Polymer materials are widely used in various industries. Polymers are characterized by low processing costs, ease of moulding, and common availability. Unfortunately, the majority of currently used polymers are non-biodegradable, which poses a serious threat to the environment. The packaging industry is one of the main "consumers" of these materials. The subject of the project is a challenge based on the implementation of low-cost and eco-friendly materials which could replace non-biodegradable ones.

The mechanical properties of biodegradable materials are worse than non-biodegradable ones. Biocomposite manufacturing solves mentioned problem. Hence, the purpose of the project concerns the development of fully biodegradable composites reinforced with flax fibres. Plant fibres have some undoubted advantages such as low price and weight, biodegradability in the environment, and renewability. The hydrophilic properties of flax fibres hinder their application in the packaging industry, where materials are in direct contact with food. In the packaging industry, where moisture resistance and microbiological hygiene are extremely important, strict requirements are imposed on packaging materials. Packaging materials must exhibit increased hydrophobicity and inhibit the growth of microorganisms present on their surface.

To affect these properties of the biocomposites, the modification of the flax fibres will be done. Plant-derived compounds will be applied as sustainable modifiers for flax fibres. The evaluation of the influence of various concentrations of plant agents on selected properties of biocomposites, such as biocidal activity, hydrophobicity, and mechanical resistance is the subject of this project. The selection of the following biocidal agents: geraniol, trans-cinnamic acid, trans-ferulic acid, naringenin, and eugenol was based on the literature analysis. Preliminary research has shown that application of the plant-derived modifier (geraniol) had a positive effect on the biocidal properties of biocomposites and increased their hydrophobicity while preserving the mechanical properties. Based on the mentioned research results, the following project hypotheses were formulated:

1. The application of plant-derived modifiers will enable the development of eco-friendly biocomposites with improved biocidal and hydrophobic properties.
2. Plant-based modification will not have a negative impact on the mechanical properties of biocomposites.
3. Biocomposites containing modified fibres will exhibit increased resistance to aging due to the antioxidant properties of the agents applied.
4. The application of plant-derived agents will enable the effective replacement of widely used toxic disinfectants.

Additionally, materials with biocidal and increased hydrophobic properties are known for higher durability. Due to their resistance to bacteria and moisture, their life time is elongated which results in economic benefits. Elimination of toxic and non-ecological modifiers will support the natural environment and promote the development of sustainable materials that have a positive impact on human health. Due to their innovativeness, the research results obtained within this project will have a significant impact on the development of materials engineering, especially natural fibre-reinforced biocomposites. Furthermore, the biocidal properties and increased hydrophobicity of biocomposites make them potentially applicable in the packaging industry.