

Brief information about the project

Name of the project	AP19677705 «The utilization of coal restudies with microalgae biomass for co-firing to yield an environmentally and economically attractive bio-fossil fuel» (0123PK00493)
Relevance	Coal utilization poses numerous serious environmental challenges, including land subsidence, damage to the aquatic environment, mining waste disposal, and air pollution. Introducing appropriate technology and adopting proper management practices are crucial to reduce the levels of coal waste discharged into the environment. Therefore, the use of algal biomass as a partial substitute for coal appears very promising from both an environmental and economic perspective. Microalgae, as a source of biomass, can be easily employed to treat coal residues before combustion to increase energy efficiency and reduce environmental impacts.
Purpose	To develop an environmentally and economically sustainable bio-fossil fuel of the new generation, co-firing by combining coal restudies and microalgae biomass.
Objectives	<ul style="list-style-type: none"> • To collect and characterize the coal residues based on their chemical composition and morphological structure using proximate- and ultimate, spectroscopic analyses and microscopic observations. • To isolate, identify and characterize the microalgae <i>Oscillatoria</i> sp. from different water reservoirs in terms of microbiological, functional, and chemical properties. • To determine optimal microalgae growth conditions and promote its mass cultivation, harvesting, and processing. • To investigate the potential of using microalgae as a binder for binding/pelleting. • To prepare various coal-microalgae blends by combining microalgae biomass with fine-powdered coal residues. • To understand the details of coal and microalgae interaction and synergistic effects. • To design and operate a binding/pelleting process of coal-microalgae blends. • To produce ‘bio-fossil fuel’ in the form of agglomerated coal-microalgae pellets. • To study the co-firing behavior and parameters of coal-microalgae pellets. • To characterize the pellets by means of thermogravimetric analyses. • To characterize the pellets using compressive strength and water resistibility. • To investigate the effect of co-firing coal with microalgae on the emissions of SO_x and NO_x. • To gain knowledge on co-firing coal with microalgae through the experimental characterization of GHG emission and resulting ash.

	<ul style="list-style-type: none"> • To investigate the effect of microalgae's various proportions (as a partial substitution) on pellet durability-related properties, energy density, and combustion characteristics. • To foster scaling up the production of coal-microalgae fuel briquettes.
Expected and achieved results	The research project will result in the development of a reliable bio-fossil fuel displaying safe and strong energy characteristics.
Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles	<ol style="list-style-type: none"> 1. Akimbekov S. Nuraly - Ph.D., professor: <i>h</i>-index – 10. Scopus: 45160897400, Web of Science: A-5130–2014; ORCID: 0000-0002-5262-5155. 2. Tastambek T. Kuanysh, PhD: <i>h</i>-index – 6. Scopus: 57200176041, Web of Science: AAO-3781–2020; ORCID: 0000-0002-2338-8816. 3. Sherkhan Dinara Kumiskhanovna, Master of Technical Sciences, <i>h</i>-index – 4, ID in Scopus: 57217359617, ID in Web of Science: AGF-5716-2022; ORCID ID: 0000-0001-7623-7205. 4. Altynbai Nazim Pernebaikyzy, Master of Natural Sciences, doctoral student, <i>h</i>-index – 1, ID in Scopus: 57384147300, ID in Web of Science: AAE-7318-2022; ORCID ID: 0000-0002-7067-2457 5. Kamenov Bekzat Kelbetuly, Bachelor of Engineering and Technology, Web of Science: HDN-8563-2022, ORCID: 0000-0002-1484-9000.
List of publications with links to them	
Patents	-

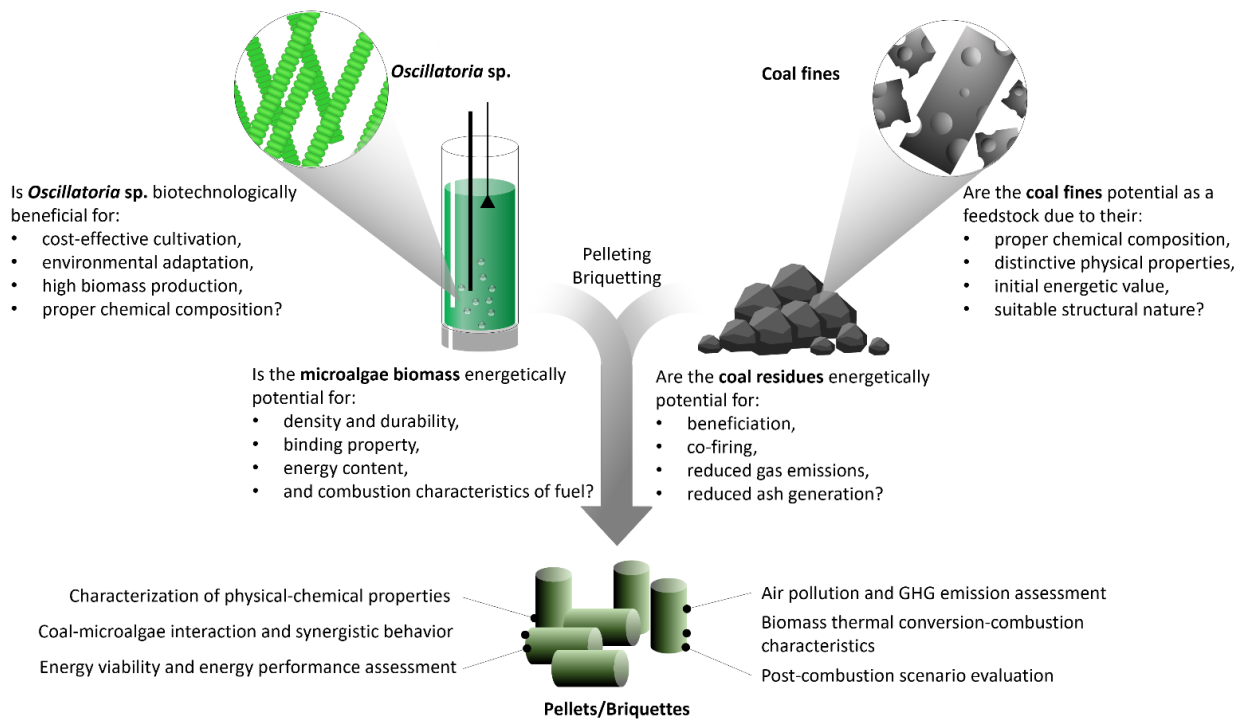


Figure 1. Designing a research hypothesis supported by research questions. The research questions, in turn, are addressed by various methods, which are discovery-oriented, descriptive, and exploratory in nature.