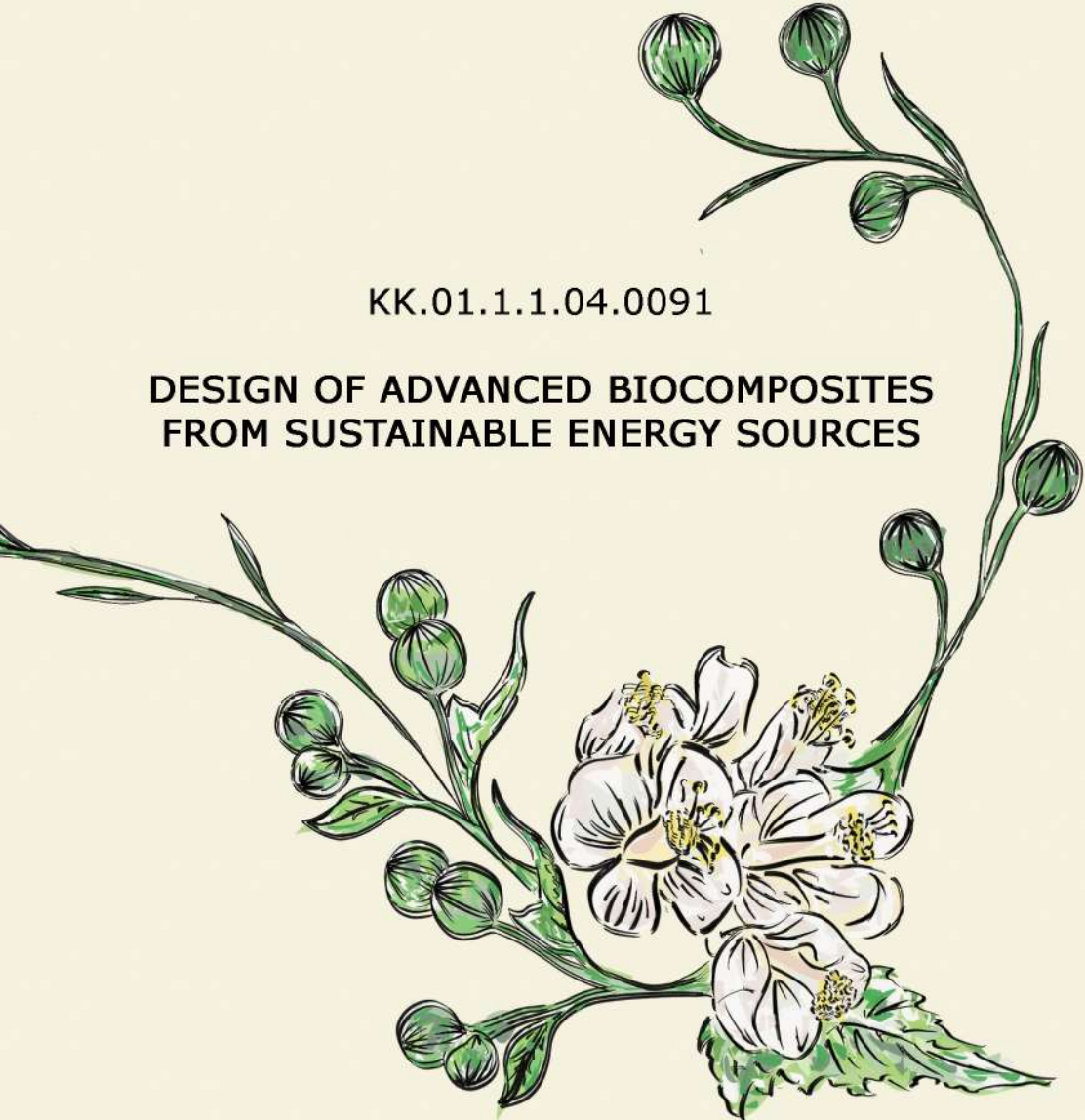




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**DESIGN OF ADVANCED BIOCOMPOSITES
FROM SUSTAINABLE ENERGY SOURCES**



According to The European Green Deal, which requires climate neutrality in Europe by 2050, the Action Plan for the Circular Economy was revised, and a new version was adopted in 2020. It emphasizes a production and consumption model that enables the extension of the end of life of existing materials and products, and at the same time reduces the amount of waste. To achieve this, it is necessary to interact and cooperate with different economic sectors, maximizing the effective exploitation of existing raw materials, and whenever possible to substitute fossil-based products. One of such pathways is the production of bio-composite materials made from a biopolymer matrix reinforced with lignocellulosic fibers extracted from biomass.

2nd GENERATION OF BIOMASS

In this project, emphasis is on the use of fibers from lignocellulosic biomass extracted from agricultural residues of energy and wild crops. Figure 1 shows classification of fibers due to their origin.

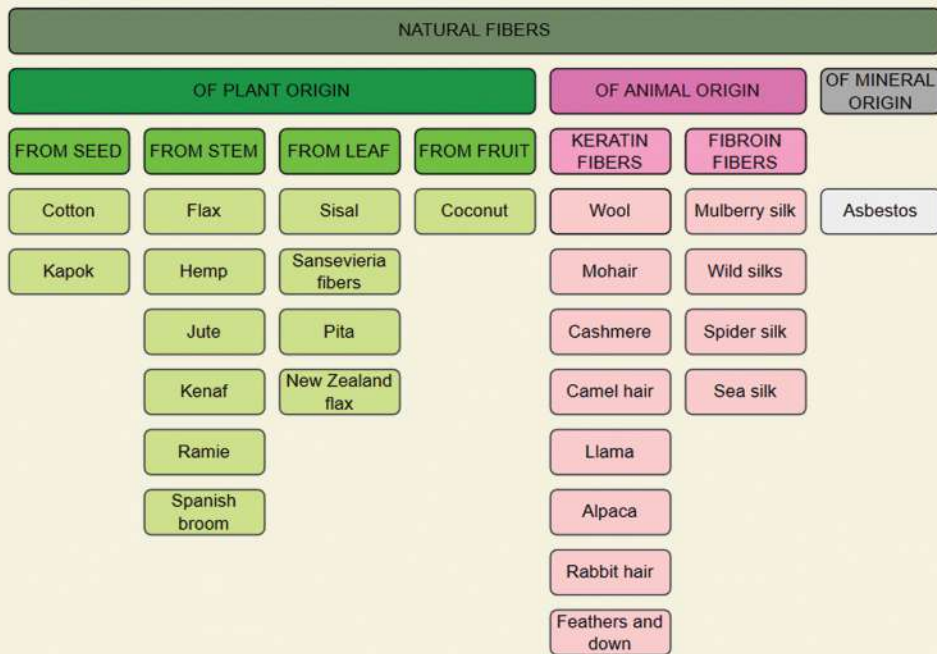


Figure 1: Classification of natural fibers according to EU 1007/2011 regulation (fibers of Spanish broom are already a part of this classification, categorised as fibers from stem). In the near future, it is assumed that the fibers of Virginia mallow will be classified in the same category. Fibers extracted from giant reed and giant Miscanthus are assumed to fall into a new category of grasses and reeds.

BIOCOMPOSITES PRODUCTION

With selected cultures, it is possible to use the entire plant, without any waste. The flowers of Spanish Broom and Virginia Mallow can be used in pharmaceutical and/or food industry and are not in the research focus of this project. The stems of four selected crops were applied as feedstock for the extraction of fibers. Long fibers were produced from the stems of Spanish Broom and Virginia Mallow, and short fibers in the form of pulp from Giant Miscanthus and Reed. The waste, after extracting the valuable raw material - biofiber, becomes a secondary raw material for green energy production, which gives the project additional economic significance.

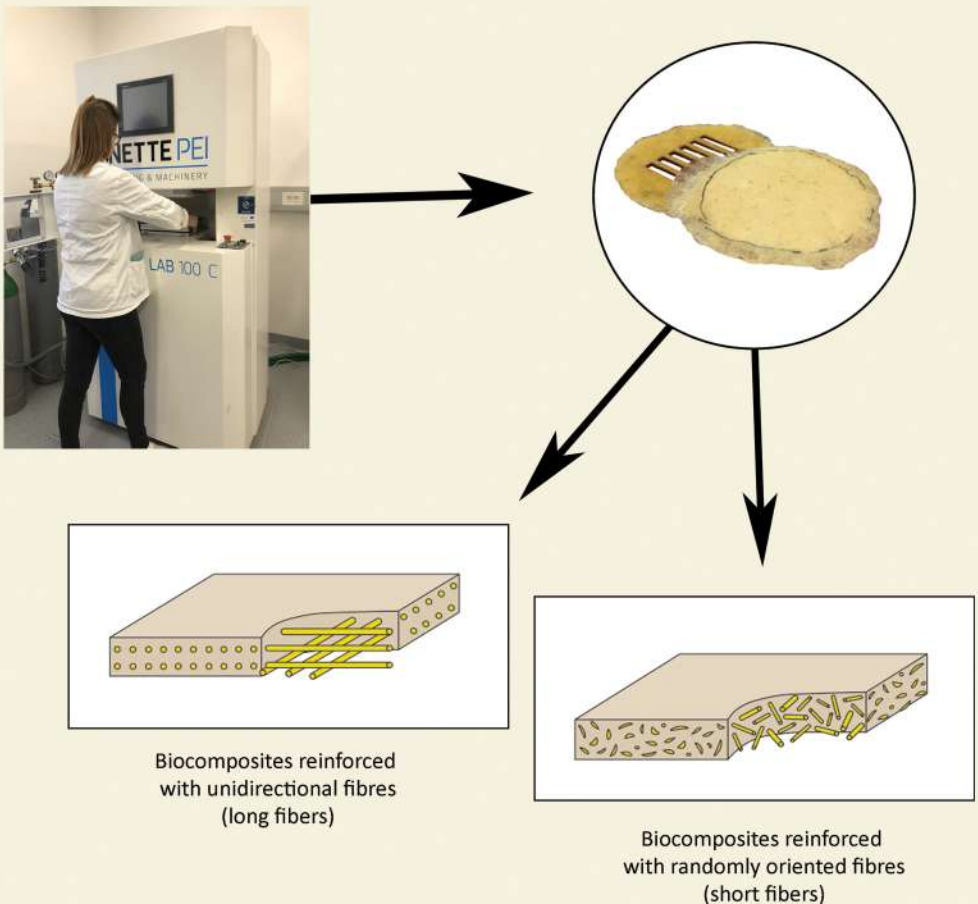


Figure 2: Scheme of biocomposites production

BIOFUELS PRODUCTION

Second generation bioethanol includes biomass that is not used in human and animal nutrition.

The process of bioethanol production from lignocellulosic biomass consists of delignification (removal of lignin by a chemical process) to free cellulose and hemicellulose, then depolymerization (separation of polymers into polymers of lower relative molecular weight) of carbohydrate polymers, to free sugars and fermentation of a mixture of hexose and pentose to bioethanol.

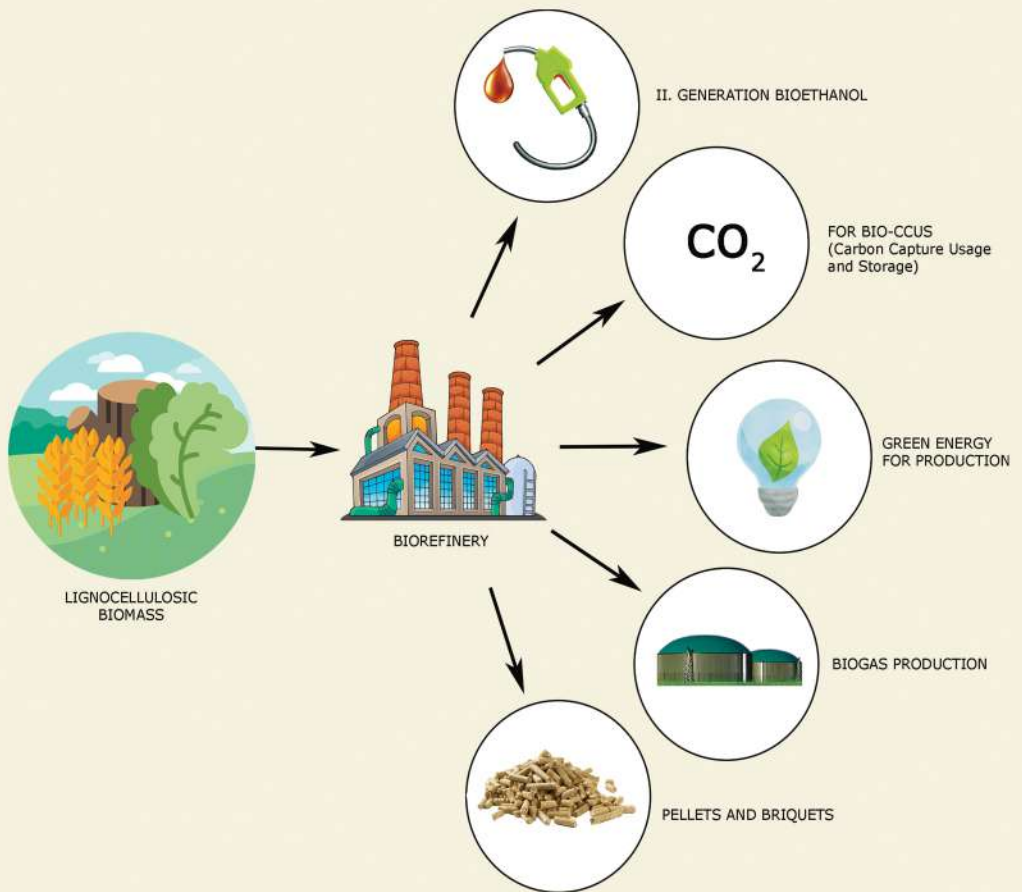
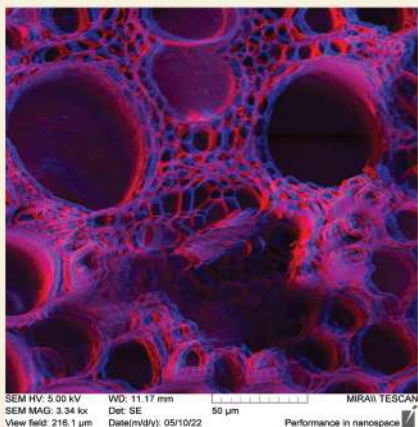
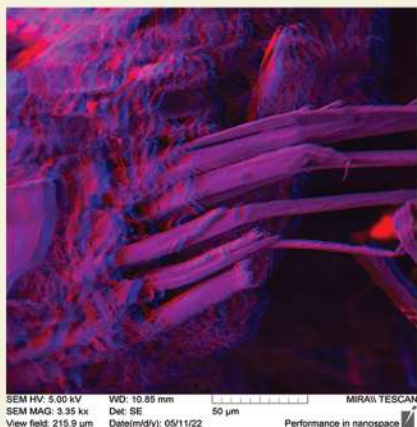


Figure 3: Production scheme of 2nd generation bioethanol from lignocellulosic feedstock

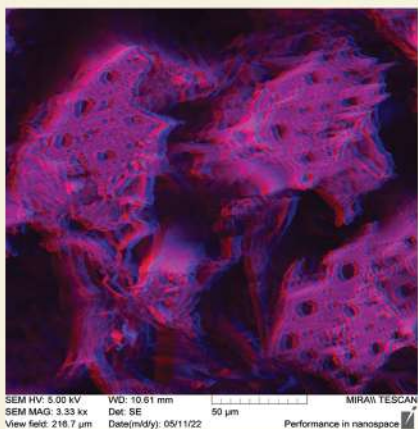


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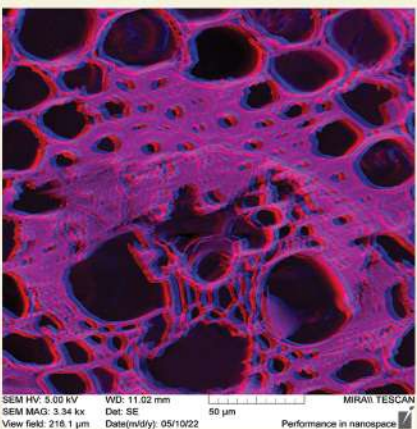


Spartium junceum L.

Project Design of advanced biocomposites from sustainable energy sources: **BIOCOMPOSITES**, is addressing eco-design and manufacture of advanced biocomposite materials with improved properties for a wide range of applications. Sustainable raw materials are completely utilized, due to the scheme where waste from the textile-fibers production is further utilized for the biofuels production. Project is generating 4 patents, and the first one P20230330A: Biogas production process, based on development and application of new technological solutions is already pended at Republic of Croatia State Intellectual Property Office. Innovations and developed technologies will be transferred to the scientific and business society fully respecting the principles of resource efficiency and the circular economy.



Sida hermaphrodita L.



Miscanthus x giganteus

COORDINATOR

University of Zagreb Faculty of Textile Technology

PARTNERSHIP

University of Zagreb Faculty of Agriculture

INTERMEDIARIES

Central finance and contracting agency (CFCA) - **LEVEL 1**
Republic of Croatia, Ministry of Science and Education - **LEVEL 2**

LOCATION

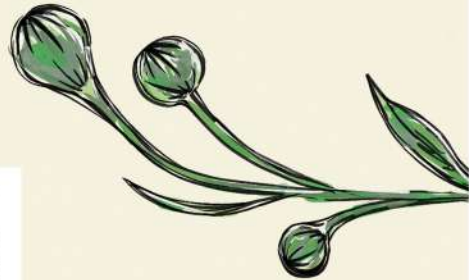
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