Available Online at

http://www.ijcpa.in

IJCPA, 2014; 1(4): 197-199

International Journal of
CHEMICAL AND PHARMACEUTICAL
ANALYSIS

ISSN: 2348-0726

Research Article

Biodiesel Production from Karanja oil and Improve its Flow Property by using Karanja Cake Adsorbent

V. N. Ganvir, Mayuri Chaudhari*

Department of Petrochemical Technology, Laxminarayan Institute of technology, Nagpur, India.

Received: 21 July 2014 / Revised: 24 August 2014 / Accepted: 02 September 2014 / Online publication: 30 September 2014

ABSTRACT

The main objectives of the present research work was to study feasibility of Karanja oil for the production of biodiesel, optimization of different parameter for high yield of Karanja oil to biodiese and the purification of biodiesel using Karanja seed cake adsorbent. The composition of the Karanja seed cake activated carbon were studied to better understand its properties as an adsorbent Karanja Seed Oil Cake is by-product after oil extraction, which otherwise goes waste or as fertilizers, is used for Activated Carbon Preparations. Flow property of Karanja biodiesel was found to be improved by passing it through the Karanja Cake adsorbent.

Keyword: Karanja, Methyl ester, Purification, Activated carbon.

1. INTRODUCTION

Due to the growth of human population and industrialization consumption of Petroleum has been increased, which caused depleting fossil fuel reserves and increasing petroleum price. Vegetable oils hold promise as alternative fuels for diesel engines. But their high viscosities, low volatilities and poor cold flow properties have led to the investigation of various derivatives. Fatty acid methyl esters, known as Biodiesel, derived from triglycerides by transesterification with methanol have received the most attention. Biodiesel is a fatty acid methyl ester (FAME) formed from renewable sources with short carbon chain alcohols in the presence of some catalyst.

In India, with abundance of forest resources, there is a number of other non-edible. Among these, Karanja (*Pongamia glabra*) and Jatropha (*Jatropha curcas*) have been successfully proved for their potential as biodiesel [1]. In this study, the production of biodiesel from Karanja oil through base catalyzed transesterification was investigated. After separating the glycerol, the crude methyl esters were purified using activated carbons produced from Karanja seed cake[2]. Solid waste disposal has become a major problem in vegetable oil mill / refinery and biodiesel plant. Either it has to be disposed safely or use for the recovery of valuable materials. Therefore, AC has been prepared from Karanja cake which is thrown out as a waste from Karanja oil mill and biodiesel plant have no further use after seed removal. After the glycerin removal, biodiesel can shows traces of alcohol, catalyst, glycerin and water. Beside these products, traces of unreacted glycerides (mono-, di- and tri-acylglycerides) can also be found[3]. With the objective to attend the international specification for commercialization, it is fundamental the use of a purification step. Biodiesel purification process with water is normally used due its capacity to solubilize the glycerin, methanol and catalyst, allied to its abundance and low cost. However, the use of water can cause some problems as emulsion formation, preventing the separation of the esters and allowing the formation of free fatty acids and soaps[4, 5].

Corresponding Author:
Email: mayurichaudhari44@gmail.com

2. MATERIALS AND METHODS

2.1 Evaluation of feedstock

The various properties of Karanja Oil, taken as feedstock for Biodiesel preparation, were evaluated.

Table 1: The physiochemical properties of raw Karanja oil

Sr. No.	Property	Test value
1	Colour	Dark brown
2	Kinematic viscosity	35.325 cSt at 40 ^{o}C
3	Acid value	5.3295 mg of KOH / gm of oil
4	Saponification value	178.1176
5	Molecular weight	944.881
6	Specific gravity	0.9345 gm/ml at 30 ^{o}C
7	Flash point	184^{o}C by Cleveland Open Cup Apparatus
8	Fire point	189^{o}C by Cleveland Open Cup Apparatus.

Based on the properties of Karanja oil the Methanol required for biodiesel preparation was calculated.

2.2 Biodiesel preparation from Karanja Oil

The FFA contents of Karanja oil collected is high, a two step process, i.e., acid catalyzed esterification, followed by based-catalyzed transesterification process, is selected for converting it into methyl ester. This is to avoid the problem of saponification. The first step, i.e., acid catalyzed esterification is for the reduction of FFA, which is mainly a pretreatment process. The process used sulphuric acid as acid catalyst. Once the FFA contents in Karanja oil reduce to 1-2%, the base catalyst transesterification is applied to get biodiesel.

2.3 Preparation of activated carbon

a) Impregnation

Impregnation of karanja cake were done with (0.25, 0.5, 1.0, 1.5, 2.0) N phosphoric acid. 2 gm of sample is impregnated with appropriate volume of phosphoric acid of different concentration. The impregnated sample was washed with distilled water till we get 7 pH.

b) Carbonization

After drying, the samples were placed in crucibles and into a high temperature furnace for carbonization. The carbonization temperatures used were, 500-800°C.

2.4 Flow Properties optimized via adsorption on Karanja adsorbent

Biodiesel obtained was then treated with adsorbent. A bed of 10 cm height was packed with 5 grams of Activated Carbon. Next, crude methyl esters were transferred into the column and allowed to pass through the adsorbent bed with a flow rate of (15 drop/min).The samples were then collected after passing through the bed. The viscosity of sample was then calculated using Ostwald's D type viscometer.

3. RESULTS AND DISCUSSION

3.1 Calculation for first stage

The reaction time in all the run studied in this works was taken as 10 min for the feed stock Karanja oil in an Oscillatory Baffled Reactor under the optimum conditions for biodiesel production are 1:6, 1:9, 1:12 oil to alcohol ratio, catalyst concentration 1-5 vol % sulphuric acid, reaction time of 10 minutes for first stage. The graphs showing responses are depicted below in fig.1 and fig.2:

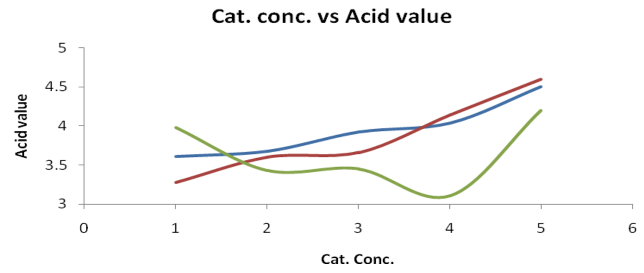

Fig.1: Graph of catalyst concentration versus acid value

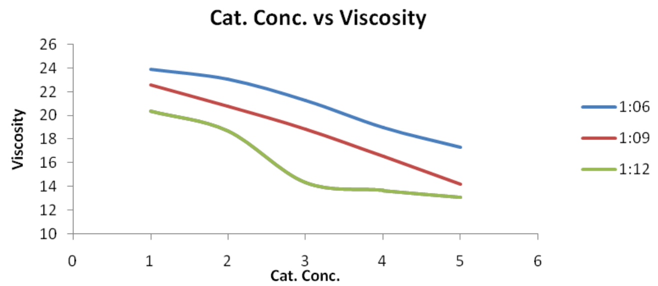

Fig.2: Graph of catalyst concentration versus viscosity

3.2 Calculation for second stage

Experimental work was carried out to study the effect of Cat. Conc. on biodiesel properties, at room Temperature (34-36^{0}c), catalyst concentration = 0.3-0.7 wt%, Reaction time = 10 min. This data is represented in below mentioned graphs (Fig.3 and Fig.4).

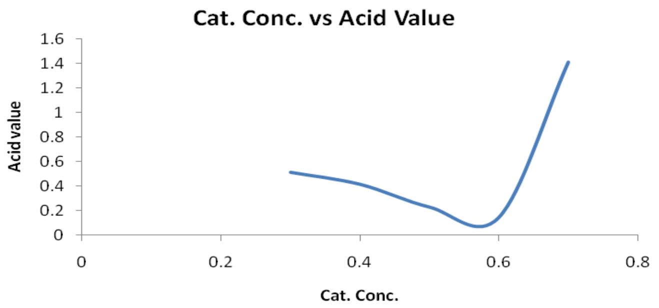

Fig.3: Graph of catalyst concentration versus acid value

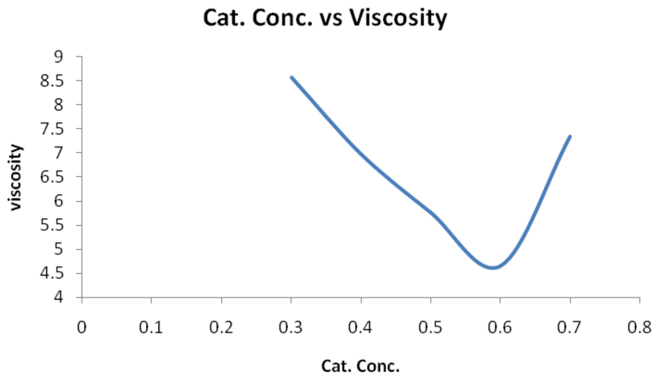

Fig.4: Graph of catalyst concentration versus viscosity

3.3 Calculation for third stage

Table no. 2 shows percentage decrease in viscosity and density after passing biodiesel through Karanja cake activated carbon.

Table 2: Run Summary for Third stage

Sr. No.	Amount of Biodiesel	Amount of Activated Carbon	initial viscosity	final viscosity	initial density	final density	% decrease in viscosity	% decrease in density
1.	25	5	8.56	5.7933	0.874	0.7588	32.321	13.18
2.	25	5	6.98	5.086	0.8691	0.7188	26.925	17.29
3.	25	5	5.76	4.9455	0.847	0.6658	14.141	21.393
4.	25	5	4.655	3.5325	0.816	0.6596	24.1138	19.1667
5.	25	5	7.342	6.499	0.879	0.7026	11.482	20.064

4. CONCLUSION

Karanja cake Activated Carbon was successfully used as an adsorbent for purifying biodiesel from Karanja oil showing efficiency in increasing the flow properties of biodiesel. The main advantage of using the Karanja cake Activated Carbon as an adsorbent is that it facilitates complete utilisation of Pongamia Pinnata besides contributing to waste management. The study showed that in general, using activated carbons for biodiesel purification resulted in higher yields and better fuel properties.

REFERENCES

1. Ghadge SV, Raheman H. Process optimization for biodiesel production from mahua (*Madhuca indica*) oil using response surface methodology. Bioresource Technology 2006; 97(3):379-384. [Google Scholar]
2. Saksule AS. Adsorbents from Karanja Seed Oil Cake and Applications". ISSN 2012;2278. [Google Scholar]
3. Crittenden B, W John Thomas . Adsorption: Technology and Design". Reed Educational and Professional Publishings. Woburn: 1998. [Google Scholar]
4. Sharma YC, Singh B. Development of biodiesel from karanja, a tree found in rural India". Fuel 2008; 87(8-9):1740-1742. [Google Scholar]
5. Onorevoli B. Candice Schmitt Faccini. "Rice husk ash as an adsorbent for purifying biodiesel from waste frying oil". Fuel 2012; 92(1):56-61. [Google Scholar]