The paradigm of traditional solutions for obtaining biomaterials is currently extremely dynamic and in the last few years has undergone major revolutions. This is due to the development of numerous fields such as materials engineering, nanotechnology, additive technologies, and biotechnology, all of which are significantly changing the understanding of modern medicine. Not only is the method of manufacturing functional biomaterials changing but also the range and availability of materials that can be used for this purpose is expanding. Much attention in this context is being paid to raw materials of natural origin, including raw materials derived from renewable energy sources, or raw materials that are superfluous intermediates/products of widely used reactions. An interesting group of materials are polyesters of bacterial origin – polyhydroxyalkanoates (PHAs), which for years have offered a wide range of applications, including the manufacture of everyday objects, medical devices, pharmacology, and many others. This project proposes the use of chemical recycling to expand the applicability of polyhydroxyalkanoates and their depolymerization products for the preparation of novel (meth)acrylate-PHA monomers and, based on them, bioresins for the production of biomaterials by 3D printing.

The aim of the project ***„Curable biomonomers based on bacterial polyhydroxyalkanoates as a novel bioresin base for potential use in 3D printing"*** is to **obtain mono- and multifunctional monomers from bacterial polyhydroxyalkanoates as a base for reactive bioresins for the preparation of functional biomaterials through polymerization, including 3D printing**.
The implementation of this objective consists of 5 research tasks:

TASK 1: Synthesis of mono- and multifunctional (meth)acrylate monomers from bacterial polyhydroxyalkanoates (PHAs);
TASK 2: Physicochemical characterization, biological studies and determination of reactivity of synthesized (meth)acrylates obtained from bacterial PHAs;
TASK 3: Development of reactive bioresins based on monomers from bacterial PHAs;
TASK 4: Comprehensive studies of the properties of developed bioresins and polymers obtained from these bioresins;
TASK 5: Utility studies of developed resins based on monomers from bacterial PHAs.

The proposed research project is a response to an identified research gap that is the lack of solutions for the use of biopolymers of natural origin – bacterial polyhydroxyalkinates (PHAs) and their depolymerization products for their functionalization and further applications in polymerization processes, including for obtaining biomaterials by 3D printing (EBB/SLA/DLP). The project has an interdisciplinary character and will undoubtedly influence the development of disciplines such as: organic chemistry, polymer chemistry, materials engineering and certain medical aspects. Moreover, the implementation of the proposed research contributes to the theoretical and experimental basis for expanding the knowledge of the synthesis of reactive methacrylate and acrylate monomers derived from bacterial polyhydroxyalkanoates. Ensuring appropriate water solubility of the reactive monomers may be key to the broader use of this group of materials in biomedical applications. In addition, a detailed study of the properties of the resulting monomers and the starting biopolyesters, including their bio-properties, and linking them to the structures and synthesis pathway has not been studied before and will be groundbreaking not only for this topic, but also for related modifications of other natural polymers. In addition, the developed PHA-monomers will be used to develop novel bioresins for the manufacture of biomaterials using 3D printing techniques, which will certainly be a significant added value for fields such as biomaterials engineering and bioprinting. Finally, the implementation of the project will enable the introduction of a new closed-loop cycle concept for polyhydroxyalkanoates.