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Optimization of Biodiesel Production from Yellow Oleander (Thevetia Peruviana) using Response Surface Methodology

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Abstract

Due to growth in population and economic development of the nation, particularly in developing countries like India, has led to huge increase in energy demand. Due to depletion of non-renewable petroleum sources and recent increase in petroleum prices and uncertainties concerning petroleum availability have generated interest in renewable energy sources wherein the biodiesel places an important role which is derived from plant origin for diesel engines. In this study, we used Response Surface Methodology in order to optimize the reaction factors for biodiesel production from non edible Yellow Oleander oil. A central composite rotatable design was used to study the effect of catalyst concentration, quantity of methanol, Reaction time and Reaction temperature for the conversion of fatty acids to methyl esters. Using Response Surface Methodology, a quadratic polynomial equation was obtained for biodiesel yield by multiple regression analysis. The optimized values of transesterification process parameters were 75 minutes of Reaction time at Temperature of 70\textdegree C with a Methanol: oil ratio of 11:1 (v/v) and Catalyst concentration of 2.8 grams (w/v), where Calcium oxide (CaO) was used as Heterogeneous base Catalyst. The predicted results were compared with actual results obtained by RSM software.

Keywords: Fatty acid Methyl Ester; Optimization; Response Surface Methodology (RSM); Transesterification; Yellow Oleander.
1. Introduction

Vitality usage and extraction assumes significant part in the financial advancement of any nation. Expanding populace thickness and financial advancement, especially in developing nations such as India, has prompted gigantic interest of vitality sources. Fossil energizes are the real wellsprings of vitality. More than couple of decades, the world is confronting with the issues identified with fossil fuel consumption and natural contamination? The fast extraction and utilization of fossil powers have prompted exhaustion in petroleum saves. Petroleum-based energizes are separated from constrained stores. What's more, just couple of locales of the world are suited with these stores. Subsequently, different nations which are not having these assets are confronting the issues of vitality emergency. This is mostly because of the import of rough petroleum. It prompts a consistent increment in the expense of petroleum-based powers. The decrease of world petroleum holds, the insecurity of petroleum sources, late trek in petroleum costs and absence of accessibility of petroleum items have created enthusiasm for the advancement of interchange powers for diesel motors. Biodiesel shapes an option fuel, whose properties are nearly like the routine diesel. Biodiesel is an unsaturated fat alkyl ester which is renewable, biodegradable and non contaminating fuel which can be gotten from palatable and non consumable oil seeds by transesterification process with a liquor in vicinity of Impetus [1].

In the present trial work clarifies the transesterification of yellow oleander oil by utilizing methanol and Calcium oxide (CaO). Yellow oleander (Karabi) seeds are non-palatable seeds which are acquired from Thevetia Peruviana bush, which fits in with Apocyanaceae Family, Cascabela Class and C.peruviana Species. There are two assortments of plants, one with yellow blooms, yellow oleander and other with purple blossoms, nerium oleander [2]. The organic products are green in shading and get to be dark on aging. Every natural product contain a nut which is longitudinally and transversely separated. Every organic product contains 1-4 seeds in its bit [2]. The Karabi seeds contain 63% of oil [3] and the cake include 30-37% of protein [2]. All parts of plant are toxic because of vicinity of heart glycosides [5]. Every well developed tree yields 400-800 natural products for each year, contingent on precipitation [2]. The seeds are additionally utilized as a part of the treatment of heart issues, asthma and skin issues [4]. In this study, Yellow oleander biodiesel was gotten by transesterification process by utilizing Heterogeneous impetus, which is a greater number of worthwhile than homogenous impetus. Heterogeneous impetuses are more satisfactory in view of their primary favorable circumstances, for example, detachment of impetus is simple and immaculate last items can be acquired, its non-destructive nature and eco-accommodating. In any case, larger part of heterogeneous impetuses are more costly and intricacies in arrangement of impetus, henceforth their utilization in mechanical applications is constrained [7, 8]. Heterogeneous base impetus named as calcinated CaO is utilized for the present work.

Reaction Surface Procedure (RSM) is a valuable measurable method, utilized for the improvement of perplexing procedures and for the most part it decreases the quantity of examinations to be done to get adequate information for a factual sensible result. We streamlined the related response components utilizing focal composite rotatable configuration (CCRD). The CCRD groups the point of interest to ascertain reactions by using just few arrangements of trial information in which all components are fluctuated inside of a chose range.

2. Materials and Methods

The yellow Oleander organic products are gathered specifically from oleander plants and are dried altogether in regular daylight and dried natural products are squashed to get the seeds. The seeds are pounded by utilizing mechanical expeller to get crude oil. This oil is sifted and utilized for transesterification process. Methanol and Calcium oxide impetus were utilized as a part of this work. The examinations were led in a research center scale setup with hermetically sealed stops to keep the vaporization of methanol from the response blend. The blending velocity of the blend keeps up consistent for all keeps using so as to run attractive stirrer. The refining setup was utilized for recuperation of methanol and impetus likewise recouped and reused.
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