Nowadays, we cannot imagine daily life without a mobile phone, a notebook, a tablet or a camera. Often, we do not realize that these devices, or rather that what leads them to action, have a negative impact on the environment. Each of these devices need energy to work, which it is collected and stored in small and larger energy sources called "batteries"- which become waste after some time. The energy storage devices often contain environmentally unfriendly metals, electrolytes and other materials not indifferent for environment. Thus, there has been a growing need to produce environmentally friendly products in recent years. Many companies all over the world are strongly involved in the idea of manufacturing products environmentally friendly in the three aspects of its protection: prevention of global warming, efficient use of natural resources and the management of chemical waste. This can be realized through the increase in production devices with the highest energy efficiency and the use of natural materials. One of such material may be natural polymers such as: cellulose, chitin, starch or proteins. The interest in this group of compounds has been growing from year to year. This is due to the increase of social consciousness, concerning the environmental protection and the easy access and low price of these materials. Also, development of modern research methods and tools that enable research microstructure natural materials is very important. It is crucial to understand the relationship between their structure and properties, origin and processing methods. The acquisition of this knowledge greatly increases the possibility of use and development of natural materials for new applications.

The aim of this project is to develop a new generation composites based on chitosan and chitin with specific electrochemical properties. These specific properties should be possessed by materials for energy conversion and storage devices.

The research aim consists of two main aspects. The first concerns the preparation and modification of composite materials based on chitosan/chitin in several different morphological structures such as membranes, hydrogels or gel polymer electrolytes. These composites are going to be prepared from biomaterials with different degrees of deacetylation. Then, the structural, physicochemical and electrochemical characteristics of biopolymer composites in different environments (organic, mainly ionic liquids as an aqueous medium) will be performed. The second aspect concerns the preparation of electrode composites with preselected biopolymer composites, using electrode materials such as: activated carbon, graphite or spinel. The selection of electrode materials is associated with a test of measuring cells (electrochemical system, in which the electrochemical characteristics is planned to be performed).

In these studies, a variety of analyzes will be performed, in order to explore the basic physicochemical and electrochemical properties of the obtained composite materials (biomembran, bioelektrolitów polymer and biocomposites electrode) using spectroscopic methods, e.g. Fourier Transform Infrared Spectroscopy (FTIR) or Attenuated Total Reflectance (ATR) as a method complementary to FTIR , Raman Spectroscopy, X-Ray Photoelectron Spectroscopy (XPS) X-ray X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM), Differential Scanning Calorimetry (DSC). The Electrochemical techniques, which will be applied, are cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS) , chronoamperometric and potentiostatic methods.

The basic aspect of this project is due to constant efforts to reduce costs and negative impact on environment of everyday devices, by applying to their preparation cheap, biodegradable natural materials. The cost of basic research conducted in this area, although often high, is incomparably low in relation to the huge costs associated with utilization of this problematic waste in the context of environmental protection. Use of chitosan as one of the many derivatives of chitin, which is second only to cellulose waste product, seems to be justified. As well as, ease to modify chitosan and its ability to create different structural forms is very significant.