

Newsletter

Issue #2 – March 2020



MEWLIFE

**MicroalgaE biomass from phototrophic-heterotrophic
cultivation using olive oil Wastewaters**

PROJECT SUMMARY

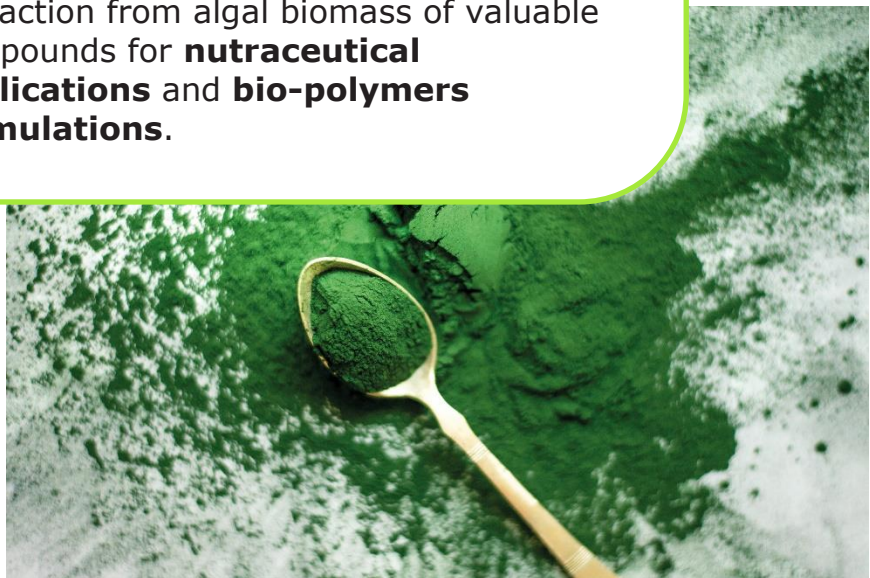
MEWLIFE is a 3-years LIFE project aiming to demonstrate the environmental benefit and economic feasibility of an innovative approach to produce microalgal biomass in an integrated phototrophic-heterotrophic cultivation system using preconcentrated (in a membrane filtration plant) olive oil wastewaters as carbon source for growing algae, thus contributing to waste reuse and valorization.



The main pillars of the MEWLIFE project are:

1. Re-use and valorization of **wastewaters from agri-food industry** as input for algae cultivation.
2. Costs reduction in **microalgae cultivation** step due to the integrated phototrophic-heterotrophic system.
3. Extraction from algal biomass of valuable compounds for **nutraceutical applications** and **bio-polymers formulations**.

Check out the
MEWLIFE
brochure and video



Olive oil wastewaters

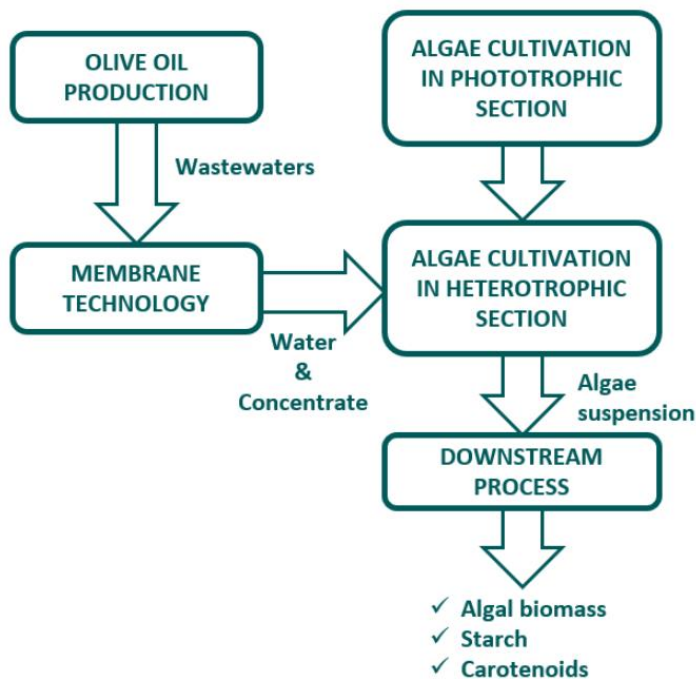
Europe produces about 70% of the global olive oil (Spain, Italy and Greece as main producers). Wastewaters from olive oil production plants cannot be treated in conventional biological depuration plants due to the toxic effect of antioxidants (polyphenols) on active sludge.

As results, these wastewaters are discharged in the environment acting as anti-microbial and phytotoxic agents.

The 3-years MEWLIFE project aims to overcome these hurdles with the development and validation on pilot scale of an integrated set of technologies for olive oil wastewaters remediation based on both physical and biological treatments.

Microalgal biomass

Microalgae are a promising feedstock for the sustainable supply of commodities and specialties for food and non-food products. Despite this potential, implementation to date is limited, mainly due to unfavorable economics. Major bottleneck is the lack of available biomass at acceptable costs. In the MEWLIFE project a new integrated microalgal cultivation strategy has been developed, reducing costs associated with the cultivation system and using the organic carbon content of olive oil wastewaters to enhance microalgal biomass growth.



Extraction of high-added value products

The microalgal biomass produced in the MEWLIFE project will be tested for application in nutraceuticals (by extracting the lipid fraction and carotenoids: astaxanthin, lutein and beta-carotene) and for bio-polymer production (by extracting starch and other carbohydrates).

INSIDE PROJECT COORDINATOR



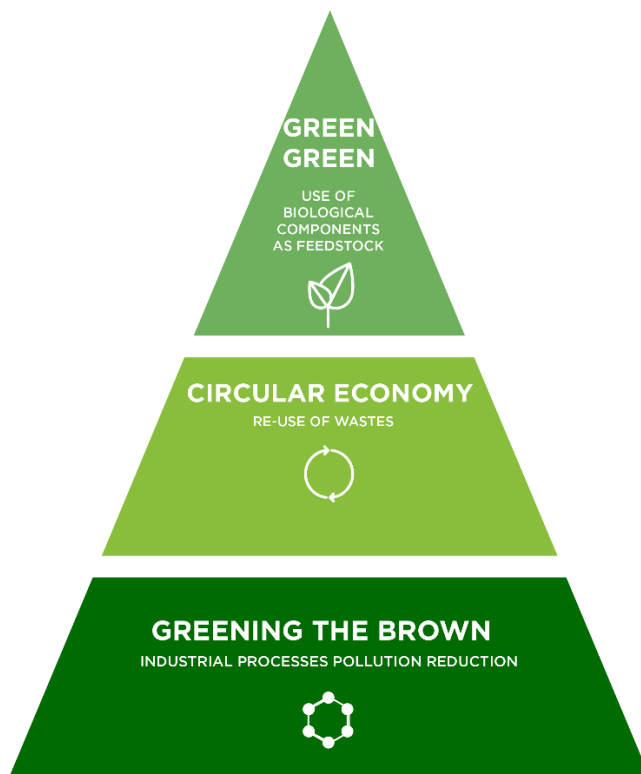
NextChem is Maire Tecnimont company dedicated to Green Chemistry and energy transition which will manage technological initiatives to best address new market dynamics.

The company is active in a series of initiatives aimed at: **Carbon Footprint Reduction**, mitigating the environmental impact of the technologies used for oil and gas processing; **Circular Economy**, implementing mechanical recycling of plastics and promoting chemical recycling; **Bio-fuels**, identifying oil substitutes to produce bio and renewable fuels from biomass feed-stocks.

NextChem portfolio of technologies includes a catalyst process to convert H₂S rich gas into sulphur and hydrogen, a dual pressures cryogenic process to separate CO₂ from natural gas and a catalytic/thermal process to convert natural gas into olefins.

NextChem has developed proprietary technologies for the Upcycling of industrial plastic waste and for the conversion of urban waste (non recyclable plastics and refuse derived fuel) to synthetic gas, hydrogen and methanol.

NextChem is acting as a technologist and engineering contractor, able to develop, industrialize and commercialize new technologies and then filling the gap between the lab and the market.



For more information visit the company website: www.nextchem.it

INSIDE PROJECT PARTNERS



High Tech Recycling Research Center (HTR) is an inter-university research center with the participation of the **La Sapienza University of Rome** (operative center), the University of L'Aquila, the University of Genoa, the University of Bologna, the University of Cagliari, the Polytechnic of Marche and the National Research Council.

HTR Center promotes the development of innovative processes for the treatment of **secondary raw materials** such as technological wastes and **agro-industrial wastes**.

Main activities are:

- Development of innovative **biotechnological processes** for the production of fine chemicals (high experience in microalgae biorefinery).
- Development of innovative **hydrometallurgical processes** for the recycling of technological wastes.
- Development of **innovative products** (bioadsorbent materials, nanostructured metal-based materials).
- Technical-economic feasibility and environmental impact (process analysis and life cycle analysis - LCA).



For more information: <https://www.chem.uniroma1.it/en/structures/research-centers/htr-center>



LABOR is a private company with **multi-disciplinary research laboratories** of **Prototyping, Mechanical, Electronics** and **Automation, Chemistry**. The ability to multi-disciplinary is applied primarily to the food industry, biomedical, bio-energy, environmental technologies and systems for industrial and safety at work.

LABOR provides engineering, consulting and technology development services specifically targeted at SMEs operating in the EU to boost their growth through technological innovation. The Engineering and Development team consists of electronic and mechanical engineers, computer scientists, laboratory technicians and industrial chemists. A network of technology partners and centers of excellence at European level support the qualified staff of the company.

Apart from third party engineering, LABOR develops its own technological platforms, for selling or licensing purposes. The infrastructures include:

- a laboratory for electronics, software (C/C++ / LabVIEW) and firmware tailored to developing IoT embedded devices and automation;
 - an area for innovative prototypes fabrication, development, engineering and testing.
- Applications developed concern industrial waste treatment, industrial crystallisation, including on-line sensing devices, production of ceramic nanopowders.

For more info visit:
www.labor-eu.net



INSIDE PROJECT PARTNERS



Technosind srl is a company founded in 1990 in order to coordinate the research and development activities, mainly in the field of **treatment** and **recovery** of **raw and innovative materials** and in the field of **storage systems of renewable electric energy**.

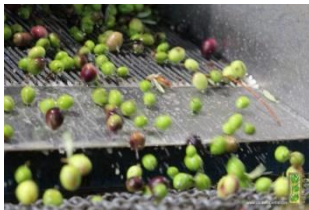
The company is currently involved in projects that aim to reduce greenhouse gas concentrations, through the reuse and conversion of CO₂, to store electricity from renewable sources, through molten salt storage systems, and to **reuse of agro-industrial waste for the production of bio-products**.

Technosind is developing a technology based on the storage of electricity through a storage system consisting of a solar assisted supercritical heat pump cycle that converts the surplus electricity into high temperature heat during charging and converts it back into electricity in a thermal engine during the discharge cycle.

The company has also designed a new storage system that also aims at the conversion of CO₂ and consists in the electrocatalytic reduction of CO₂ into synthesis gas through the use of innovative nanostructured electrodes

For more information visit the company website: www.technosind.it

INSIDE PROJECT STAKEHOLDERS



The "**Associazione Frantoi Oleari Lazio**" (ALFO, President: Paolo di Fonzo) agreed to contribute to the project development providing in total 40 m³ of olive oil mill wastewaters (OMWW) produced by the 3-phases olive oil production plant '**Cooperativa Agricola Sant'Antonio**' located in **Rocca Massima (LT)**. The interest in the project was also confirmed by Mr Paolo Mariani (Asso.frant.o.i / Associazione Laziale Frantoi Oleari) during the MEWLIFE round table at Ecomondo expo in November 2019.

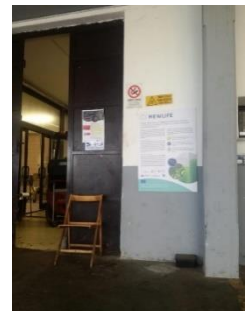
During the olive oil production campaign 2019-2020, about 20 m³ have been collected, transferred and pre-treated by LABOR in the revamped membrane prototype. The resulting concentrate and permeate streams will be then used by BIO-P as input for algae growth in the heterotrophic cultivation section.



Paolo Mariani speaking at Ecomondo.



Tanks provided by LABOR at mill site for filling with OMWW.



MEWLIFE noticeboard installed at olive mill site.

For more information visit: <http://alfofrantolazio.it/>

Optimization of phototrophic section

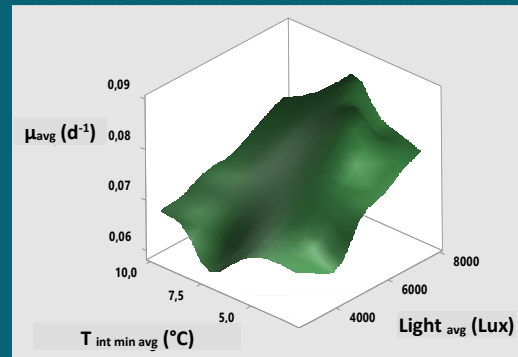
Bio-P has optimized the phototrophic section, carrying out all the activities necessary to the correct operation of the phototrophic unit, analyzing also the outdoor parameters influencing the microalgal growth.

PHOTOTROPHIC ALGAE CULTIVATION SECTION INSTALLED AND OPERATING AT NEXTCHEM SITE IN ROME



Results

At the end of the start-up phase a concentration of 0.3 g/L was reached. In order to complete the optimization of the phototrophic unit, 8 cultivation batches were carried out, monitoring besides growth also the outdoor variables.



The figure represents the specific growth rate (μ) as function of light availability and temperature. Indeed, is visible that at high light availability and higher temperatures the specific growth has higher values, even if the highest value is obtained at about $I = 8,000$ Lux and $T = 7.5$ °C and not at $T = 10$ °C. The reason behind this is because temperature and light are not the only factors influencing microalgal growth, especially in outdoor cultivations. Some other factors have an impact on specific growth rate outcomes as nutrient amount and mixing conditions.

MEWLIFE WHERE WE ARE



Revamped MEWLIFE OMWW pre-treatment prototype



*MEWLIFE prototype:
particular of the membranes section*

OLIVE MILL WASTEWATERS PRE-TREATMENT IN THE REVAMPED AND OPERATING **MEMBRANE PROTOTYPE** AT LABOR SITE IN ROME

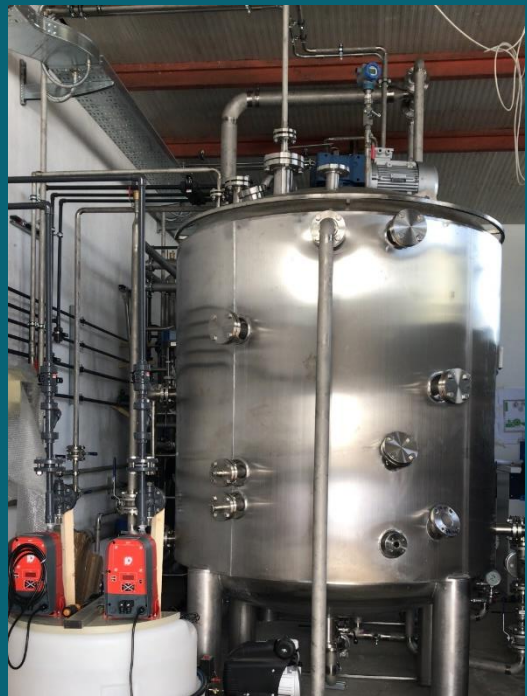


Fresh OMWW collected from the olive mill site

MEWLIFE WHERE WE ARE



*Raw materials and chemicals storage
& dosing*



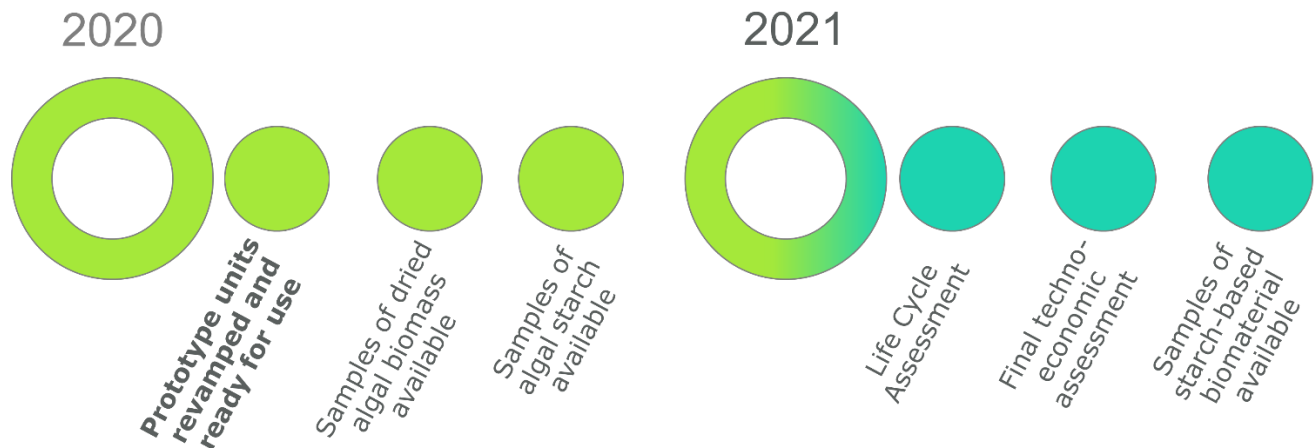
Algae growth section in fermentors



Downstream algae processing

**HETEROTROPHIC ALGAE
CULTIVATION SECTION**
INSTALLED AND READY TO OPERATE
AT NEXTCHEM SITE IN ROME

MEWLIFE NEXT STEPS



Dissemination activities

1. F. Di Caprio, P. Altimari, G. Iaquaniello, L. Toro, F. Pagnanelli, (2019). *T. obliquus* Cultivation Under Heterotrophic Conditions: Determination of Growth Parameters. **ICheaP 14** (14th International Conference on Chemical and Process Engineering), Bologna, Italy (Oral presentation).
2. F. Pagnanelli (2019). High Tech Recycling Center in MEWLIFE PROJECT: demonstrating new strategies enhancing feasibility of microalgal cultivations. **ECOMONDO**, Rimini, Italy (Oral presentation).
3. F. Di Caprio, P. Altimari, F. Pagnanelli (2019). Control of bacteria growth in heterotrophic microalgae cultures by uncoupled nutrients feeding. **AlgaEurope 2019**, Paris, France (Oral presentation).
4. F. Di Caprio (2020). Microalgal cultivations integrated with wastewater treatment: the example of the MEWLIFE project. **AquaFarm 2020**, Pordenone, Italy (Oral presentation).

The MEWLIFE project has been presented at the green technology expo **Ecomondo**, the international exhibition that brings together all sectors of the circular economy in a single platform: from material and energy recovery to sustainable development (**5-8 November 2019, Rimini, Italy**).



For more information, please contact:

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You are in this list because of the interest in the MEWLIFE project

Website: www.mewlife.eu



The project "MicroalgaE biomass from phototrophic-heterotrophic cultivation using olive oil Wastewaters – MEWLIFE" is co-funded by the LIFE Programme of the European Union (LIFE17 ENV IT 000180).