Crypthecodinium cohnii and *Zymomonas mobilis* syntrophy for production of omega 3 fatty acid

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Introduction: DHA (docosahexaenoic acid) is an omega 3 fatty acid and highly valuable infant food and vegetarian food additive. Currently cold-water marine fish oil is a source of 96% of DHA, but it is not able to meet the increasing demand for DHA for human consumption [1].

The aim is to establish a bioprocess, efficiently converting sucrose and glycerol into DHA using a syntrophic process, where the ethanol-producing bacterium *Zymomonas mobilis* continuously converts these substrates into ethanol, while simultaneously, *C.cohnii* utilizes ethanol as their optimum substrate for growth and DHA accumulation.

A new co-culturing bioreactor of immobilized *Z.mobilis* and growing *C.cohnii* will be developed.

Strains of aerobic *Z.mobilis* will be used to convert molasses (a byproduct of the sugar industry) and glycerol (a byproduct of biodiesel industry) into ethanol. *Z.mobilis* cells will be trapped in calcium alginate gel beads.

Z.mobilis beads will be removed to yield pure *C.cohnii* biomass and extract DHA.

Hydrolysate from the *C.cohnii* biomass can be reutilized as a substrate for *Z.mobilis* as starch constitutes up to 50% of dry biomass of *C.cohnii.*

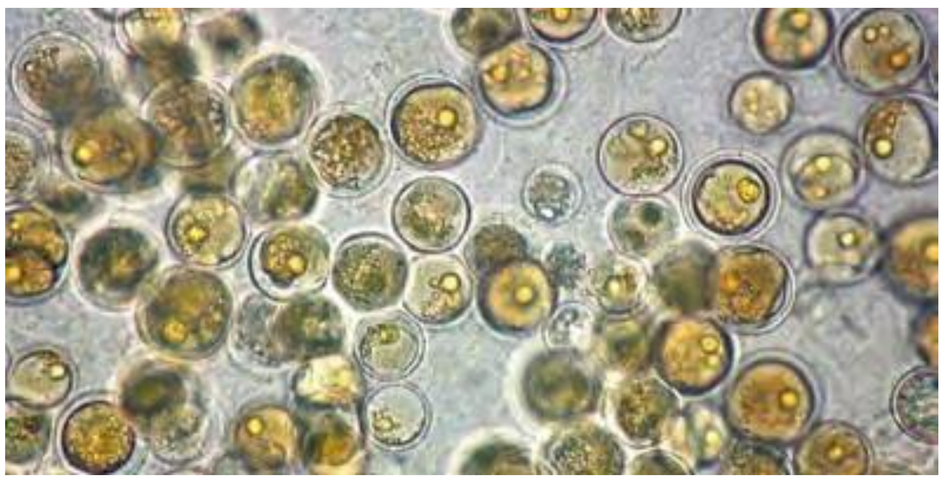

Fig. 1. *Crypthecodinium cohnii* [2]

Stoichiometric model has been built with RAVEN2 toolbox using genome of another dinoflagellate *Symbiodinium minutum.* The model consists of 2687 reactions and 3203 metabolites.

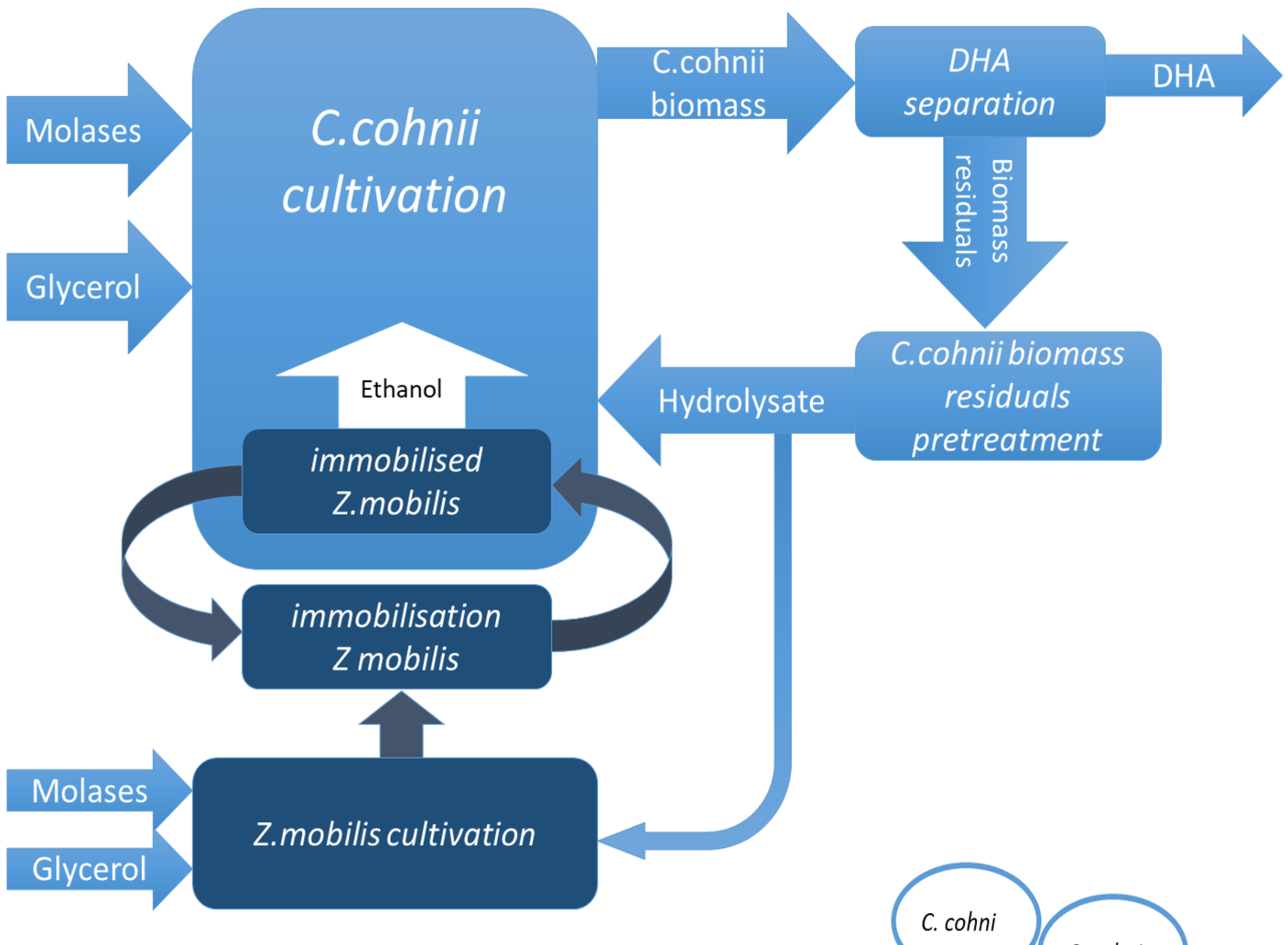

Fig. 2. Flow diagram of co-culturing

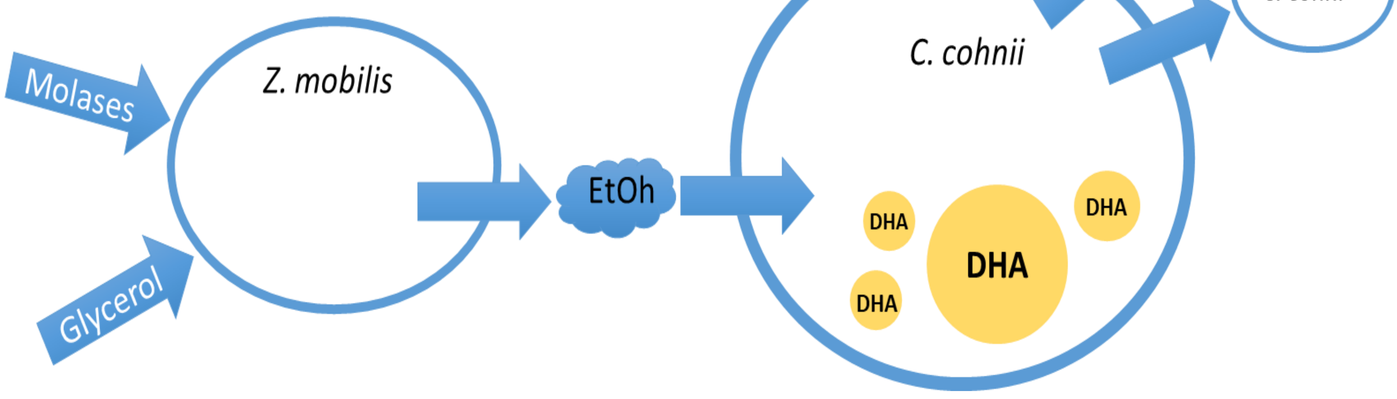

Fig. 3. Diagram of DHA biosynthesis

Kinetic and stoichiometric modeling will be applied to analyze and improve the DHA production.
Kinetic modeling will be carried out using COPASI software, while COBRA and RAVEN toolboxes for MATLAB are used for genome based stoichiometric modeling.

COPASI Complex Pathway Simulator

THE RAVEN TOOLBOX[2]

References

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[2] Carbiotech, s.l. (2019), available at: https://webgate.ec.europa.eu/fpfis/cms/farnet2/on-the-ground/good-practice/projects/cultivating-microalgae-omega-3_en (accessed on 01.08.2019.)

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