

Klaipėda University strategic research directions

“Towards sustainable technologies, blue and green growth and a healthy sea”

Postdoctoral Fellowship Topic Application (2023-2025)

Title	Designing biocomposites based on principles of sustainability and circular economy.
Postdoc science direction, Department, start date, duration	<p><i>Fields of science:</i> environmental engineering, materials engineering, mechanical engineering. <i>Departments:</i> JTGMF Department of Engineering and JTI Mechanical and Marine Engineering Laboratory <i>Start:</i> 1st of September 2023 <i>Duration:</i> 2years</p>
Short description, aim and tasks	<p><i>Goal:</i> to create an environmentally friendly biocomposite using Baltic sea algae and/or "beach wrack" and/or other biomass with mechanical strength properties and meeting the principles of sustainability and circular economy. <i>Tasks:</i></p> <ol style="list-style-type: none"> 1. Investigate the composition and amounts, seasonality and suitability of algae and/or biomass for the development of biocomposites; 2. Analyze energy-efficient technologies for the separation of suitable biomass; 3. To perform an analysis of biocomposite production technologies; 4. Conduct research on binding materials for the production of biocomposites; 5. To create a biocomposite material, to study its mechanical and environmental properties and application possibilities. <p>Keywords: Nanocellulose; Valorisation; Environmentally-friendly; Macroalgae; beach wrack; Biocomposites; Sustainability, Mechanical properties.</p>
Compliance of the topic with the goals and priorities of the KU strategic documents	<p>The topic fully corresponds to the university's strategic scientific direction "<i>Towards sustainable technologies, blue and green growth and a healthy sea</i>" priority: - <i>resource-saving technologies based on circular economy principles.</i> This topic envisages the development and research of advanced materials, taking into account the impact on the environment, ensuring product sustainability, functionality, safety, compliance with the circular economy and standards. In the proposed theme, a biocomposite material will be created from local marine or/and other bioresources. In order to create such a material, it is necessary to coordinate many different parameters, not only to create the material, but also to evaluate the energy consumption for its production, sufficient mechanical properties of the materials so that the created material has practical application. This project will explore various uses of lignocellulose at the macro and nano scales. The natural fiber/bioepoxy resin composite is one of the possible solutions to solve the issue of fiber/resin compatibility, which is quite actively researched by other scientists in the world. The main uncertainties related to the creation of biocomposites are the fact that the created biocomposite materials often do not have the necessary strength properties, are energetically inefficient and their use in practical activities becomes economically unprofitable. In these studies, research on nanocellulose from local biomass will be a central part of this project, both in terms of potential prospects, both in terms of production and utilization. In recent years, research on</p>

	nanocellulose from various materials has been quite frequent, due to the high potential strength (8 GPa), availability, non-toxicity and biocompatibility.
Intermediate and final results (publications, reports and etc.)	<ul style="list-style-type: none"> ✓ Scientific publications in CA WOS journals (Q1, Q2) are planned, depending on the obtained research results. ✓ In the second year of the internship, it is planned to present the research at a significant international conference abroad. (eg ICCM 2024:18. International Conference on Composite Materials, December 20-21, 2024.) ✓ It is expected to prepare a project application for receiving support from EU funds after the end of the research.
Requirements for a candidate	<ul style="list-style-type: none"> ✓ Have a PhD degree (T004, T009, T008) and ✓ Have publications confirming the intern's theoretical and/or practical basis for biocomposite production.
Existing research infrastructure and support from the projects	<ol style="list-style-type: none"> 1. Cooperation with Palanga's utility service 2. Available equipment: Chemical laboratory equipment (Department of Engineering 430 a.) Equipment for testing the mechanical properties of materials (MRI Mechanics and Marine Engineering Laboratory)
Supervisor	Supervisor: prof. dr. Olga Anne Consultans: prof. dr. J.Janutėnienė, dr. A.Tadžijėvas
Supervisors expertise in the proposed topic	<p>In recent years, the topic's supervisor has carried out research related to the issues of using algae, biomass/biowaste and specifically "beach wrack", research on lignocellulose, etc.</p> <p>The main publications related to the planned topic:</p> <ol style="list-style-type: none"> 1. Vincevica-Gaile, Zane; Sachpazidou, Varvara; Bisters, Valdis; Klavins, Maris; Anne, Olga... Burlakovs, Juris. Applying macroalgal biomass as an energy source: utility of the Baltic Sea beach wrack for thermochemical conversion // Sustainability, 2022, t. vol. 14, nr. iss. 21, art. no. 13712, p. 1 - 18, ISSN 2071-1050. doi:10.3390/su142113712. 2. Burlakovs, J; Vincevica-Gaile, Z; Bisters, V; Hogland, W; Kriipsalu, M; Zekker, I; Setyobudi, R.H; Y. Jani; Anne, Olga. Application of anaerobic digestion for biogas and methane production from fresh beach-cast biomass // EAGE GET 2022: 3rd EAGE Global Energy Transition Conference & Exhibition: November 7-9, 2022, Hague, 2022, t. vol. 2022, p. 1 - 5. doi:10.3997/2214-4609.202221028 3. Rudovica, Vita; Rotter, Ana; Gaudêncio, Susana P.; Novoveská, Lucie; Akgül, Füsün; Akslen-Hoel, Linn Kristin; Alexandrino, Diogo A.M.; Anne, Olga; ... Burlakovs, Juris. Valorization of marine waste: use of industrial by-products and beach wrack towards the production of high added-value products // Frontiers in marine science. Lausanne : Frontiers Media S.A. eISSN 2296-7745. 2021, vol. 8, art. no. 723333, p. 1-39. DOI: 10.3389/fmars.2021.723333. 4. Ahrens, Thorsten; Drescher-Hartung, Silvia; Anne, Olga. Sustainability of future bioenergy production // Waste management. Oxford : Elsevier. ISSN 0956-053X. 2017, vol. 67, p. 1-2. DOI: 10.1016/j.wasman.2017.07.046. 5. Ahrens, Thorsten; Drescher-Hartung, Silvia; Anne, Olga. Sustainability of the biowaste utilization for energy production // Biomass volume estimation and valorization for energy. Rijeka : InTech, 2017. ISBN 9789535129370. eISBN 9789535141099. p. 165-185. DOI: 10.5772/65825

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