XV Encuentro de Química Analítica y Ambiental
XXIV International Symposium on Advances in Extraction Technologies
18 al 21 de Octubre, 2022. Iquique, Chile

# Carotene and phenolic profile from *D. salina* and *H. lacustri* microalgae, culture under different lights, by RP-HPLC-MS for nutraceutica application

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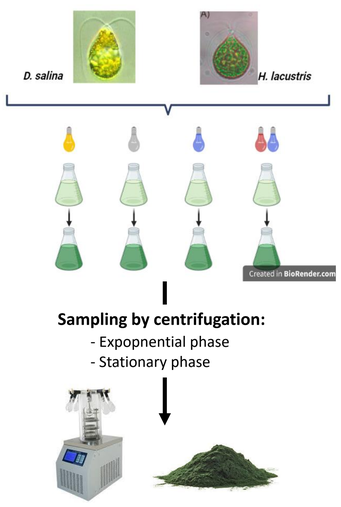
## Introduction

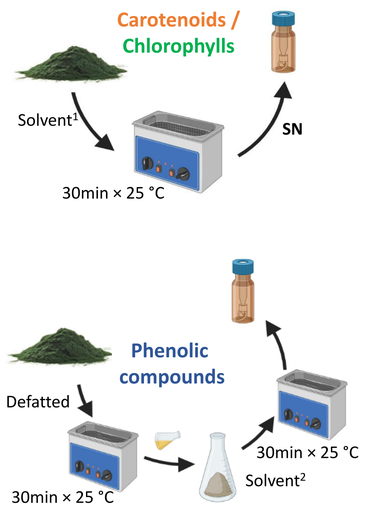
Carotenes are photosynthetic pigments in microalgae with high bioactive properties for nutraceutical applications. The main commercialized carotenoids worldwide are β-carotene and astaxanthin, produced by *Dunaliella salina* (*D. salina*) and *Haematococcus lacustris* (*H. lacustris*) microalgae, respectively [1]. Extraction and isolation methods are proposed for the direct recovery of these carotenoids, nevertheless, the use of dry biomass as a nutraceutical is also commercialized. This biomass has other highly bioactive carotenes and phenolic compounds, and their proportion depends on the culture conditions. The light effect on the culture of microalgae has been largely studied to increase both growth rate and carotene induction [2,3]. Therefore, this research aims to characterize the carotenoids and phenolic profile by RP-HPLC-MS from *D. salina* and *H. lacustris* dry biomass culture under different lights.

## Methodology

### Microalgae culture

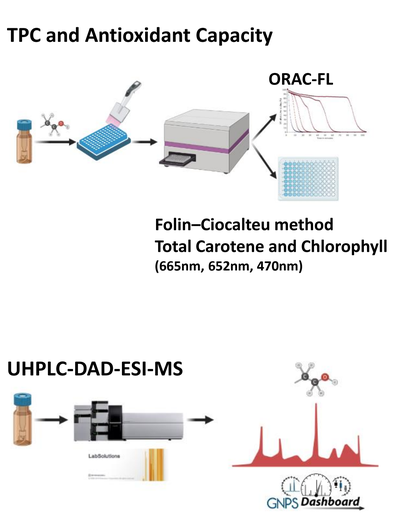



### Extraction




[1]MetOH:TBME (80:20, v:v), [2]Methanol (100%), SN: Supernatant

### Characterization / Data analysis




## Figures and Tables

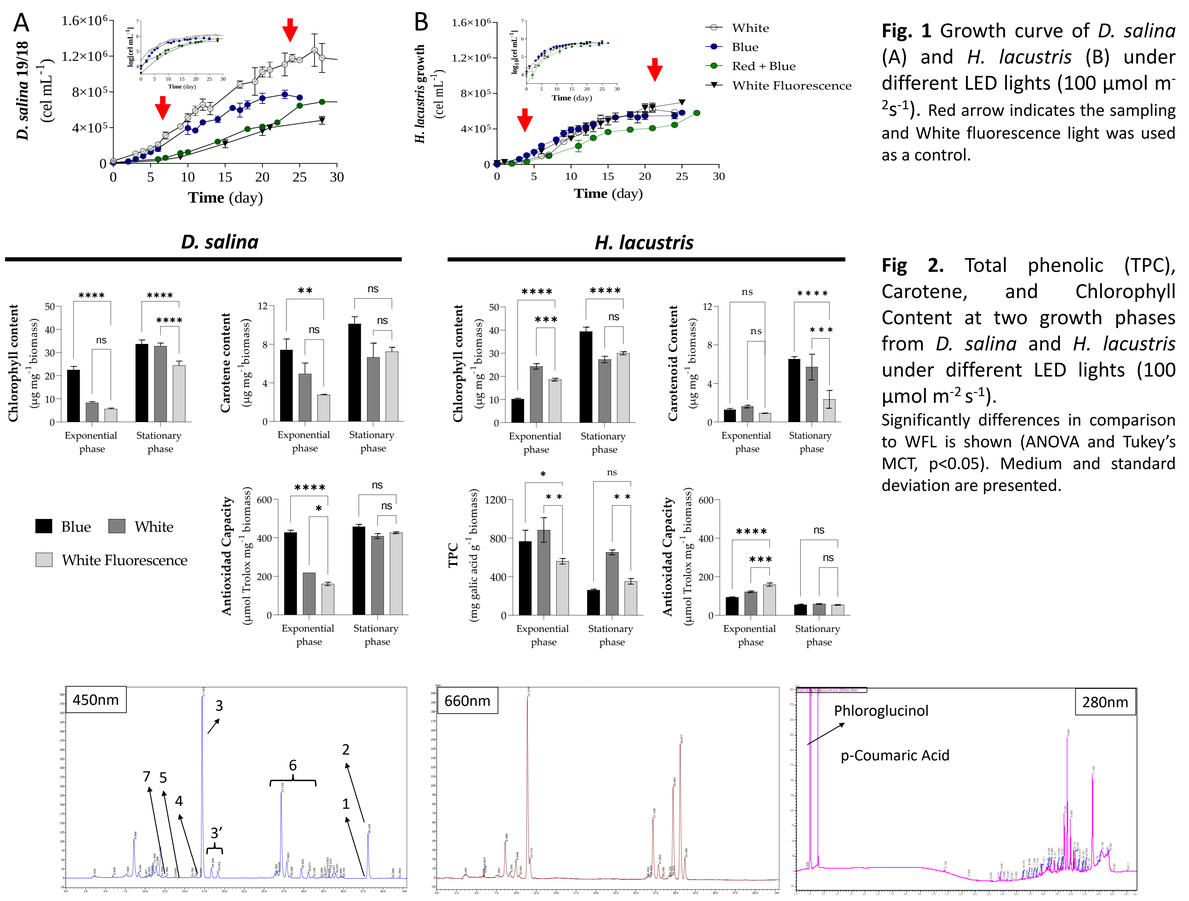



**Fig. 1** Growth curve of *D. salina* (A) and *H. lacustris* (B) under different LED lights (100 µmol $m^{-2}s^{-1}$). Red arrow indicates the sampling and White fluorescence light was used as a control.

**Fig 2.** Total phenolic (TPC), Carotene, and Chlorophyll Content at two growth phases from *D. salina* and *H. lacustris* under different LED lights (100 µmol $m^{-2}$ $s^{-1}$).
Significantly differences in comparison to WFL is shown (ANOVA and Tukey's MCT, $p<0.05$). Medium and standard deviation are presented.




**Fig 3.** Chromatogram of microalgae MetOH/TBME extracts measured at 450nm for carotene (A) and 660nm for chlorophyll (B) compounds. Polyphenolic compounds in MetOH extract were measured at 280nm (C).

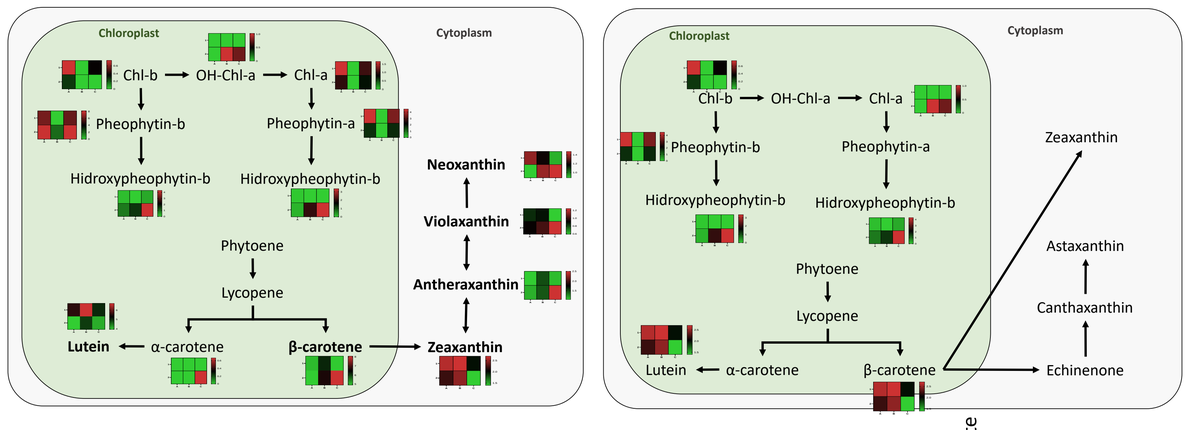



Fig 4. Metabolic profile of carotene and chlorophyll metabolism of *D. salina* and *H. lacustris* growth under different photoautotrophic lights

## Results and Discussion

*D. salina* had a higher growth with white LED, followed by blue, blue+red, and white fluorescence light. On the other hand, *H. lacustris* had the same growth rate for white LED, blue LED, and white fluorescence light. Lower growths was observed for blue+red LEDs, therefore were not further evaluated (Fig. 1).
The difference in growth observed by the different lights on each microalgae suggested a differential light-harvesting molecule synthesis and tolerance to these stress conditions. Therefore, carotenoids, chlorophyll, and polyphenols compounds were evaluated (Fig. 2).
Chlorophylls and carotenes were higher in cultures at the stationary growth phase. At this phase, the blue LED used for the photoautotrophic growth of both microalgae presented a higher amount of chlorophylls and carotenes.
The higher variation on antioxidant capacity and TPC was observed during the exponential growth phase of *H. lacustris* and decreased drastically at the stationary phase for both microalgae.
The chlorophyll biosynthesis was stimulated by blue light in both microalgae. The lower content of chlorophyll was detected with white fluorescence light. In addition, degradation metabolites were detected, indicating a high turnover.
Carotenes biosynthesis during the green growth phase accumulates lutein (and their isomers) and β-carotene in both microalgae with all lights. In addition, zeaxanthin, violaxanthin and neoxanthin were higher with blue LED followed by white LED in D. salina.
The major polyphenols identified in the MetOH extract were phloroglucinol and p-coumaric acid in both microalgae, with higher content in the microalgae culture in blue and whit LED.
Overall, the photoautotrophic culture of both microalgae with blue light showed a higher amount of bioactive compounds in comparison to the common light (White LED and white fluorescence light) used during the production process for nutraceutical applications.

## Conclusion

Variations of the light wavelength during the green microalgae phase with a photoautotrophic culture of *D. salina* and *H. lacustris* increase the production profile of bioactive compounds. Nevertheless, focus on the correct balance between biomass growth and bioactive compound biosynthesis in the microalgae green phase must be optimized. For these, mixotrophic conditions can be explored with blue LED to increase the bioactive profile for nutraceutical applications.

## Acknowledgment

The authors thank Postdoctoral FONDECYT project N°3210523, FONDEQUIP project EQM150067, Laboratorio de Compuestos Bioacctivos de la Fac. de Ingenieria Agricola (UdeC-Chillán)