

The project deals with issues related to flame retardancy of elastomeric bio-composites containing cereal straw. The aim of the project is to learn, study and explain the relationship between cereal straw and its fireproof additives in the development of polymeric materials. It will be important to get answers to the following research questions:

- How do modifications affect structural changes, morphology resulting from the combination of cereal straw powder with environmentally friendly flame retardants?
- How to combine additives so that their effectiveness in limiting flammability was as high as possible?
- What is the impact of cereal straw modification on compatibility, interactions and properties in an elastomeric medium?
- How does the architecture and dispersion of additives used influence the tested properties?
- Is there a synergy effect between the additives used?
- What processes/phenomena are responsible for interactions occurring between components?
- What is the impact of modification of cereal straw with selected silane and antipirens on compatibility, interactions and properties in the elastomeric medium?

The works will include the production of new materials containing natural rubber and cereal straw. As part of the project, treatments will be carried out to reduce the flammability of biocomposites. The work will include:

- modifications of cereal straw with silanes containing various functional groups
- addition to elastomers, straw homogenized with environmentally friendly halogen-free retardants, which will be nanoadditives in the form of montmorillonite, halloysite tubes, carbon black and silica.
- interaction of silanized straw with nanoadditives

The project will carry out work including the characteristics of new, modified materials that will combine the specific properties of the precursors used. Effectiveness of the carried out modifications to fire protection will be examined. The thermogravimetry techniques, conical calorimetry, as well as the oxygen index determination method, will be used to study flammability and thermal stability of composites and fillers. Structural and morphological-dispersion properties of new systems will be determined by other spectroscopic and microscopic methods. The intermolecular interactions at the interface between the modified straw and elastomer molecules will be characterized on the basis of dynamical-mechanical analysis. What is more, the spatial structure, mechanical, barrier and rheometric properties of elastomeric compositions will be analyzed.

The subject of the project is closely related to an interesting and current research direction regarding a broadly understood, interdisciplinary field of knowledge, which includes functionalized, hybrid materials and biocomposites. Elastomer composites made of natural rubber filled with cereal straw in the form of finely ground powder constitute a new scientifically unrecognized material. Straw as a by-product of crop production is a valuable source of lignocellulosic material. However, it is not resistant to fire. According to literature reports, in order to minimize the negative properties of natural materials, an increased tendency to smoke should be prevented. The reason for undertaking research in this area was the desire to acquire knowledge that can contribute to better recognition and understanding of the impact of modification of straw particles on the specific properties of elastomeric composites. The research will allow to formulate guidelines for further work on the preparation of materials with reduced flammability.