Name and surname:	**Andrzej Białowiec**
Academic Degree	prof. dr hab. inż. (Prof.)
Institute/Department	Department of Applied Bioeconomy
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ORCID:	0000-0002-5871-2129
UPWr Base of Knowledge - link	https://bazawiedzy.upwr.edu.pl/info.seam?id=UPWr903a39c81e8e493eb3646a16ed2782f5&affil=&lang=en
Researchgate:	https://www.researchgate.net/profile/Andrzej-Bialowiec
Personal website / Working group website:	https://www.facebook.com/Department-of-Applied-Bioeconomy-105678112161156
Participation in projects in last 5 years (chronological; with distinction into PI (kierownik) and RF (wykonawca)):	2021 – present – Research grant entitled "Research on the release of volatile organic compounds from carbonized solid fuel produced from municipal solid waste" NCN funding, Preludium BIS 2 program, decision number DEC-2020/39/O/ST8/02750, - PI 2020 - present – Research grant entitled "Investigation of the influence of technological parameters of pyrolysis and substrate properties on the release of volatile organic compounds from biochar". NCN funding, Preludium BIS program, decision number DEC-2019/35/O/ST8/03353, - PI 2020-present - Academic Exchange Grant "The effect and microbial mechanisms of hydrochar on the enhancement of methane production from organic waste", the bilateral, scientific exchange between Poland and China, Polish National Agency for Academic Exchange, PPN/BCN/2019/1/00050, - PI 2019 The development of an innovative, effective method of biomass biological treatment under an anaerobic condition - the project implemented under the Bon for Innovations program. Project number: POIR.02.03.02-10-0024/18. - PI 2015-2019 An innovative technological line for the conversion of organic waste into innovative, high-quality solid fuels - the project from program 1/1.1.1/2015 action 1.1.1. PO IR POIR (NCBiR). - PI 2017 Selection of the composition of substrates based on the best-terra compost and composting technology at the factory composting plant at the Boguszowice sewage treatment plant - the project implemented under the Bon for Innovations program. Project number: POIR.02.03.02-24-0019/17. - PI
Do you plan to engage support of second supervisor	YES
	Second supervisor (from other discipline, polish or international research unit)
Name and surname:	Krzysztof Marycz
Academic Degree	prof. dr hab. (Prof.)
Faculty, Institute/Department	Department of Experimental Biology
e-mail address:	krzysztof.marycz@upwr.edu.pl
ORCID:	0000-0003-3676-796X
UPWr Base of Knowledge - link or most important publications from last 3 year (JCR) / patents from last	https://bazawiedzy.upwr.edu.pl/info.seam?id=UPWr1f4dea0edf494227b872e54669d6d13b&affil=&lang=en
Researchgate:	https://www.researchgate.net/profile/Krzysztof-Marycz
Personal website / Working group website:	
Participation projects in last 5 years (chronological; with distinction into PI (kierownik) and RF (wykonawca)):	2022-present. Development of a therapeutic platform based on nanometric hydroxyapatite doped with iron oxides and functionalized with RNA molecules for accelerated bone regeneration including patients suffering from osteoporosis. TANGO, NCBR. - PI 2020-present. Exploring the role and therapeutic potential of sex hormone binding globulin (SHBG) in the course of insulin resistance, inflammation, lipotoxicity in adipose stem progenitor cells and adipocytes in equine metabolic syndrome (EMS) mares. OPUS, NCN, - PI 2016-2021. Preparation and characterisation of biocomposits based on nanoapatites for theranostic. OPUS, NCN - PI. 2017-2019. Modulation of metabolism and mitochondrial dynamics as well as DNA methylation of adipose tissue progenitor cells applying resveratrol and 5-azacytidine as a therapeutic strategy in the course of EMS. OPUS, NCN - PI. 2016-2021. The effect of bioactive algae enriched by biosorption on the certain minerals such asCr(III), Mg(II) and Mn(II) on the status of glucose in the course of metabolic syndromehorses. Evaluation in vitro and in vivo. SONATA BIS, NCN, - PI
PhD topic:	**The microbial mechanism of enhancing the biomethane production by carbon materials**
Research discipline in Doctoral School	Environmental Engineering, Mining and Energy
Short description of the research problem to be solved in the PhD (minimum 1000 characters):	One of the recent trends in anaerobic digestion (AD) of biowaste (including food waste) is the addition of various carbon materials (CMs), such as biochar, hydrochar, and activated carbon, for the enhancement of biomethane yield. Besides the fact, that the positive influence of CMs on CH4 production has been proven, the mechanism remains still unknown. There is a niche for the determination of the real nature of the microbial mechanism of the CMs influence on CH4 production, and the contribution of each of the properties in this microbial mechanism. The scientific aim of the project is the discovery of the real nature of the microbial mechanism of the influence of CMs on biomethane production efficiency and kinetics and the possibilities of CMs properties modification to achieve the highest yield of the biomethane. The following hypotheses have been put: 1. The mechanism of CH4 production enhancement by CMs may be explained by the high buffering capacity (BC), caused by higher alkalinity, cationic exchange capacity, and presence of functional groups, which mitigates the H+ from the hydrolytic phase and stabilize the pH conditions preferable for methanogenic microorganisms. 2. The mechanism of CH4 production enhancement by CMs may be explained by the high sorption capacity (SC), caused by the high specific surface area, cationic exchange capacity, and presence of functional groups, which mitigates the inhibitive by-products of anaerobic digestion of organic matter and regulate the biodegradable organic compounds availability for heterotrophic microorganisms. 3. The mechanism of CH4 production enhancement by CMs may be explained by the high electric conductivity (EC), caused by cationic exchange capacity, and the presence of functional groups and minerals, which enhances the direct interspecies electron transfer. 4. The mechanism of CH4 production enhancement by CMs may be explained by the low zeta potential (ZP) selectively immobilizing sulfate-reducing bacteria on the surface resulting in the higher densification of methanogens in the solution and exclusion of other groups of microorganisms. 5. It is possible to determine for the first time the qualitative and quantitative model describing the microbial mechanism of CMs influence on anaerobic digestion, allowing the intentional modification of CMs properties for AD optimization. The overall research plan can be divided into 4 main work packages: • WP 1. Production and characterization of carbon materials – CMs will be produced from wheat straw due to thermochemical treatment. The produced CMs will be analyzed in a wide range of properties related to putting hypotheses. • WP 2. Biomethane production from glucose with the application of different CMs – where glucose solution will be anaerobically digested in lab-scale batch and continuous flow reactors, with the addition of the produced in WP1 CMs. The CH4 potential and kinetics of its production will be determined. The characterization of feedstock and digestate will be analyzed. Additionally, microbial communities will be characterized due to DNA and RNA sequencing together with microorganisms' topography in the pores of carbon materials tests. • WP 3. Mechanism analysis for biomethane production enhancement by CMs – where the advanced statistical evaluation (neural networks, fuzzy systems, and multiomics) will be applied to identify which of the CMs properties enhance the CH4 production and to build the mathematical model of these dependencies.
Professional skills for PhD candidate (e.g. master program, specializations, softwares, language, analytical techniques, minimum 500 characters):	The proposed research project has an interdisciplinary character. Therefore, the candidate should be open to immersing numerous scientific approaches and disciplines, should be capable of application of different research methods and techniques. The candidate should have interests in among the following fields analytical chemistry, application of SEM-EDX and confocal laser microscopy, biotechnology, biosorption, bioaccumulation, industrial microbiology, organic matter biotransformation, biochar or hydrochar production, characterization, and application, data validation and analyses. The candidate should be ready for intensive application for external funds, active writing papers, and participate in international internships.
Project title:	The research on the microbial mechanism of enhancing the biomethane production from biowaste by typical carbon materials
Agreement number:	UMO-2021/43/B/ST8/01924
Number of months in the project to support PhD (in months; starting from 1st of October 2022):	36
Project website:	