Utilization of volatile fatty acids for the production of omega-3 by *Crypthecodinium cohnii*

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Microalgae are microorganisms found in marine or freshwater ecosystems, which are able to grow autotrophically or heterotrophically, supported by an external organic carbon source, and produce useful metabolites, including lipids, polyunsaturated fatty acids and carotenoids. The potential industrial applications of microalgal metabolites, as well as the nutritional value of their biomass, has directed a substantial amount of research towards the discovery of new methods for their cultivation. During the past few years, especially the heterotrophic cultivation of microalgae has gained momentum, due to the high biomass yields that can be obtained and the easy control of the process, in contrast to the autotrophic one. However, apart from the high biomass and product yields, the minimization of the process cost is another goal yet to be achieved.

Industrial production of heterotrophic microalgae is hampered by the high economic and environmental costs of glucose, commonly used as main carbon source. In order to reduce the cost of the process, a proposed method is the utilization of waste derived substances as carbon sources for the cultivation of microalgae. The process of dark fermentation can be used for the conversion of municipal solid biowaste fractions and sludgy biowaste from other industries, such as food industry or waste water treatment facilities into volatile fatty acids (VFA). Acetate one of the volatile fatty acid fraction`, can be easily converted by microalgae into acetyl-CoA, which is the main precursor for lipid synthesis (Ramanan, 2013). In addition, butyrate could be metabolized by heterotrophic microalgae (Turon, 2015). Good lipid productivity could be reached by using acetate, butyrate and propionate as carbon sources.

The microalga strain *Crypthecodinium cohnii* is known for its ability to accumulate high amounts of docosahexaenoic acid (DHA; c22:6), which is one of the necessary omega-3 fatty acids. DHA, is a primary structural component of the human brain and skin and therefore has a high nutritional value. Recently it has been found that *C. cohnii* can grow heterotrophically on acetate. The purpose of the depicted work is, apart from examining the ability of the strain to grow on other VFA, to find the optimized conditions (nitrogen source, VFA ratio, temperature, agitation) for maximizing the biomass productivity of the microalga on a VFA mixture and triggering a high accumulation of DHA by the cells.

For this purpose, batch cultures of the strain *C. cohnii* ATCC 30772 were examined under different conditions. The biomass production was determined both by measuring the optical density of the culture and gravimetrically. DHA, as well as fatty acid profile was identified through GC-MS. The discovery of the optimum conditions can provide the possibility to cultivate *C. cohnii* in a pH-auxostat culture with VFA, derived from biowaste, such as vegetable, garden and food (VGF) waste and waste water treatment plants derived sludge, as main carbon source.

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