

Valorisation of Purple Non-Sulfur Bacteria Biomass from Anaerobic Treatment of Fuel Synthesis Process Wastewater to Aquaculture Feed: A Means of Enhancing Food Security in Arid Climes

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Abstract

The advent of climate change has further contributed severity of the food and water security risks in arid climates like the Middle East. Thus, there is an increased need for unconventional approaches to ameliorate the challenges. This study examines the feasibility of recovering single-cell protein (SCP) via the anaerobic treatment of fuel synthesis process water (FSPW) using purple non-sulfur bacteria. FSPW is of interest because the wastewater is rich in short-chain organics (COD 11 g/L) and abundant in the region. Replicate non-axenic cultures dominated with PNSB (0.1 g/L) were prepared using bench fermenters and exposed to continuous light. The COD removal efficiency was 78%, while the total nitrogen removal efficiency was 99%. Furthermore, biomass proximate analysis revealed that the biomass consisted of 35% protein, 32% lipid, 16% carbohydrate and 7% ash, and 0.004% coenzyme Q-10. This composition is similar to some aquafeed sources. In addition, undesirable metals like Ar, Cd, Hg, and Pb were undetected in the process water and biomass. The results indicate that PNSB could efficiently treat FSPW and recover nutrients and carbon into valuable bioproducts. Further studies are required to enhance biomass protein yield and examine key feed characteristics like amino acid profile and digestibility.