International Journal on Emerging Technologies **10**(2): 291-298(2019)

ISSN No. (Print) : 0975-8364
ISSN No. (Online) : 2249-3255

A Novel Method Applied to the Production of Biodiesel from Neem Oil

A. Balasundaram[1,2] and A. Cyril[3]

[1]Research scholar, Department of Chemistry, Alagappa University, Karaikudi, India.
[2]Department of Chemistry, Arumugam Pillai seethai Ammal College, Thiruppattur-630211, India.
[3]Head, Post graduate & Research Department of Chemistry, R.D. Govt. Arts College,Sivagangai-630561, India.

(Corresponding author: A. Balasundaram)
(Received 30 April 2019, Revised 20 July 2019 Accepted 29 July 2019)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: In this study, a new type of process is applied to the conversion of neem oil into biodiesel. This method involves complete saponification of the neem oil by reacting it with sodium hydroxide solution to give sodium salt of fatty acid. This sodium salt of fatty acid called soap when treated with a mineral acid such as concentrated sulphuric acid separates into four layers, the top layer is the free fatty acid, is easily separated and then esterified with ethanol in the presence of a mineral acid which acts as a catalyst to get the final product neem oil biodiesel(NOBD) and hence this new method of production of biodiesel is named SAFALE (Saponification, Fatty Acid Liberation and Esterification). The product obtained by the above process is analyzed and confirmed by GC-Mass spectra and FT-IR spectra. This process does not involve high temperature and pressure. The main advantages of this method are less processes time, less effluent discharge, toxic materials are not involved, more yield, and more environment friendly compared with the only available two-step process in the production of biodiesel from raw neem oil, which usually contains more than 5% of free fatty acid.

Keywords: Neem oil Biodiesel, free fatty acid, saponification,esterification, and Gas chromatographic- Mass spectra.

I. INTRODUCTION

With the desperate search for a suitable replacement of automotive fossil fuels, mainly the petrodiesel, researchers across the world are trying to identify the feedstock for the economical production of biodiesel without making competition for food-based edible vegetable oils.

In countries like India, the non-edible neem oil obtained from the tree called *Azadirachta indica* is a suitable and viable option for conversion to biodiesel, this oil-bearing tree can be grown in various geographical location of India with different percentage of oil content of 30-60% [1-3]. The climatic condition in India is very much favorable for the growth of neem trees and requires less attention and irrigation for the production of neem seeds compared to any other type of oil seed bearing crops, average annual neem oil production in India is about 30000 tons [2]. At present, there is a good market for neem oil due to its use of its bioactive compound called 'Azadirachtin' in organic farming activities as natural pesticides [4]. Azadirachtin can be separated from neem oil during the oil extraction process,and this oil can be used for biodiesel production [5], which has no other applications.

The conversion efficiency and applicability of transesterification of any vegetable oils (triglycerides) to biodiesel mainly depend upon the free fatty acid content. The free fatty acid content of more than 2% in the feedstock will not only decrease the total yield of biodiesel but also makes the much favorite base catalyzed homogenous process more complicated and time consuming due to the formation of soap, forming an emulsion between biodiesel and glycerol making the separation of biodiesel very difficult [6]. The soap formed has to be removed by washing the reaction mixture several times, and the effluent has to be discharged to the environment before getting the final product biodiesel, making this transesterification [25] process very difficult, less economic and environmentally less favorable. Ragit *et al.* carried out transesterification of neem oil to get a biodiesel yield between 41.53 to 87.69%, most of his trial out of 81 gave a low percentage of conversion [7].

To produce biodiesel at a low cost, two factors gain much importance. One is getting low-cost feedstock [26],and another is finding a suitable and economical process to convert that feedstock into biodiesel. Life cycle analysis, in the production of biodiesel by Varanda *et al.,* showed that biodiesel obtained from oil containing a high percentage of free fatty acid is more economical [8]. Generally, the low-cost feedstock contains a higher percentage of free fatty acid and hence, a new type of process for the utilization of this kind of feedstock has to be investigated [9]. The free fatty acid content in oil could vary to a much extent, even for a single batch of oilseeds depending upon the moisture content, the process used in the extraction of oil and conditions of storage [10]. The raw neem oil generally contains 5 to 25% of free fatty acid depending upon the feedstock. Hence many researchers tried synthesizing biodiesel from neem oil using the two-step process [11-15], that is the esterification followed by a transesterification process.

Even though the yield obtained in this two-step process (esterification followed by transesterification process) is better than the alkali-catalyzed transesterification process, the two-step process still suffer from many disadvantages such as long processing time to get the final product, formation of soap when the process temperature is more than 60°C [12], removal of methanol before water washing at the end of the second step to avoid soap formation [5]. The pretreated oil in the first step contains water and the acid catalyst, which has to be