RETASTE Conference Abstracts
RETASTE-AWR-1336-In-person Oral
Rethymno, September 16-18, 2026
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DOI:10.5281/zenodo.23678065

Sustainable Process for Microalgal Based Value Added Products Using Fishery Wastewater Through Biorefinery Approach

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Abstract

The expanding global demand for aquaculture products creates large amounts of nutrient-rich fisheries effluent, which contains high concentrations of nitrogen and phosphorus and poses major environmental concerns. Surprisingly, microalgal development requires both nitrogen and phosphorus. Based on this premise, the current work investigates the potential for long-term bioremediation of fishery effluent using thermotolerant *Coellastrella thermophila*, a newly identified microalgal strain. The state of Gujarat is characterized by a semi-arid to arid tropical climate and during peak summer (April–June), temperatures frequently rise to 40–45°C, and heatwaves can push it even higher. In such climatic conditions, its difficult to perform bioremediation of fishery wastewater in open ponds through circular economy model is slight tough to operate. The study assessed *Coellastrella thermophila*'s growth performance in fishery wastewater in open ponds at a temperature of 40-45 □C as well as its effectiveness in converting the wastewater into recovered water appropriate for irrigation. Present study addresses the growth characteristics of *Coellastrella thermophila* grown in fishery industry (FWW) waste water (FWW) along with its nutrient profiling, which includes lipids, proteins, pigments, carbohydrates, ash content and mineral content to produce biodiesel. In addition, the functional components of the generated biomass were identified. *Coellastrella thermophila* substantially decreased major pollutants such as BOD (from 560 mg/L to 19 mg/L), COD (1876 mg/L to 85 mg/L), sulphate (1226 mg/L to 596 mg/L), and ammoniacal nitrogen (from 127 mg/L to 34.3 mg/L). *Coellastrella thermophila* (control, FWW+25 % nutrients, FWW+50 % nutrients, FWW+75 % nutrients and FWW+100 % nutrients) was grown and faster growth was observed in the FWW containing 25 % (395.3 mg L-1 biomass) and 50 % (450.3 mg L-1 biomass) nutrient as compared to control medium i.e. Bold Basal Medium (BBM). Zeaxanthin (28.86 ± 0.5 µg/Ll) which is necessary in ocular health was the most abundant pigment in BBM identified in HPLC. Maximum phospholipid (31 %) and neural lipid (58 %) were in FWW+25 % nutrient, whereas glycolipid (26 %) was highest in FWW+50 % nutrient. Triacylglycerol (TAG), a phospholipid, was the most abundant lipid accumulated in the *Coellastrella thermophila*, grown in FWW, thus making it a potential biodiesel feedstock.

Keywords: aquaculture wastewater, microalgae, carotenoids, sustainable aquaculture, pigment production