USE OF SPIRULINA *ARTHROSPIRA PLATENSIS* FOR DAIRY BYPRODUCTS TREATMENT: GROWTH AND QUALITY TRAITS

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AIM OF THE WORK

To obtain a biomass of Spirulina grown on dairy byproducts to use as feed supplement in fish farming

Introduction

Some byproducts of the dairy industry, such as ricotta whey and buttermilk, represent a problem both from an economic point of view, as the dairies have important disposal costs, and from an environmental point of view, due to their high microbial and COD content. The traditional treatment technologies are particularly expensive and of hard management. In this respect a possible solution may be given by microalgae, as a sustainable biotechnology able to assimilate the nutrients present in the dairy byproducts, which permits not only to reduce the COD load in the byproducts, but also to obtain biomass that can be valorised in various sectors of commercial interest (nutraceuticals, pharmaceuticals, cosmetics, food and feed supplements, bioplastics and phytobiostimulants).

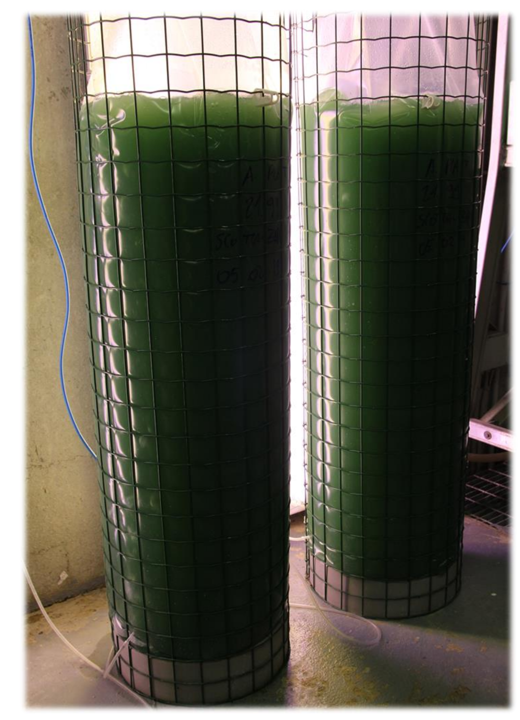

Fig. 1 Vertical column PBRs with *A. platensis* grown on whey.

Materials and methods

Arthrospira platensis was grown in semi-batch cultures in 100-liter column photobioreactors. The culture broth was composed in ricotta whey diluted with Zarrouk medium (Zarrouk, 1966), in ratio 1:4. Simultaneously a control trial in which *A. platensis* was cultured on SM as such without addition of any byproduct was carried out for comparison. The trials, conducted in duplicate, lasted 25 days in controlled conditions, at temperatures of 25-27° C, pH 9-10, a light intensity of 30 µE m^{-2} s^{-1} and with a Hydraulic retention time (HRT) of 12 days.

Results

A. Platensis growth

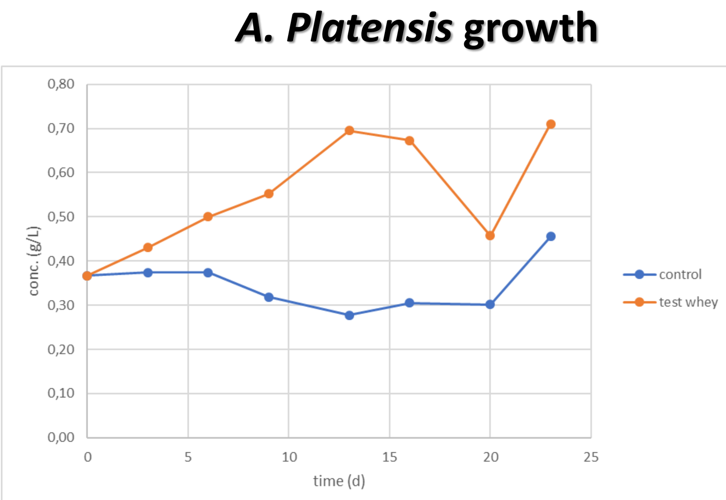

Fig. 2 Growth of *A. platensis*. The highest concentration values were reached with Spirulina grown on whey.

Total nitrogen (TKN) removal

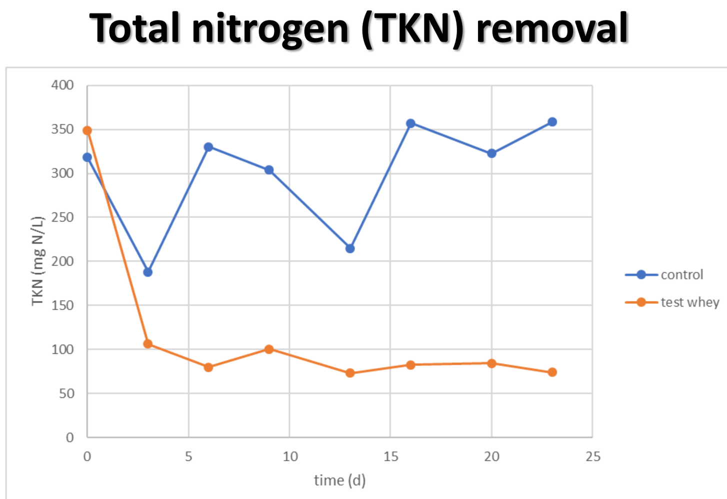

Fig. 3 Curve of total nitrogen removal. On whey it was possible to have removal values of about 80%.

COD load removal

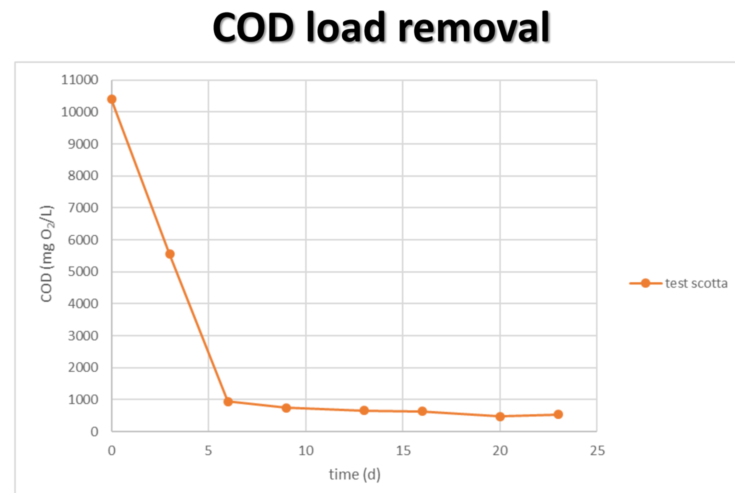

Fig. 4 Curve of COD load removal. On whey the reduction was 96% after 20 days.

Figg. 5-6 *A. platensis* after harvesting and liophylization.

	Water (%)	Protein (%)	Lipid (%)	Carbohydrate (%)	Ash (%)
A. platensis on control medium	8.05	47.43	5.26	9.7	24.80
A. platensis on whey	11.30	35.91	2.59	5	34.02

Tab. 1 Biochemical composition in the biomass of *A. platensis* harvested during the experimentation.

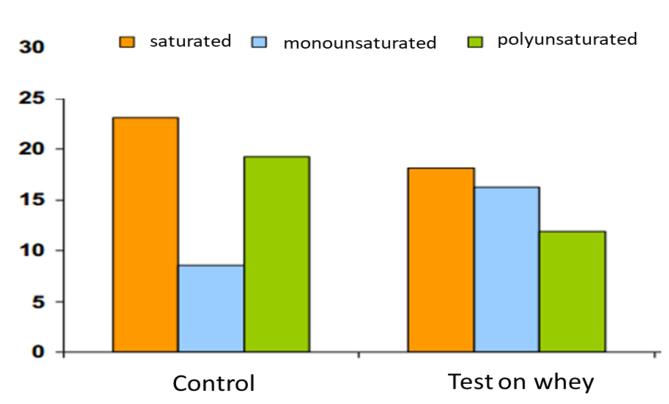

Fig 7 Fatty acid composition (%). High difference in n-3 was found between control and test ($p<0.05$).

	TBC (CFU/g)	Enterobacteriaceae (CFU/g)	*E. coli* (CFU/g)	SO_2^{3-}-reducing *Clostridium* (CFU/g)	*Salmonella* (CFU/g)
A. platensis on control medium	7,5*10³	<100	<100	<100	absent
A. platensis on whey	1,9*10⁶	<100	<100	<100	absent

Tab. 2 Enterobacteriaceae, *E. coli* and sulphite-reducing *Clostridia* were found below the detection limits of the method. *Salmonella* resulted absent.

Conclusions

- *A. platensis* proved to grow slightly better in experimental medium than in the control, thanks to presence of microbial community naturally present in the whey and with which it integrated in a symbiotic equilibrium: Cyanobacteria (as well as other microalgal strains) produce through photosynthesis oxygen, that can be exploited by microbes that provide CO_2 and nutrients that improve photoautotrophic growth of microalgae (Subashchandrabose et al. 2011).
- COD in the mixture whey-SM, starting from 10,400 mgO_2 l^{-1}, was reduced by over 90%, until values that are compatible with the Italian law-limits concerning emissions of wastewater into the sewerage system (500 mg O_2 l^{-1}).
- The microbiological analysis and biochemical composition show that the microalgal biomass grown on exhausted whey has excellent nutritional values, potentially useful as feed in aquaculture. Further studies should be carried on, in other types of PBRs, in order to increase yield and verify the feasibility and reliability of these systems in producing *A. platensis*.

References

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Work supported by Cariplo Foundation and Lombardy Region – Research project: The Microalgae Hub: Microalgae for the treatmentn and valorization of Agro-zootechni waste and dairy byproducts