Harnessing the communication between a green microalga and bacteria for increased biomass productivities and plant biostimulants

Câmara Manoel, J A [1,3], Masojidek, J[1,3], Saurav, K[3], Gouveia, L[2]

[1] Faculty of Sciences, University of South Bohemia, České Budějovice, Czech Republic

[2] Laboratório Nacional de Energia e Geologia, Lisbon, Portugal

[3] Laboratory of Algal Biotechnology, Institute of Microbiology of the CAS-Center Algatech, Třeboň, Czech Republic

Abstract

Algae and bacteria form communities and relationships in nature[1], that can potentially benefit each other for growth. There are several studies exploring these relationships to understand the mechanism behind promoting microalgae growth[2–4]. With some microalgae being known to produce molecules that can mimic those involved in a well-studied bacterial communication system[5] – Quorum Sensing. . It is hypothesized that signal molecules produced by co--habitating heterotrophic bacteria within its phycosphere can promote the growth of microalgae. To explore these relationships, we isolated these co-habitating bacteria from the phycosphere of the green microalga *Monoraphidium sp.*, Culturing of the microalga in filter sterile cell free spent medium of bacterial isolates (5% in microalgal medium) showed increase in dry mass and cell numbers when compared to the control. This dilution was further selected for a germination assay of commercially available Barley (*Hordeum vulgare*) and Cherry tomato (*Solanum lycopersicum* var. *Cerasiforme*), at different points of the microalga growth curve. The results showed a positive in terms of germination index (GI) effect against Distilled water (DW) and Gibberellic Acid (GA). For Barley, the undiluted algae (UA) showed a better GI when used at the exponential and lag phase. The 5% diluted culture (DC) showing a better result than control at the exponential phase. For the Cherry Tomato, the DC was the one showing better GI both, at the exponencial and stacionary phases when compared to DW and GA.

References:

1. Johansson, O. N. *et al.* Friends With Benefits: Exploring the Phycosphere of the Marine Diatom Skeletonema marinoi. *Front. Microbiol.* **10**, 1–11 (2019).
2. Bilanovic, D., Holland, M., Starosvetsky, J. & Armon, R. Co-cultivation of microalgae and nitrifiers for higher biomass production and better carbon capture. *Bioresour. Technol.* **220**, 282–288 (2016).
3. Cho, D. H. *et al.* Enhancing microalgal biomass productivity by engineering a microalgal-bacterial community. *Bioresour. Technol.* **175**, 578–585 (2015).
4. Xu, J., Cheng, J., Xin, K., Xu, J. & Yang, W. Strengthening flash light effect with a pond-tubular hybrid photobioreactor to improve microalgal biomass yield. *Bioresour. Technol.* **318**, 124079 (2020).
5. Amin, S. A., Parker, M. S. & Armbrust, E. V. Interactions between Diatoms and Bacteria. *Microbiol. Mol. Biol. Rev.* **76**, 667–684 (2012).