[O2.29]

Biomass harvest and bioethanol production from Chlorella vulgaris treating swine wastewater

M.P. Mezzari[1], M. Pirolli[2], J.M. Prandini[3], E.O. Nunes[2], H.M. Soares[1], M.L.B. Da Silva*[4]

[1]Federal University of Santa Catarina UFSC, Brazil, [2]West University of Santa Catarina UNOESC, Brazil, [3]Contestado University UnC, Brazil, [4]EMBRAPA Swine and Poultry, Brazil

Carbohydrate-rich microalgae cells have successfully been recognized as a promising feedstock source for bioethanol production. The present research addresses the production of bioethanol from *Chlorella* sp. combined with ammonia-rich swine wastewater digestate treatment in a photobioreactor, and the use of cost-effective LED lights and natural tannin polymer to overcome upstream processes issues regarding microalgae culture and biomass harvesting.

Red LEDs and fluorescent lights were employed to study the responses of microalgae growth rate, biomass production and performance on nutrient removal ($N\text{-}NH_3$ and $P\text{-}PO_4^{-3}$) from swine wastewater digestate under mixotrophic conditions. Harvesting of microalgae biomass was further studied using jar tests with different tannin dosages (11, 22, 44, 89, 178 mg L) at neutral pH. The residual sugar of the liofilized biomass (41% carbohydrates, 50% proteins, 1% lipids) was fermented (*S. cerevisae*) and analyzed by acid hydrolysis at 0.25, 0.5, 1.0, 1.5 and 3.0% (v/v).

Red LED lights exhibited the highest specific growth rate of 0.45 (day^{-1}), 1.6 times more biomass production and better $N\text{-}NH_3$ and $P\text{-}PO_4^{-3}$ removal (41% and 78%, respectively). Tannin recovery efficiency at neutral pH improved from 50% to 97% with increasing biomass concentration from 47 mg/L to 160 mg/L dry weight, respectively. The highest sugar content (0.49 g-sugar/g-microalgae which is equivalent to 18 ton sugar/ha compared to 16 ton sugar/ha-sugar cane) was achieved with 1% acid and 15 g/L of microalgae at 100˚C for 30 min.

This study indicated high biomass production and nutrient removal from red LED light grown microalgae. Tannin was very effective on harvesting due to its high efficacy, low dose requirements, and no interference with residual sugar recovery process. Overall, this study demonstrated that the exceeding carbohydrate and protein-rich content in *Chlorella* sp. from mixotrophic photobioreactors treating swine wastewater digestate are potential feedstocks for bioethanol production.

Keywords: Chlorella vulgaris, swine wastewater, flocculation, bioethanol