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Biodiesel Production using Hexane as Co Solvent

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Abstract: *As demand for petroleum is increasing day by day, also the emissions of harmful gases as carbon dioxide, oxides of nitrogen, are increasing. Therefore the need for alternative fuels such as bio fuels is increasing. This has led to the development of fuels from various renewable sources such as, fats and oils. Several fuels can be derived from these feed stocks. One of them is biodiesel. Biodiesel is a mono alkyl ester of vegetables oils and animal fats produced mainly by Transesterification of oil and fats with alcohols in the presence of acid, alkali or enzyme base catalysts. The co-solvent helps the reaction to take place in single/homogeneous phase and hence facilitate the reaction (better mass transfer) to proceed and reducing the reaction time.Various researches have been carried out for the production of Biodiesel from various feedstocks by various methods. But till date no research is carried for the production of biodiesel from Jatropha oil by using Hexane as co solvent. The objective of this research work was to produce Biodiesel from Jatropha oil by Transesterification method using hexane as co-solvent, to determine optimum conditions (co-solvent and catalyst content) for Biodiesel production and finally to determine various properties of the produced Biodiesel according to ASTM methods.*

Keywords*: JatrophaCurcas, Transesterification, Hexane (Co solvent), Biodiesel, Reaction time*

1. INTRODUCTION

Biodiesel is an alternative fuel for diesel engines that is produced by chemically reacting avegetable oil or animal fat with an alcohol such as methanol. The reaction requires a catalyst, usually a strong base, such as sodium or potassium hydroxide, and produces new chemical compounds called methyl esters. It is these esters that have come to be known as biodiesel [1].

The use of animal fats and edible vegetable oils for the production of biodiesel has recently been given great attention. However, as the population is rising at an alarming rate the demand for vegetable oils for food has been increasing tremendously in recent years, it is not economically feasible to justify the use of these oils for biodiesel production as it is competing with food production [2]. The economy of the process is the main issue which poses a question mark on the process especially in the developing countries like India [3].

Therefore attention is given to the non edible oil feedstocks such as Jatropha oil that will be significant as non edible seed oil sources for biodiesel production. Jatropha can be a good option in the present scenario in South Asian Countries [4]. Jatropha is a wild plant; it can be grown in marginal and uncultivated lands.

The objective of this paper is to describe the processing and production of biodiesel using hexane as Co- solvent. The emphasis will be on optimization of co-solvent content (i.e. hexane) and catalyst amount (KOH).

2. MATERIALS AND METHODS

The feedstock i.e. Jatropha oil, co-solvent (hexane), catalyst potassium hydroxide (KOH), alcohol (Methanol) are employed to get Biodiesel by Co-solvent method.The methodology involved is the transesterification reaction. It is the most conventional method used for biodiesel synthesis, However the major drawback of this method is that the alcohol is not completely miscible with the oil. Hence a non uniform reaction mixture is obtained, which inhibits the proper mass transfer between the two components.

The co-solvent method is used in order to get rid off this problem. The co-solvent used (hexane) makes the reaction mixture homogeneous and it speed up the reaction. The main advantage of adding the co-solvent is the faster reaction rate, higher yield and better separation from the by-products such as glycerol[5].

3. RESULTS

As per the literature survey keeping the other variables constant (reaction time, reaction temperature, alcohol content) the co-solvent content and the catalyst amount was varied and the following results are obtained

3.1 EFFECT OF CO-SOVENT VOL.%

TABLE 1: Co-Solvent Volume vs Yield

S. No.	Oil Used (esterified Jatropha) *ml*	Co-Solvent (*vol. %*)	Catalyst (*wt .%*)	Methanol (*vol %*)	Time (*Mins.*)	Temperature (°*C*)	Yield (%)
1	100	1	1.5	20	60	55	89
2	100	5	1.5	20	60	55	90
3	100	8	1.5	20	60	55	90.5
4	100	12	1.5	20	60	55	92
5	100	15	1.5	20	60	55	94
6	100	20	1.5	20	60	55	95
7	*100*	*25*	*1.5*	*20*	*60*	*55*	*96*
8	100	30	1.5	20	60	55	91.5
9	100	35	1.5	20	60	55	90

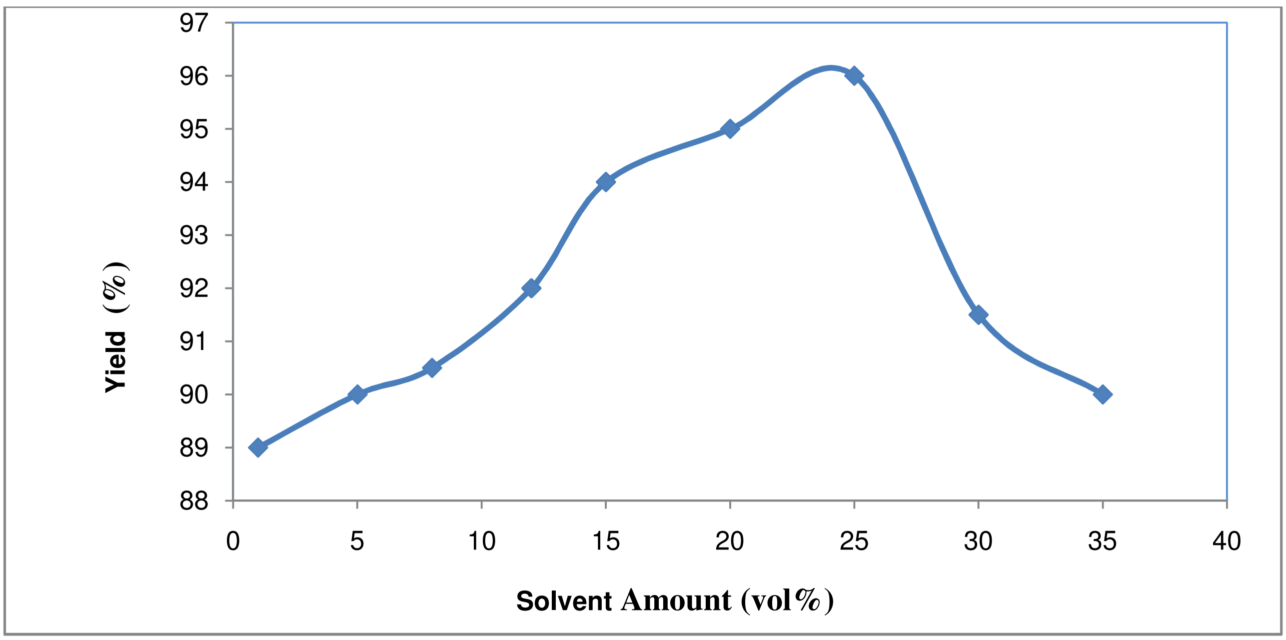

Fig. 1. Co Solvent (Hexane) Volume% v/s Volumetric Yield of Biodiesel Produced from Esterified Jatropha Oil Using 20 vol.% Methanol,1.5 wt.% Catalyst (KOH) at 55°C and for 60 min of reaction time.

3.2 EFFECT OF CATALYST CONCENTRATION

TABLE 2: Variation of yield with KOH Percentage

S. No.	Oil Used (esterified Jatropha) *ml*	Solvent (*vol. %*)	Catalyst (*wt. %*)	Methanol (*vol. %*)	Time (*Mins.*)	Temperature(°*C*)	Yield (%)
1	100	25	0.25	20	60	55	89
2	100	25	0.50	20	60	55	92
3	*100*	*25*	*1.00*	*20*	*60*	*55*	*96*
4	100	25	1.50	20	60	55	96
5	100	25	2.00	20	60	55	75

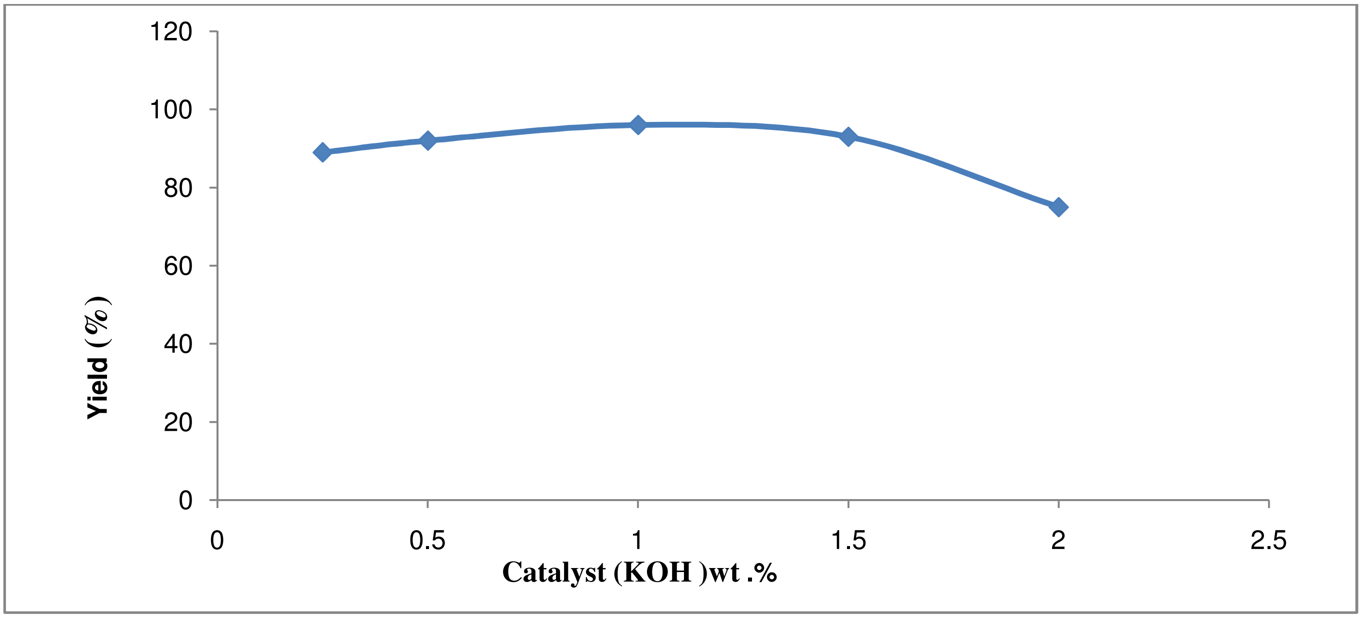

Fig. 2. Effect of Variation of KOH (Wt. %) V/s Volumetric Yield of Biodiesel produced from Esterified jatropha Oil Using 20 vol. % Methanol, 25 vol. % Hexane, for 5 min. at 55°C by Co-Solvent Method

4. CONCLUSIONS

On keeping the other reaction conditions constant (such as reaction time, reaction temperature and alcohol content) the co-solvent content and the catalyst contents are optimized. It can be concluded from the data obtained that the biodiesel yield increases initially as the co-solvent content increases and then decreases. The maximum yield is obtained at 25 volume % of hexane as co solvent. At the higher concentrations than 25 vol.% the yield decreases due to over dilution effects. The later run is performed so as to optimize the catalyst content. Same as earlier the yield of biodiesel increases as the catalyst (KOH) in weight% increases and becomes maximum (i.e.96 %) at 1 wt.%. The yield decreases further as we increase the catalyst content because it favors saponification reaction.

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