

ABSTRACT

The unnecessary use of fossil fuels has resulted in the multiple crises of fossil fuel exhaustion and environmental deprivation. The search for alternative fuels, which promises sustainable development and environmental preservation, has become extremely crucial now. Therefore, the fuels of bio-origin can offer a possible solution to this petroleum and environmental crisis. The present research focuses on the production of biodiesel from algal oil. Samples of algae were collected from different areas of Pakistan followed by their culturing, identification and screening for the production of oil. Ten isolates of algae were identified based on their morphology, and out of them, three were found to produce oil. These three isolates were identified as *Chlorella vulgaris*, *Cladophora sp* and *Oedogonium sp*, showing 25.3 %, 11.6% and 9.8% (w/w) yield of oil, respectively. The optimum conditions for the production of oil from these strains were 65°C temperature, 6hr time interval and hexane was used as a solvent. Different physicochemical parameters of *Chlorella vulgaris* i.e., acid value (0.54 ± 0.02 mgKOH/g), peroxide value (1.0 ± 0.025 meq/kg), Iodine value (86.61 ± 0.15 g I₂/100g), Saponification value (177.6 ± 1.12 mgKOH/g) and Unsaponifiable matter (1.6%) were measured to check the quality of extracted oil. The values indicated that the oil was suitable for the production of biodiesel. Chemical and Enzymatic transesterification of algal oil was carried out for the production of biodiesel by using NaOH and free *Aspergillus terreus* lipase/ *Aspergillus terreus* lipase immobilized on ferrous oxide nanoparticles (Fe₃O₄_PDA_Lipase), as catalysts respectively. Fuel properties of biodiesel i.e. Kinematic viscosity (4.98 ± 2.20 mm²/mL, 40 °C), Flash point (150 ± 2.01 °C), Fire point (167 ± 2.52 °C), Cloud point (3.0 ± 0.2 °C), Pour point (6.1 ± 0.5 °C), Relative density (0.86 ± 0.04 g/cm³, 15°C) and Carbon residue content (0.02 % by mass) were determined. Hence, the algal oil can be used for the production of biodiesel by using nano-biocatalyst.