



POLISH NATIONAL AGENCY
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PROGRAMME

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head of the unit: Prof. Krzysztof Strzelec, Ph.D., D.Sc.	potential promoters: Prof. Krzysztof Strzelec Marcin Masłowski Ph.D. Justyna Miedzianowska Ph.D.	contact person: Marcin Masłowski Ph.D. tel: 48-42-6313211 marcin.maslowski@p.lodz.pl
scope of activities: Polymer composites are one of the most important material groups that are of great interest both in terms of experimental research and the possibility of their applications. Composites and additives obtained from renewable raw materials constitute their special branch. Focusing on modern and ecological technologies, it is important to emphasize the important role played by substances of plant origin. Their high application potential allows for obtaining materials with unique properties that often exceed those of their synthetic counterparts. The conducted research concerns the knowledge, research and explanation of the effectiveness of plant materials as a source of active functional compounds for the modification of polymer composites. Moreover, they are intended to provide information on the characteristics of successively separated products from selected plants in the form of biomass, extracts or phyto-ashes.		graphic material <p>The diagram illustrates the process of plant material processing. It starts with 'Plant material' (represented by leaves, wheat, and a pine tree). This material is processed into three main components: 'Biomass' (represented by a pile of brown material), 'Extract' (represented by a green liquid in a beaker), and 'Phyto-ashes' (represented by a pile of grey material). These three components are then combined to form 'Polym' (represented by a brown material). Finally, the 'Polym' is used to create 'Polymer biocomposites' (represented by a stack of yellow and black sheets).</p>
present activities: The work is based on the use of bioadditives in the form of plant biomass, natural extracts and phyto-ashes obtained, among others, from horsetail, cereal straw, nettle, chamomile, yarrow and elderberry. <ul style="list-style-type: none">• Mechanical modification of selected plants and their division into fractions. Incorporation of plant material as a fibrous filler in elastomeric mixtures. Assessment of biomass activity as a modifier of biocomposites.• Solvent extraction of selected plants. Isolation of active compounds contained in plant material. Characteristics of extracts, their lyophilization and their use as compounds for anti-aging and microbiological protection of polymers.• Obtaining phyto-ashes by the two-stage method with the applied hydrolysis process and high-temperature thermal treatment. Checking the activity of the obtained bio-additive as a filler for polymer composites.• Hybridization of individual bio-additives obtained as a result of the implementation of earlier research stages.		
Future activities: Further development of the conducted research topics consisting in learning, testing and explaining the effectiveness of selected plants as a source of active functional compounds for the modification of polymer composites.		
Keywords: biocomposites; elastomers; biofillers; natural fibers; plant extracts; phyto-ashes; biomass; physical and chemical modifications		
List of internship proposal in this research team: Further development of the conducted research topics consisting in learning, testing and explaining the effectiveness of selected plants as a source of active functional compounds for the modification of polymer composites.		
List of attachments: <i>Selected scientific publications:</i> <ul style="list-style-type: none">• Masłowski, M. ; Alekseyev, A. ; Miedzianowska, J. ; Strzelec, K. Potential Application of Peppermint (<i>Mentha piperita</i> L.), German Chamomile (<i>Matricaria chamomilla</i> L.) and Yarrow (<i>Achillea millefolium</i> L.) as Active Fillers in Natural Rubber Biocomposites. <i>Int. J. Mol. Sci.</i> 2021, 22, 7530, doi:10.3390/ijms22147530.		



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- Masłowski, M. ; Miedzianowska, J. ; Delekta, M. ; Czyłkowska, A. ; Strzelec, K. Natural rubber biocomposites filled with phytoashes rich in biogenic silica obtained from wheat straw and field horsetail. *Polymers (Basel)*. 2021, 13, 7711, doi:10.3390/polym13071177.
- Miedzianowska, J. ; Masłowski, M. ; Rybiński, P. ; Strzelec, K. Straw/Nano-Additive Hybrids as Functional Fillers for Natural Rubber Biocomposites. *Materials (Basel)*. 2021, 14, 321, doi:10.3390/ma14020321.

Research projects:

- Research on the effects of cereal straw modification methods in reducing the flammability of elastomer composites, National Science Center, *Preludium 16*, (2018/31/N/ST8/00802).
- Field horsetail (*Equisteum arvense*) as a source of active functional compounds for the modification of elastomeric biocomposites, National Science Center, *Miniatura 3*, (2019/03/X/ST5/00512).