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Findings

Petroleum-based fuels are key factors in the rapid depletion of conventional energy sources and are substantial polluters of the environment. Additionally, the continuous exhaustion of fossil energies in addition to their high price has emphasized the relevance of biodiesel; a clean and nontoxic alternative source of energy biodiesel may be synthesised from various feedstock. The inefficiency of producing biodiesel from first and second generation feedstock stems from high production costs and inadequate food security. Researchers have been looking for a feedstock that is both ecologically responsive and sustainable. They have found that sustainable resources such as microalgae and algae can be used as third-generation feedstock for the synthesis of biodiesel.

In the current study, biodiesel is synthesised from Neochloris Oleoabundans microalgae, a third-generation feedstock, using the hydrodynamic cavitation technique under a range of operating conditions, including , operating pressures (0–4 bar) , catalyst concentrations (0.5–1.5%), reaction times (5–25 min), and molar ratios (3:1–7:1). The optimal condition was determined using genetic algorithms (GA) and response surface methodology (RSM). The working pressure of 3.6 bar, catalyst conc. of 1.301 weight percent, reaction time of 11.5 minutes, and the molar ratio of 6.5:1, were the ideal parameters for the production of biodiesel. Under ideal circumstances, the highest yield of biodiesel produced was 97.3%.For biodiesel produced by HC under conditions equivalent to those of the mechanical stirring method, the reaction time was shortened by 85%. Because the HC methodology takes less time to process, it is better than the standard way.

Additionally, the biodiesel made from microalgae was tested in a single-cylinder diesel engine as a green fuel. The qualities of biodiesel and blends were evaluated and contrasted with those of

petroleum-based diesel. Utilizing diesel and microalgae biodiesel combined at volumetric ratios of B10, B20, and B30, the fuel was utilized to analyze the combustion, performance, and emissions, the diesel engine. When compared to diesel fuel, the B20 blend increased BSFC while slightly reducing brake thermal efficiency (0.92%). When compared to petro diesel, the largest reductions in CO, HC, and smoke were achieved -23%, 14.34%, and 18.78%, respectively. The B20 combustion measurements showed a maximum reduction of 1.3% for peak pressure and 3.1% for HRR, in compared to diesel, along with a reduction in ignition latency of 1.3°CA. Thus Neochloris oleoabundans microalgae biodiesel can be a potential substitute for the diesel engine operations by the method anticipated in present study.