BIOREGIO PROJECT: Good practices for biological streams in Castilla-La Mancha

Silvia Nieto Sevillano- Jose Luis Suárez Vicente - María Caberta de la Cruz
Deputy Ministry of the Environment
PROYECTO BIOREGIO www.interregeurope.eu/bioregio/ **Junta de Comunidades de Castilla-La Mancha**
www.castillalamancha.es

Ilustración: Oona Rouhiainen

Bioeconomy is a term which includes the set of activities that obtain products and services, generating economic activity by using biological resources as raw material. The production of these products comes with it the generation of a large amount of waste. Such production is presented as an opportunity under the framework of the circular economy which pursues the efficiency of sustainable resources. (*Spanish Bioeconomy Strategy: Horizon 2030)*

Due to the fact that bioeconomy is an integral part of the new economic and social paradigm of the circular economy, the **BIOREGIO project** has been developed to encourage changes in regional policies in favour of the promotion of the circular economy of biological resources. This initiative, led by the Lathi University of Applied Sciences (Finland) and framed within the Interreg Europe program, focuses its actions through the identification and exchange of good regional practices of cooperation models and techniques available among its eight European partners.

GOOD PRACTICES DEFINITION

The concept of best practice refers to an experience implemented with positive results, effective and useful in a specific context. Based on this premise, the project partners agreed on the criteria and definition of good practices in the frame of BIOREGIO project.

Therefore, each BIOREGIO good practice is characterized by its excellence and fulfilment of the following criteria:

1. **Promotes circular economy.**
2. It is **related to biological materials**, in other words, products are composed of substances originally derived from existing compounds in nature.
3. **Promotes social and environmental sustainability**, as well as economic growth
4. It is resource **efficient and economically feasible.**
5. **Minimizes waste** directly or indirectly according to waste hierarchy whose objective is to maximize the benefits of the products, whereas the generation of waste is reduced.
6. **Encourages closing the loops and emphasizing longer cycles/cascades.**
7. Includes **joint actions** (discussions/cooperation/business) between different stakeholders: RDI, government, companies and consumers.
8. It is most likely **transferable and scalable** in different European regions in line with the objectives of the Interreg Europe program.

In order to disseminate them actively to the rest of the European Union regions and facilitate their replication, all of them are reported through the learning platform enabled by the Interreg Europe program (https://www.interregeurope.eu/policylearning/).

Partners of BIOREGIO project

CASTILLA-LA MANCHA GOOD PRACTICES

Based on the definition and the criteria assigned to the good practices of the BIOREGIO project, the Deputy Ministry of the Environment with its stakeholders has identified the following good practices in the region:

1. CLAMBER: The commitment of the Government of Castilla-La Mancha to the Bioeconomy

The Regional Government of Castilla-La Mancha developed the project "Castilla-La Mancha Bio-Economy Region" (CLAMBER) through the Agri-Food and Forest Research and Development Regional Institute of CLM. The project´s aim is to make this region the benchmark in the south of Europe within the research related to the use of biomass, given

that it is a large producer of it. It involves a total investment of €16.1 million with ERDF co-financing through the MINECO of 80%. The development results of this project were:

- An acquisition of knowledge through Pre-commercial Public Procurement for the realization of R&D projects with the objective of recovering organic agri-food, livestock, municipal waste, etc., generated in CLM.
- And the construction of a biorefinery on a demonstrative scale: The CLAMBER R&D Biorefinery.

It is the first technologically advanced biorefinery at a demonstration scale in Spain, designed and built so that those companies or organizations that have developed at laboratory scale a novel bioprocess for the valorization of biodegradable wet biomass (slurry, whey, WWTP sludge, slaughterhouse wastes, etc.) or lignocellulosic biomass (vine shoots, olive branch, pruning remains, residual straw, etc.) can perform scale-up experiments at a size very close to industrial to determine their technical and economic viability, as well as to optimize the operating parameters for the subsequent design and construction of the industrial plant.

In short, CLAMBER offers an important minimization of the times and costs necessary to develop an idea industrially, giving a boost to competitiveness and the creation of new business opportunities based on innovation.

Picture 1. Explosion steam reactor

2. UNIVERSIDAD DE ALCALÁ: Recovery of agroforestry wastes by pyrolysis with microwaves

In recent years, the Chair of the Environment of the University of Alcalá has focused its activity on the recovery of forest residues, in order to advance in solutions heading for the development of a circular economy, reducing the use of resources, waste production and favoring sustainable forestry.

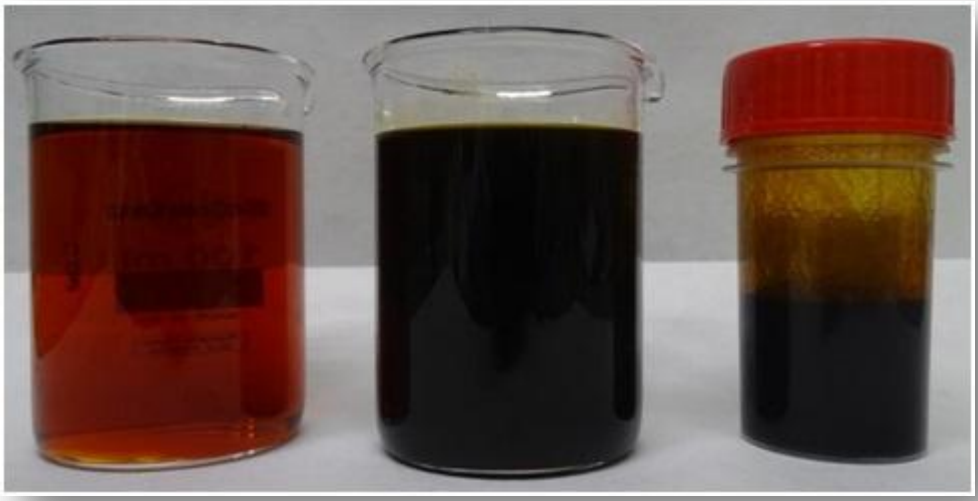
In this sense, agroforestry waste is postulated as a renewable energy source for the production of high added value bioproducts. Obtaining these compounds is carried out by thermochemical processes such as microwave pyrolysis. This process consists of the thermal degradation of biomass in an inert atmosphere, giving rise to a phase composed of hydrocarbons, a gas phase formed mainly by non-condensable gases, and a solid fraction, biochar.

Biochar is a porous material with a high carbon content. Besides being considered as a permanent carbon store, it is used as fertilizer to improve the physical and chemical properties of soil. Moreover, it can be used as a precursor of activated carbon.

The liquid fraction is composed of three phases. The aqueous phase or wood vinegar, with 80-85% water and more than 200 organic compounds, is currently being tested as a herbicide. This application is of great interest, especially since the qualification of glyphosate as "probably carcinogenic to humans" in March 2015 by the International Agency for Research on Cancer (IARC).

The light organic fraction or bio-oil is mainly composed of light hydrocarbons and can be used as fuel, while the heavy organic fraction or bio-bio is composed of hydrocarbons of high molecular weight which is mostly used for the preparation of asphalt mixtures.

Finally, the gaseous fraction, also called synthesis gas, has a high calorific value (15-30 MJ / Nm3). Therefore, it can be used in the process to heat the pyrolysis reactor, making the process even more efficient from an energy point of view.



Picture 2. Left to right: Wood Vinegar, Bio-oil and Bio-betún

3. CHAMPINTER: Mushrooms, ideal partners to create a circular economy

The function of fungi in the life cycle of the biosphere is of great relevance, owing to them being one of the main agents responsible for the transformation of dead organic matter into other substances usable by other living organisms. Lacking chlorophyll, the fungi secrete enzymes capable of breaking down the cellulose structures of the generated plant detritus. The cooperative company 'Champinter', located in Villamalea (Albacete), has been able to take advantage of this process to generate an economic and environmental benefit; while integrating it as its production engine.

Although there are more than 1,500,000 species of known mushrooms, only about 40 can be grown and only 20 can be grown industrially. *Agaricus bisporus*, *Pleurotus ostreatus*, *Lentinus edodes*, *Flamulina velutipes, Volvariella volvace*,

Pleuotus eryngii and *Agrocybe aegerita* are the ones grown in greater amounts. Each of them needs a different substrate both in composition and in processing, based on its ability to assimilate lignin and its need for nitrogen compounds.

Champinter produces composts from the raw materials available in each area. Concentrating on mushrooms as the fungus with the highest worldwide sales, the substrate is achieved through the fermentation of cereal straw, mixed with chicken manure, gypsum, ammonium sulfate and water. On the other hand, for more lignivorous species, such as *Pleurotus* or *Shii-take*, straw and sawdust are used, with a very different fermentation process or even a sterilized substrate. After the preparation of the substrate, it is inoculated with the required species and transported to the culture rooms, where after an incubation, the fruiting is induced to obtain the fungi which are then marketed.

After the harvest, the used compost is an exceptional fertilizer for cereal, vineyard, and olive crops and suchlike., due to the high content of organic matter, minerals and other nutrients not consumed by the fungi. Furthermore, it is free from heavy metals or seeds of competing weeds. In this way, the cycle is completed by returning the previously used raw materials to the field, generating an environmental benefit and a food with lots of goodness. It is a clear example of circular economy.

Picture 3. Mushroom farming

4. GESREMAN: Rehabilitation and decontamination of soils through in situ bioremediation strategies

Gestión de Residuos Manchegos, SL (GESREMAN), SME located in Madridejos (Toledo), embarked on the Compoclean projects (45/16/IN/1/025) and LIFE + Regrow (LIFE 16 -ENV/ES/331), given the need to find solutions to important problems such as the recovery of waste, water management or the rehabilitation and decontamination of land.

The first project has developed a compost that has the ability to decontaminate soils with hydrocarbons by 80%. The addition of compost also means a recovery of the characteristics of the rehabilitated soil which is fundamental to define its subsequent use. At the same time, COMPOCLEAN involves a commitment to bioremediation in situ, a low-impact, low-cost technique, as opposed to the destruction or isolation of contaminated soil that other techniques involve.

Furthermore, the main objective of the European LIFE + Regrow project is to regenerate a space occupied by disused wastewater ponds through different bio-recovery strategies in situ. In order to decontaminate the soil and recover the area where a multifunctional green infrastructure will eventually be built. Finally, LIFE + Regrow will contribute to mitigate the problem of the impossibility of using contaminated soil, by restoring this space and contributing to the recycling of non-hazardous organic waste that will be used to reduce such contamination.

Both GESREMAN projects are a good example in Castilla-La Mancha of how the circular economy, with an integrated perspective towards the bioeconomy, can be a generator of solutions not only to the problem of waste management, but also to soil recovery through the search for new uses and alternatives to the simple recovery of waste.

Picture 4. Reclamation of abandoned olive oil waste lagoons

CONCLUSION

The best practices identified in the region of Castilla-La Mancha are perfectly adjusted to the criteria set by the BIOREGIO project. These are replicable experiences, economically viable and aimed at promoting the circular economy of organic flows through sustainable development.

The experts of the Interreg Europe program will evaluate the good practices of Castilla-La Mancha. After this evaluation, the accepted practices will be accessible in the program's online platform.

REFERENCES

- Interreg Europe. BIOREGIO – Regional circular economy models and best available technologies for biological streams. https://www.interregeurope.eu/bioregio/
- BIOREGIO CLM. http://www.castillalamancha.es/gobierno/agrimedambydesrur/estructura/vicmedamb/actuaciones/proyecto-bioregio-interreg-europe
- *Spanish strategy on bioeconomy: Horizon 2030. http://bioeconomia.agripa.org/download-doc/102159*
- Policy Learning Platform System. Interreg Europe. https://www.interregeurope.eu/policylearning/

ACKNOWLEDGEMENTS

- Proyecto CLAMBER. http://clamber.castillalamancha.es/
- Catedra de Medio Ambiente UAH. http://catedrademedioambiente.fgua.es/
- Cooperativa Champinter. https://champinter.com/
- LIFE REGROW Project. http://www.liferegrow.eu/