Brief information about the project

Name of the project	AP09058376 «Obtaining and research of activated carbons based on plant raw materials waste, their use in noble and heavy metals sorption»
Relevance	The idea of the project is to obtain highly efficient activated carbons based on plant waste materials, study their basic physico-chemical characteristics and their application in the sorption extraction of noble and heavy metals from aqueous media. The relevance of this project lies in the fact that new activated carbons will be obtained from plant waste materials such as corn cobs, grape seeds, etc. The composition, structural, textural and physico-chemical characteristics of the obtained activated carbons will be studied, and the optimal parameters for obtaining activated carbons will be determined. A detailed study of sorption processes will allow the development of new materials and innovative methods for selective sorption of noble and heavy metals.
Purpose	Production of activated carbons based on plant waste materials and their further study in the processes of sorption of noble and heavy metals from aqueous media
Objectives	1. Production of activated carbons based on plant waste materials of the Republic of Kazakhstan and determination of their basic textural and physico-chemical characteristics. 2. Investigation of sorption purification of model solutions and industrial wastewater from heavy metal ions on the obtained activated carbons. 3. Investigation of sorption extraction of precious metals from model and industrial solutions on the obtained activated carbons.
Expected and achieved results	**Expected results**: - The fundamental foundations of the production of activated carbons based on plant waste materials will be studied and their main physical and chemical characteristics will be determined; - Sorption purification of model solutions and industrial wastewater from heavy metal ions on the obtained activated carbons will be investigated. - Sorption extraction of precious metals from model and industrial solutions on the obtained activated carbons will be investigated. **Achieved results.** Plant waste materials were selected for the production of activated carbons (corn cobs, grape seeds, birch, pine cones, etc.). Activated carbons were obtained by carbonization and activation methods. Carbonization was carried out in two ways: thermal carbonation and hydrothermal carbonation. Activation was performed with superheated water vapor (physical activation). The resulting activated carbons had a developed microporous surface structure. Then the textural and physico-chemical characteristics of the obtained activated carbons were determined by such methods as: BET, SEM, XRD, Raman spectrometry, X-ray fluorescence analysis, IR Fourier spectroscopy, determination of sorption capacity by iodine, determination of ash content, particle size distribution, etc. Studies on the sorption of heavy and noble metals from model and industrial

	solutions have been carried out. Sorption of heavy and noble metals from model solutions was carried out with variation of the following parameters: pH, S:L ratio, initial metal concentration, sorption time. Work has also been carried out on the sorption of heavy and noble metals from industrial solutions or from an imitation solution for industrial use.
Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles	**Research Team Members.** **1. Project manager:** Kishibayev Kanagat Kazhmukhanovich, PhD, leading researcher. *Scopus Author ID*: 56604294100 (https://www.scopus.com/authid/detail.uri?authorId=56604294100) *Researcher ID*: C-7678-2015 (https://publons.com/researcher/2429119/kishibayev-kanagat-kkk/) *ORCID*: https://orcid.org/0000-0003-1590-5243 *Google Scholar*: https://scholar.google.com/citations?user=XG23bY8AAAAJ&hl=ru *ResearchGate*: https://www.researchgate.net/profile/K-Kishibayev **Executors:** **2. Tokpayev Rustam Rishatovich**, PhD, leading researcher: *Scopus Author ID*: 56998810900 (https://www.scopus.com/authid/detail.uri?authorId=56998810900) *Researcher ID*: D-3859-2015 (https://publons.com/researcher/2424520/rustam-r-tokpayev/) *ORCID*: https://orcid.org/0000-0002-0117-4454 *ResearcherGate*: https://www.researchgate.net/profile/Rustam-Tokpayev *Google Scholar*: https://scholar.google.com/citations?user=bmnxQHEAAAAJ&hl=ru **3. Atchabarova Azhar Aidarovna**, PhD, senior researcher: *Scopus Author ID*: 56998822600 (https://www.scopus.com/authid/detail.uri?authorId=56998822600) *Researcher ID*: D-3857-2015 (https://www.webofscience.com/wos/author/record/D-3857-2015) *ORCID*: https://orcid.org/0000-0002-4600-2728 **4. Khavaza Tamina Narimanovna**, master, researcher: *Scopus Author ID*: 57345081100 (https://www.scopus.com/authid/detail.uri?authorId=57345081100) *ORCID*: https://orcid.org/0000-0002-1614-3060 *ResearcherGate*: https://www.researchgate.net/profile/Tamina-Khavaza **5. Ibraimov Zair Tairovich**, 3rd year doctoral student, researcher: *Scopus Author ID*: 57345388600 (https://www.scopus.com/authid/detail.uri?authorId=57345388600) *ORCID*: https://orcid.org/0000-0002-1476-3231 *ResearcherGate*: https://www.researchgate.net/profile/Zt-Ibraimov/research
List of publications with links to them	1. K.K. Kishibayev, J. Serafin, R.R. Tokpayev, T.N. Khavaza, A.A. Atchabarova, D.A. Abduakhytova, Z.T. Ibraimov, J. Srenscek-Nazzal. Physical and chemical properties of activated carbon

	synthesized from plant wastes and shungite for CO_2 capture // Journal of Environmental Chemical Engineering. 2021. Vol. 9. Issue 6. 106798. https://doi.org/10.1016/j.jece.2021.106798 (Elsevier, IF= 7.7, Q1 WoS, percentile – 87 (Process Chemistry and Technology), CiteScore 9.5). 2. Jarosław Serafin, Kanagat Kishibayev, Rustam Tokpayev, Tamina Khavaza, Azhar Atchabarova, Zair Ibraimov, Mikhail Nauryzbayev, Joanna Sreńscek Nazzal, Liliana Giraldo, Juan Carlos Moreno-Piraján. Functional Activated Biocarbons Based on Biomass Waste for CO_2 Capture and Heavy Metal Sorption // ACS Omega. 2023. Vol. 8. Issue 50. P. 48191–48210. https://doi.org/10.1021/acsomega.3c07120 (Q2 WoS, IF = 4.1, 72-nd percentile (General Chemical Engineering) according to the Scopus database).
Patents	-

Figure 1 – Installation for the carbonization of vegetable raw materials in an inert atmosphere

Figure 2 - Installation for activation by superheated steam

Figure 3 – Activated carbon samples

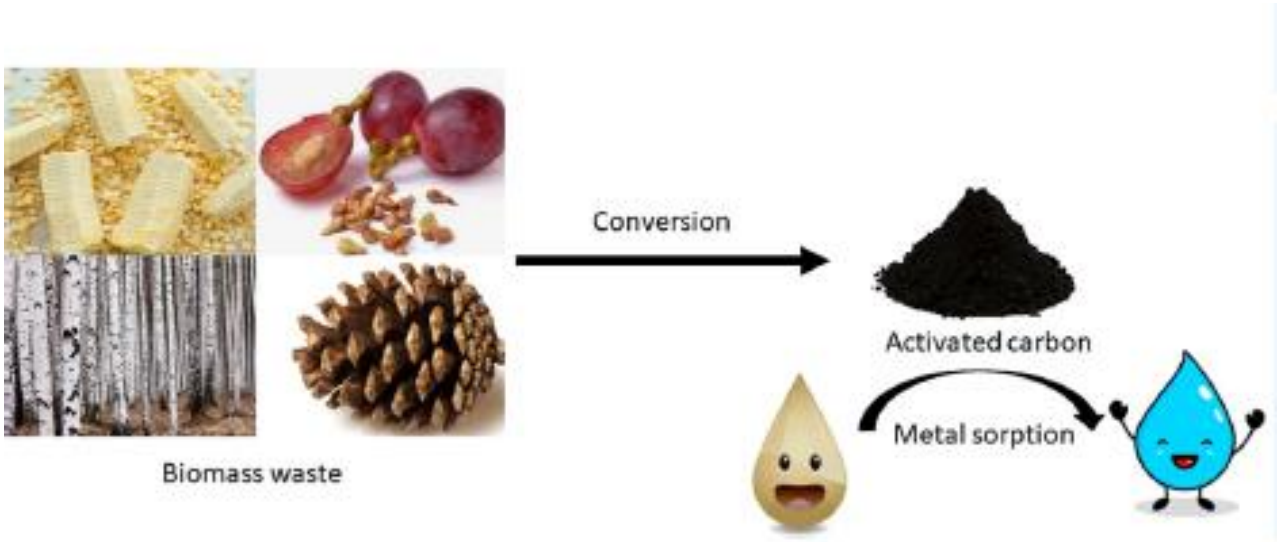
Conversion
Activated carbon
Metal sorption
Biomass waste

Фото 4