

ARTHROSPIRA PLATENSIS CULTIVATION USING GEOTHERMAL CO₂ AND HEAT

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About the author:

MSc degree in 2006 in Tropical and Subtropical Agriculture with a thesis on “Microalgae for oil: strain selection, lipid induction and outdoor mass cultivation”. PhD in 2011 in Agriculture Microbial Biotechnology at the University of Florence with a thesis on “Energetic and economic assessment of a disposable panel reactor for *Nannochloropsis* sp. biomass production”. F&M employee since 2011 and partner since 2015.

Company info:

Fotosintetica & Microbiologica S.r.l. (F&M) is a spin-off company of the University of Florence founded in 2004 to exploit the know-how on microalgae physiology and mass cultivation developed by the university team. F&M offers consultancy on microalgal cultivation for several applications, among which CO₂ sequestration and wastewaters treatment, feed, food supplements, nutraceutical and bioactives. F&M offers consultancy and training on all stages leading from strain isolation to biomass production and valorization. F&M commercializes several cultivation systems: glass bubble columns for inoculum production, annular columns, the Green Wall Panel (GWP[®]) series and raceway ponds for pilot and large-scale cultivation. F&M knowledge, along with proprietary photobioreactor technologies and a collection of over 1200 microalgal strains, makes the company the ideal partner for starting applied research and commercial activity on microalgae.

Abstract:

Tuscany (Italy) is the most important area for geothermal electrical energy production in continental Europe, with 34 geothermal plants for a total installed power of about 930 MW. In Tuscany about 32% of the electrical energy requirement is provided by geothermal sources. CO₂ enriched gas and heat

represent the two main outputs of the geothermal derived electrical energy. Large-scale algae facilities require huge amounts of CO₂ for algal growth and heat for culture thermoregulation and biomass drying. Thanks to Enel Green Power S.p.A. (EGP) financial contribution, a 120 m² pilot algae facility was built by F&M close to one EGP power plant at Chiusdino (Siena, Italy) to evaluate the use of geothermal streams (CO₂, condensed steam (40-45°C) and cold water (25°-28°C) from cooling tower), in the cultivation of microalgae. The pilot plant has been operated since June 2017 with *A. platensis* F&M-C256 grown outdoors in raceway ponds and Green-Wall Panel (GWP[®]) reactors to compare performances. The use of geothermal CO₂ did not reduce biomass productivity in both pond and GWP[®] when compared with food grade CO₂. Heavy metal content in the biomass confirmed the possibility to use geothermal CO₂ as source of carbon. Condensed steam and cold water were used for culture temperature control. Warmed cultures, regardless of the culture system used, attained higher (+ 43%) productivity. Mass and energy balances extrapolated to 1 ha size showed that the availability of geothermal heat and CO₂ reduces biomass production cost of more than 50%.

Keywords:

Geothermal energy, *Arthrospira platensis*, GWP[®] photobioreactor,



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