BIOproducts from lignocellulosic biomass derived from MArginal land to fill the Gap In Current national bioeconomy

BIOmagic

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PRESENTATION PLAN

- Introduction
- Project Consortium
- General concept of the project
- Work Packages with short description
- Conclusions
The biobased economy needs sustainable supply of biomass for bioproduct generation and multiple uses.

In this concept, no biomass should be used for energy generation unless other options have been considered of using it to produce higher value added products.
Perennial Industrial Crops (PIC) grown on marginal lands can become an important source of biomass in Poland.

It is estimated that **marginal land in Poland covers over 2 million ha** of agricultural land. In addition, it may be possible to grow PIC on post-industrial lands, fallow lands with natural plant cover.

PIC include non-food and non-feed crops and generate agricultural products that can be categorized as commodity and/or the raw material for industrial goods rather than feed and food products for direct human consumption.

The concept of cultivating PIC for non-food (and/or non-feed) uses is not new but, despite considerable investment in research and development, **little progress has been made** with regard to the introduction of such products into the commercial marketplace.
When developing **production of bioproducts in agriculture**, it is important to avoid land-use competition with production of food and feed.

In order to ensure food security and quality of food, **most productive agricultural lands must be saved** for food crop production.

Therefore, for initiating sustainable production of bioproducts it is well justified to **promote efficient crops that can grow on marginal lands**.

Thus, **BIOmagic Project** inscribes itself into the European and global trend of **sustainable and cascade-like use of PIC biomass harvested from marginal land**.
Project Consortium

1. University of Warmia and Mazury in Olsztyn (UWM) – Univ
2. ChemProf s.c. (CP) – SME
3. Quercus Sp. z o.o. (Qs) – SME
4. New Chemical Syntheses Institute – Łukasiewicz Research Network (INS) – RI
5. Institute of Soil Science and Plant Cultivation – State Research Institute (IUNG) – RI
6. Institute of Technology and Life Sciences (ITP) – RI
7. Medical University in Lublin (UMLUB) – Univ
Project Consortium

Project duration:
01.12.2017 – 31.11.2021
BIOmagic aims to design a penetration path of PIC into Polish agriculture producing feedstocks on marginal land for bioproducts to feed national bioeconomy.

Sustainable production of PIC lignocellulose biomass on marginal land and generation of bioproducts as an element of the development of the national bioeconomy.

source: the authors
The main aim of the BIOmagic project is to generate a bioproduct / bioproducts containing bioactive substances from lignocellulosic biomass produced by PIC grown on marginal land.
WP1 - Identification and potential of marginal land for PIC biomass production in Poland

- **WP1 (IUNG, ITP)**
- The major goal of this task is to identify the spatial distribution of the potential for PIC biomass production on marginal land in Poland.
- Another aim is to evaluate the influence of climate change on the possibility of using marginal land in the time horizon until 2090.

Source: Pudelko et al. 2019

Source: Stolarski et al. 2019
The objective of this task is to evaluate factors which affect the productivity and thermophysical and chemical properties of biomass of 11 PIC species, generating biomass in the form of wood, semiwood and straw, in the context of sustainable biomass production. Elaboration of optimal PIC cultivation technologies on marginal land, and delivery of biomass, satisfying the quality requirements, to the project’s partners.
The major goal is to evaluate technical possibilities of obtaining PIC biomass and elaborating its logistics depending on the quality requirements of producers of extracts and biopoducts.

To develop a technology for separation of bark from wood so as to ensure the suitable quality of substrates for further processing.
WP4 (ITP, IUNG)

The aim of this task is to identify the demand of PIC for water and nutrients. The elaboration of a water and nutrients balance in PIC cultivation.

The elaboration of recommendations (guidelines) for water and nutrients management in PIC cultivation on marginal land.

source: Paszkiewicz-Jasińska et al. 2019

source: Strzelczyk et al. 2018
The goal of this task is to:

- determine the usability of biomass originating from perennial industrial plants in terms of its content and activity of bioactive substances;
- perform extractions of selected raw materials using supercritical extraction methods;
- prepare adequate quantities of extracts for further studies by the consortium partners.

**Lignocellulosic biomass**

**Supercritical extraction**

**Extracts**

source: UWM

source: INS

source: INS
WP6 - Use of extraction products for pharmaceutical and veterinary purposes

- WP6 (UMLUB)

The major goal of this task is determination of possibilities of using standardized plant extracts for pharmaceutical and veterinary medicine purposes.

source: Grzegorczyk et al. 2019

source: Grzegorczyk et al. 2019

source: Sobczyński et al. 2019
WP7 - Biotechnology of extracts and raffinates for food and feed purposes

- WP7 (UWM, CP)

The major goal of this task is to evaluate selected extracts and raffinates and to develop a concept for their biotechnological use (biorefinery, production of food and/or dietary supplements, animal feeds).

Source: Walter et al. 2019

Source: Ostolski et al. 2019
WP8 - Management of post-extraction biomass and other processing residues

WP8 (UWM, IUNG, INS)

The major goal of this task is to balance the energy potential of post-extraction biomass and other processing residues in the context of alternative processing pathways to generation: solid biofuels, biocarbon, 2nd generation bioethanol, gaseous product.

source: Radawiec et al. 2018

source: Stolarski et al. 2019
WP9 - Technique and technology of semi-technical production of bioproducts

WP9 (CP)

The aim of WP9 is to implement a production technology on a semi-technical scale of at least one bioproduct which will serve as an ingredient of:

- food and/or feeds,
- and/or pharmaceuticals,
- and/or veterinary medical products,
- and/or supplements.

This WP has just started so there are no results yet.
The objective of this task is to deliver a multi-criterial assessment of the sustainable production of selected chains generating bioproducts, including life cycle assessment in the context of the natural environment, economics and energy as well as social factors and the development of rural areas.

![System boundary diagram](source: Krzyżaniak et al. 2018)

![Graphical representation](source: Olba-Zięty et al. 2020)
WP11 - Preparations for the implementation

- WP11 \((CP, Qs)\)

- The aim of this task is to prepare the technical documentation necessary to implement the production process of at least one bioproduct.

- Another objective is to evaluate the market demand for new bioproducts and for the service of producing high quality bark as substrate for companies which extract this raw material and produce bioactive substances.

- *This WP will start in 2021.*
Conclusions

Current situation:
- PIC cultivation is seen as competition (occupying good quality land) for food and feed crops;
- The use of PIC biomass is one-way, mainly as a raw material for energy production;
- Information about the PIC production potential and the possibilities of using biomass are dispersed and ambiguous, and their cultivation is not attractive.

- **BIOmagic** it is:
  - The bridge between PIC production on marginal land and the industrial use of lignocellulosic biomass.
  - Many types of non-food biomass (11 plant species) and integration of the entire production and logistics chain.
  - Supercritical extraction and many extracts, bioactive substances and bioproducts that can be used in industry, e.g. pharmaceutical, cosmetics, chemical, food, feed, energy.
  - A new and strategic approach to the acquisition and cascade use of PIC lignocellulosic biomass, first as raw material for the production of extracts and bioproducts, and second production residues for energy purposes.
  - Modern development of research institutions, companies and a step forward towards meeting the R&D goals pursued in the EU and globally in the field of bioeconomy.
References


THANK YOU FOR YOUR ATTENTION

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