Growth of *Arthrospira platensis* under laboratory and outdoor conditions: assessment of the effects of light and different nutrient media

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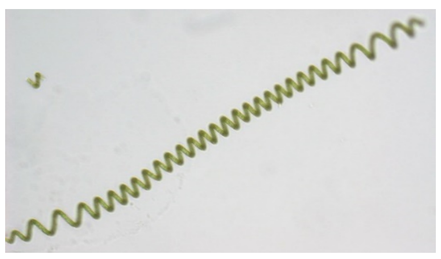
1 Introduction

Microalgae production is currently regarded as a fast-growing industrial activity, offering a noteworthy potential in several fields of science and healthcare, and a promising contribution to environment management. Standing as the most widely cultivated microalgae, *Arthrospira platensis* is highly sought out not only due to its nutritional value, but also due to its antioxidant, antimicrobial and antiviral activities, among other (Chen, et al., 2015; Falaise et al., 2016).

However, microalgae production industries still face a few challenges. Due to the highly phenotypic plasticity of this microalgae, its growth rates, biomass production and the fact that chemical compounds produced are strongly dependent on several factors, namely the location of the production systems, microalgae strains, cultivation methods, and culture conditions (Falaise et al., 2016). High costs associated with microalgae production only adds up to these challenges, as nowadays this industry still cannot be competitive enough to stand against other industries. Therefore, work must be done to improve sustainability, by producing efficiently and profitable high-quality biomass quality and, consequently, the sought-out high-value compounds.

The current study offers an approach to promote production efficiency, by comparing growth rates and protein content *of A. platensis* supplemented with different nutrient commercial media.

Zarrouk medium (1966), was used as a control.



The growth rates of A. platensis cultivated in an indoor and outdoor setting were also compared to evaluate the potential of Peniche (Portugal) climate for the growth of this microalgae.

Figure 1. *Arthrospira platensis* Gomont.

2 Methods

Arthrospira platensis was obtained from Georg-August-Universität Göttingen - Culture Collection of Algae

Batch culture systems were kept in the laboratory at 22ºC, with a photoperiod of 12:12 L:D provided by white cool light bulbs (5000 lux), and constant aeration filtered by 0,2 µm filters

500 ml flasks with four commercial fertilizers were tested: Complesal , Compo, FloraNova and Nutrafin.

Control was kept with Zarrouk.

Assay lasted for 10 days.

Scale up was performed using 20 L inoculum microalgae solution up to 75L culture grown in polyethylene plastic bags for 32 days. Zarrouk+A5 medium was used

A sample of the culture was collected and filtered every two/three days to measure dry weight and growth rates according to Vonshak (1997). At the end of the assay biomass was harvested by filtration, using filter screens of 30-50 microns' mesh.

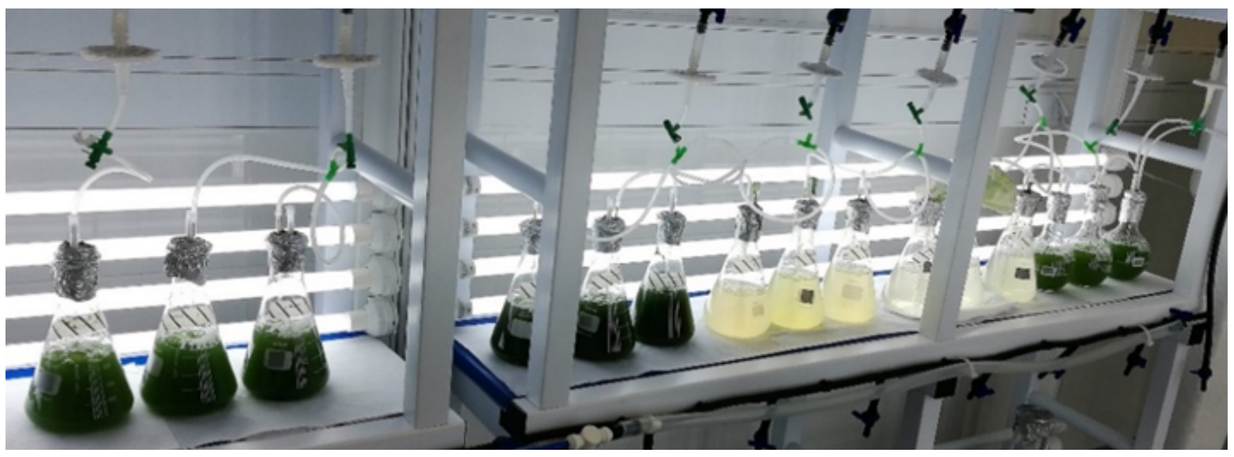


Figure 2. Cultivation room: triplicates of batch culture of Zarrouk, FloraNova, Compo, Complesal and Nutrafin, respectively (from ledt to right).

Figure 3. second assay: 75L culture grown outdoor in pastic bag.

3 Results

Results showed that the best growth medium was Zarrouk with a growth rate of 0,168 ± 0,066 g.day^{-1}, closely followed by FloraNova with 0,132 ± 0,402 g.day^{-1}. *A. platensis* grown with Nutrafin showed a weaker growth rate (0,079 ± 0,282 g.day^{-1}) whereas the Complesal and Nutrafin cultures died before the 10th day. Therefore, we performed another batch run for 12 days with FloraNova decreasing and increasing the percentage of nutritive solution by 30%. The differences weren't statistically significant: Biomass production and growth rates were similar to those found in the previous test, respectively: 0,149 ± 0,058 g.day^{-1} (FloraNova - 30%), 0,144 ± 0,031 g. day^{-1} (FloraNova), and 0,150 ± 0,053 g. day^{-1} (FloraNova + 30%), with biomass reaching concentrations higher than 2g/L, thus proving that lower nutrients' supply can be provided without decreasing productivity.

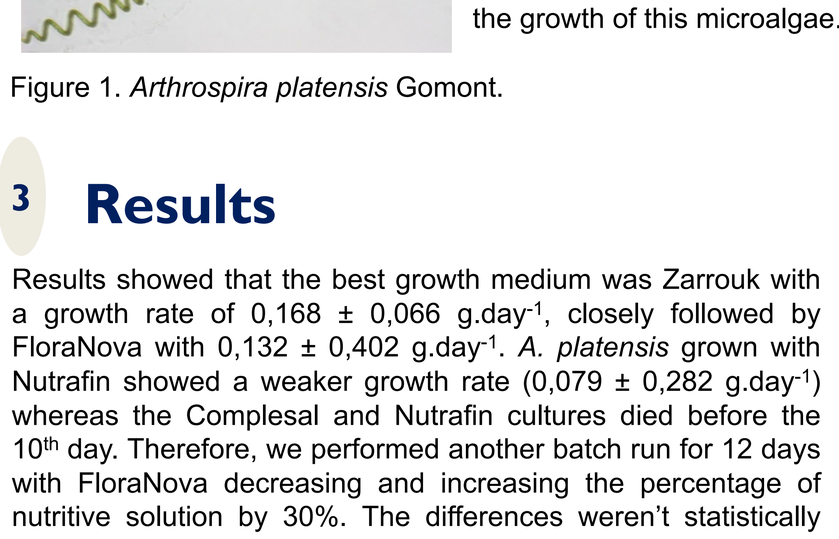


Fig.4. Mean biomass growth of *A. platensis* during 10 days, grown with 5 different media

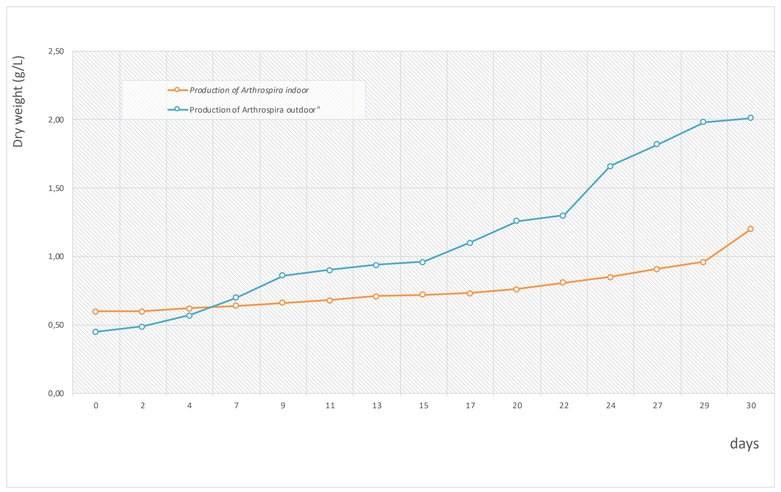


Fig.5. Biomass growth of *A. platensis* during 32 days, indoor (orange) and outdoor (blue)

Regarding the indoor/outdoor assay, the fed-batch culture reached a concentration of 1.20 g.L-1 and 2,02 g.L-1 (growth rates 0,0178 and 0,0491 g.L-1day-1), respectively.

4 Conclusion

Commercial formula FloraNova proved to be a suitable substitute to traditional growth medium, showing very interesting cell concentrations and growth rates (Carvalho et al., 2006; Delrue et al. 2017).

As to Peniche climate, the outdoor experiment undoubtedly demonstrates that the combination of temperature, natural sunlight and Peniche climatic patterns are an asset to be valued and considered in the future to produce microalgae in an outdoor industrial setting.

5 References

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