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Growth kinetics and biomass production of *Chlorella sorokiniana* grown on industrial wastewaters for a sustainable process development

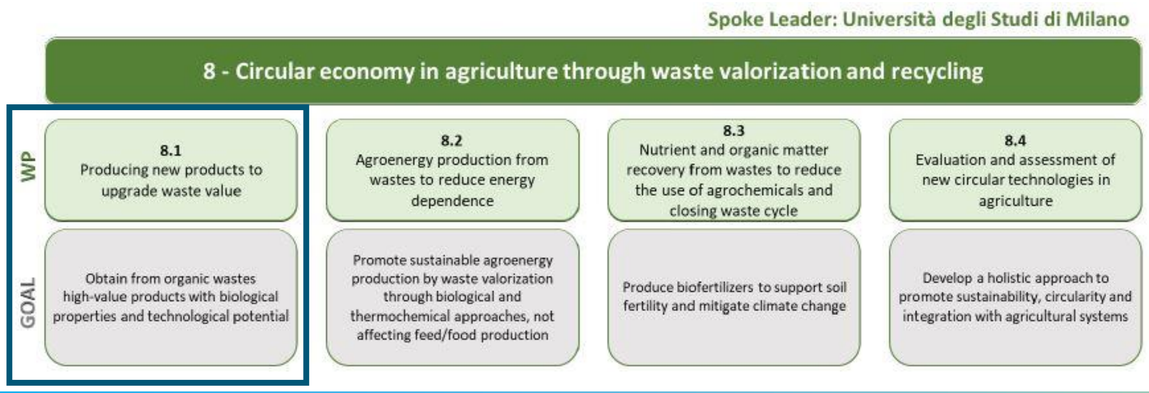
Mazzocchi E (Politecnico di Torino, IIT), Usai G (IIT), Pinton E (Università di Torino), Pirri FC (Politecnico di Torino, IIT), Stassi S (Politecnico di Torino), Menin B (IBBA-CNR, IIT) Cordara A (Politecnico di Torino, IIT)

Centre for Sustainable Future Technologies, Fondazione Istituto Italiano di Tecnologia, Turin, Piemonte, 10129, Italy
Department of Applied Science and Technology - DISAT, Politecnico di Torino, Turin, Piemonte, 10129, Italy
Department of Agricultural, Forest and Food Sciences - DISAFA, University of Turin, 10095, Grugliasco, Italy
Institute of Agricultural Biology and Biotechnology, National Council of Research IBBA-CNR, Milan, Lombardia, 20133, Italy
Department of Environment, Land and Infrastructure Engineering – DIATI, Politecnico di Torino, Turin, Piemonte, 10129, Italy

Politecnico di Torino 1859 · IIT ISTITUTO ITALIANO DI TECNOLOGIA CENTRE FOR SUSTAINABLE FUTURE TECHNOLOGIES · DISAFA Università degli studi di Torino · IBBA Consiglio Nazionale delle Ricerche Istituto di Biologia e Biotecnologia Agraria

E-mail:
elena.mazzocchi@polito.it

SPOKE, WP AND TASK

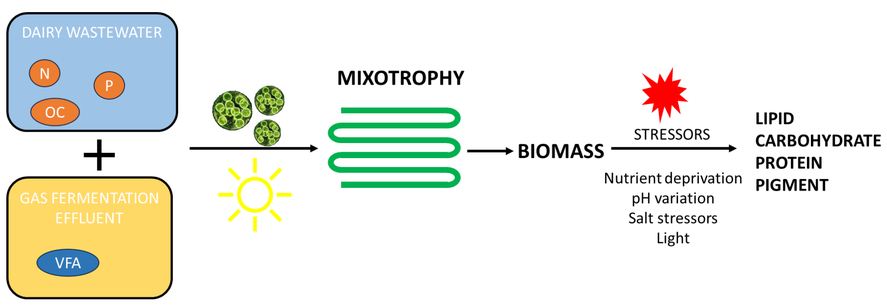


- Spoke 8
- WP 1
- **Task 8.1.2**

Development of an efficient and sustainable biotechnological process for the **valorization of wastewaters from dairy industries and gas fermentation** through the cultivation of photosynthetic microorganisms, i.e. **microalgae**. Microalgae biomass can be further valorized in:

- **Lipid**
- **Carbohydrate**
- **Protein**
- **Pigment**

INTRODUCTION



Microalgae biomasses have enormous potential as a resource of **value-added compounds** used in several industrial sectors (carbohydrates, proteins, lipids, pigments and secondary metabolites) [1]. Nevertheless, due to high **energy consumption** and the need for chemicals and water to fully sustain algae growth, the industrial production of this biomass is not environmentally or economically feasible.

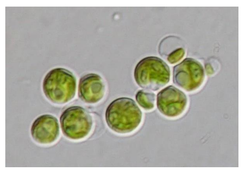
Here, to reduce water and chemicals consumption for biomass production, **industrial wastewaters** rich in dissolved nutrient have been chosen as substrate: exhausted sludge from dairy wastewaters (**DWW**) and gas fermentation effluent (**GFE**) [2]. As a result, both **cost reduction** and **bioremediation** are performed.

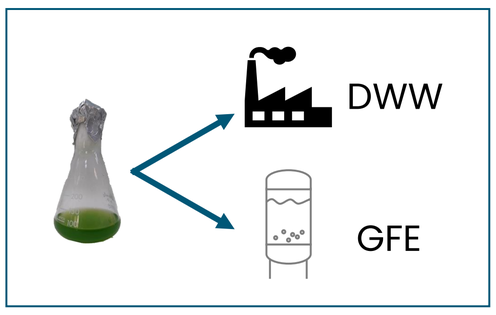
EXPERIMENTAL DESIGN

CHEMICALS	DWW (mg/L)	GFE (mg/L)
PHOSPHATE	<60	65.8
SULPHATE	24.8	96.1
NITRIC NITROGEN	<4.5	<4.5
AMMONIUM NITROGEN	370	219
TOTAL ORGANIC CARBON	78.2	2530
TOTAL INORGANIC CARBON	478.2	1569

Tab. 1 Hydro-chemical analysis of selected wastewaters: DWW and GFE

Chlorella sorokiniana CCAP 221/8k





Cultivation of *C. sorokiniana* on DWW and GFE both separately and mixed, in flasks

Multicultivator Photobioreactor

Laboratory scale-up: cultivation on mixture of wastewaters in a PBR to optimize the biomass production

RESULTS

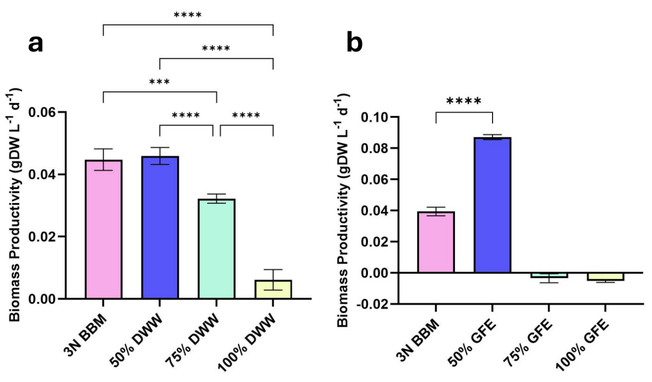


Fig. 1 Biomass productivity of *C. sorokiniana* grown on different percentages of:

a) DWW diluted with 3N BBM;
b) GFE diluted with water

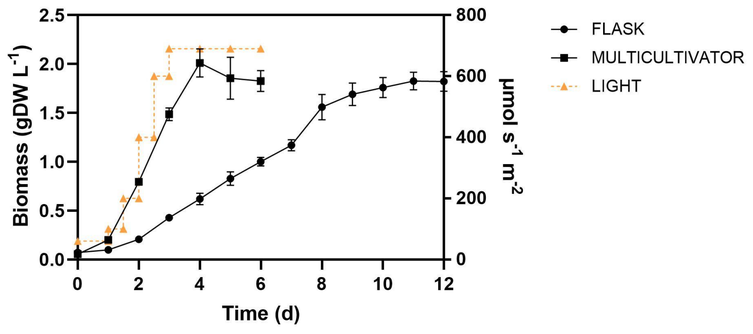


Fig. 2 Biomass production of *C. sorokiniana* grown on the mixture DWW:GFE 1:1

	50% DWW	50% GFE	50% GFE 50% DWW	M.C.
GR (d^{-1})	0.079 ± 0.003	0.276 ± 0.001	0.289 ± 0.005	1.002 ± 0.007
Biomass ($gDW\ L^{-1}$)	0.827 ± 0.02	1.209 ± 0.02	1.826 ± 0.07	2.012 ± 0.117

Tab. 2 Growth rate (GR) and maximum biomass production of *C. sorokiniana* in all tested conditions

REFERENCES

1. Uma, V. S., Usmani, Z., Sharma, M., Diwan, D., Sharma, M., Guo, M., et al. (2023). Valorisation of algal biomass to value-added metabolites: emerging trends and opportunities. Phytochem. Rev. 22 (4), 1015–1040. doi:10.1007/s11101-022-09805-4
2. Antonicelli, G., Ricci, L., Tarraran, L., Fraterrigo Garofalo, S., Re, A., Vasile, N.S., Verga, F., Pirri, C.F., Menin, B., Agostino, V., (2023). Expanding the product portfolio of carbon dioxide and hydrogen-based gas fermentation with an evolved strain of Clostridium carboxidivorans. Bioresource Technology, Volume 387, 10.1016/j.biortech.2023.129689

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