THE PHILIPPINE-AMERICAN Academy of Science & Engineering

Development of a Low-Cost Photobioreactor for the Production of Spirulina for Aquaculture

Elvis Chua[a], Maria Krishna de Guzman[a], Ramon Macaraig[b], Lea Cristina Macaraig[a] and Fabian Dayrit[a*]

[a] Ateneo de Manila University

[b]Alsons Aquaculture Corporation

[*]E-mail:fdayrit@ateneo.edu

ABSTRACT

According to the Food and Agriculture Organization (2013), aquaculture contributes about 52% of the total volume of production of fish in the Philippines. One of the challenges that this industry needs to address is to provide fish feed, which is low cost and high quality.

Spirulina (Arthrospiraplatensis) is a multicellular, filamentous cyanobacterium that contains 43-63% protein with a complete set of amino acids. It also contains high-value metabolites such as phycobiliproteins, gamma-linolenic acid, carotenoids, and vitamins. These properties make spirulina an ideal alternative ingredient for fish feed. To lower the cost of production, the following culture conditions were optimized: (1) nitrogen source and (2) light source. Results from our study show that replacement of sodium nitrate with urea give the same biomass and protein yields. This replacement will lower the cost of the culture medium. LEDs can be used as alternative light source. No significant effects in the biomass and protein yields of spirulina were observed when the light intensity, in terms of µmol photons m-2 s-1, was kept equal. This substitution in the light source further reduces the production costs since LEDs produce the same light intensity as fluorescent lights at lower power consumption.

Photobioreactor (PBR) prototypes were constructed and evaluated in terms of the biomass yields and biomass productivity. The PBR was designed according to the following criteria: (1) materials should be readily available, (2) robust, (3) affordable, and (4) scalable. The PBR prototypes were compared with those which are currently being used. Results showed that placing the light source inside the PBR increased the biomass yields and biomass productivities.

KEYWORDS: spirulina; Arthrospiraplatensis; aquaculture; fish feed; photobioreactor