/GYA-5917-2022

	https://orcid.org/0000-0002-4316-0755 Abdimomyn Saken Kynabekuly https://www.scopus.com/authid/detail.uri?authorId=57518892100 https://www.webofscience.com/wos/author/record/32548651 https://orcid.org/0000-0002-5985-9050 Kishibayev Kanagat Kazhmukanovich https://www.scopus.com/authid/detail.uri?authorId=56604294100 https://www.webofscience.com/wos/author/record/53609035 https://orcid.org/0000-0003-1590-5243 Tokpayev Rustam Rishatovich https://www.scopus.com/authid/detail.uri?authorId=56998810900 https://www.webofscience.com/wos/author/record/440647 https://orcid.org/0000-0002-0117-4454 Beknazarov Kanat Isatayuly https://www.webofscience.com/wos/author/record/46794978 https://orcid.org/0000-0001-5023-0486
List of publications with links to them	1) Saken Abdimomyn, Azhar Atchabarova*, Dinara Abduakhytova, Rustam Tokpayev, Kanagat Kishibayev, Tamina Khavaza, Andrey Kurbatov, Graziella Liana Turdean, Mikhail Nauryzbayev. Investigation of the functional layer formation on the surface of carbon material // Studia UBB Chemia, 67 (4), 2022. DOI:10.24193/subbchem.2022.4.10 2) Azhar Atchabarova, Saken Abdimomyn*, Dinara Abduakhytova*, Kanagat Kishibayev, Yelena Zlobina, Andrey Kurbatov, Graziella Liana Turdean, Thierry Djenizian. Electrochemical modification of the carbon materials surface by hydroxyl groups // Journal of Solid State Electrochemistry, 2023 https://doi.org/10.1007/s10008-023-05780-8
Patents	not planned

Walnut Shell

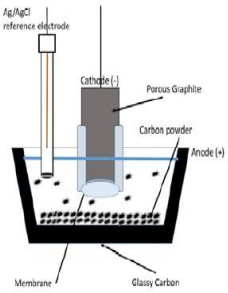
HTC (240°C, 24 hours)

SGA (800°C, 1 hour)

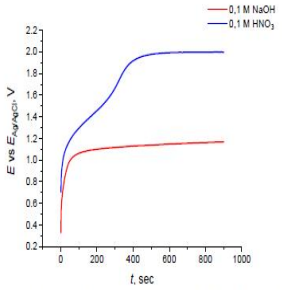
Activated carbon

Electrochemical modification (EcM)

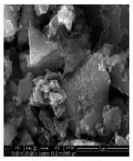
$j = 10$ mA/cm^2; $t = 15$ min



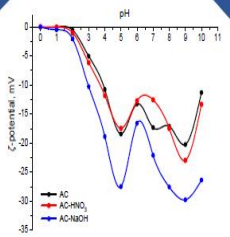
Mechanism of electrochemical modification



EcM
0,1 M NaOH

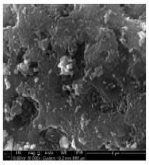


AC-NaOH



Zeta-potential measurements

EcM
0,1 M HNO_3



AC-HNO_3

Mechanism of copper ion adsorption on modified activated carbon