Integrated Microalgal Biorefinery: A zero waste management based self-sustaining and bio-economical closed loop approach

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ABSTRACT

Microalgae received tremendous research interest as bioresource for biofuel production in past few years after excessive harmful effect of petroleum consumption. To make algae mediated biofuel production feasible, it is necessary to obtain value added co-products and for such reason integrated microalgae biorefinary approach is a significant solution. Integrated microalgal biorefinery make biofuel production economically, environmentally and energetically viable in addition it enhances microalgae application in other industrial sectors. Microalgae have proven applications in various industries including nutraceutical, pharmaceutical, cosmeceutical and fuel industry due to their adaptable metabolism, which is responsible for bioeconomy and zero-waste management under biorefinery approach. In context to economical and environmental sustainability, microalgal biorefinery is based on absolute resource retrieval to make this selfsustainable closed loop method. The commercialization of microalgae mediated products and strategies are already in progress but there are certain challenges and opportunities remain to be discussed. After having such great potential valorisation of microalgae products are not economically viable due to expensive cultivation, harvesting, dewatering, pre-treatment, extraction, purification and remnant treatment techniques. However, developments in traditional methods enhances economic and environmental sustainability, which make microalgae valorisation more feasible. Integrated microalgae biorefinery supports in cost reduction including waste management aspects such as wastewater treatment, bioremediation and CO₂ mitigation. Algal residue may have utilised for various applications like biochar, biofertilizer and nanomaterials production to support zero-waste approach.

Keywords: Microalgae, Biorefinery, Biofuels, Bio-products, Industrial applications

