Research Article

Modification of "*Shorea robusta* oil" by esterification for getting improved Property

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ABSTRACT

Biofuels are obtained from renewable sources like vegetable oils, animal fats etc.and these are considered as an alternative to fossil fuels. The intended application of bio-fuels has been replacement of petroleum diesel. However, due to higher viscosities, these fuels are trans-esterified to produce fatty acid alkyl esters or biodiesel for engine applications. The major feed stocks recognized for biodiesel production in India are Jatropha, Karanja etc. In this context, the present work deals with an underutilized vegetable oil known as "Shorea robusta" as a potential feedstock for biodiesel production which can significantly increase the feedstock availability. When oil is modified by using esterification and trans-esterification methods we get different modified oil which has favourable for mixing in normal fossil fuels. Extracted seed oil was modified by esterification and trans-esterification method. We obtained improved characteristics in this oil. It was also confirmed by analysis FTIR and other physical properties Such type of modified oil also show improved other properties like kinematic viscosity, aniline point, cloud point, pours point etc.

Key words: *Biofuel, Sal oil, Esterification, Tran-esterification.*

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INTRODUCTION

Shorea Robusta (Sal) belongs to the family named as *Dipterocarpaceae*. Sal has an important role in the economics of central states of India (i.e. Orissa, Jharkhand and Madhya Pradesh), cover about 45 % of forest area[1]. Sal is a deciduous tree that reaches up to 50 m height. Sal plant is famous for their seed and oil. Sal fruit pulp is edible; it contains sugar, gum, malic, citric and tartaric acids. Sal is a crucial plant for veterinary medicines (used as vaccine and medicine for respiratory diseases). Sal fruit content 66.4% of kernel and pod, remaining 33.6% is shell and calyx[2]. Sal seeds are processed mainly for its fat or oil. Sal also has a leading role in food and cosmetic sectors. The extracted Sal oil is greenish brown colour and characteristic odour. The refined oil from Sal seed is used for cooking purposes and substitutes for cocoa butter in chocolate manufacturing industries. It also used for the production of vanaspati, paints, pigments, lubricants, biogas and biodiesel. Besides, de-oiled cake also has a good export market for cattle, poultry and fish feed [3].

Sal seed is light brown in colour, contains calyx and wings. It is mainly used for oil extraction. The de-shelled seeds contain a thin seed coat and seed pod. The kernel has five segments covering the embryo.About 2 kg of seed yields 1 kg of kernel [4]. These seed contains 34.6% of fat, 8.46% of moisture, and 6% of ash. Sal seed has a largest demand in Indian export market and seven multinationals companies that account for 60% of the global chocolate and confectionery production. Sal fat can also be used as a substitute for cocoa butter [5]. Sal seed contains around 60 to 80% moisture in them. It is dried up to 8 to 10% moisture content**.** The most common methods of Sal drying are done by sun drying method. Drying process is carried out to minimize processing loss and storage loss [6].

MATERIAL PROCESSING

Ssal oil seeds were collected from the market of Dehradun and then processing is done. Sal seeds are processed in two ways:

In one process seeds are beaten on a plain hard ground area with a wooden stick to remove the wings. In this method or process the wings are separated from the seed kernel. This is the recommended process for manual collection since quality and nature of kernels remains unchanged.

In second process seeds are spread on plain dry hard ground area and putting a light fire to Sal seed. With the light fire the wings are burnt. The round seed kernel with shell and covers remain unhurt. This is a risky process, but easier for de-winging. Sometimes fire adversely affects seed and oil contents. In case of cloudy weather or pre-monsoon showers this is the only process for de-winging fruits. Other methods like Sal seeds are spread on hard ground surface and pressed by a wooden roller or stone roller. During the process of rolling under pressure the kernels are come out from the whole seed. This can be separated by using natural air blowing or artificial air blower. After this process, Sal seed kernels were kept in dry place to increase the quality of oil. Then oil was extracted from Centre for aromatic Plants(CAP) , Selaqui, Dehradun. The extracted crude Sal oil is greenish-brown colour and has a characteristic odour. Due to the presence of more saturated fatty acids, it is solid at room temperature. Because of this, it is known as Sal fat or Sal butter. oil was extracted by solvent extraction, in which the Sal seeds are pressed as flacks first in a flaker mills and then exposed to solvent extraction. The oil contains 45-60% stearic acid, 18-carbon saturated fatty acid, and 35-50% of oleic acid, which is a mono unsaturated fatty acid, with 18 carbon atoms (Table II). The extracted fat is used as cooking oil, after refining. And also refined oil is used as substitute for cocoa butter in chocolate manufacturing

So formed oil was tested for its properties lile physicochemical properties, hydrolysis, vitamin contents and storage study of seed oil and its component of fatty acids compared well with those of other edible vegetable oils.

Esterification

Esterification is the chemical process for making esters, which are compounds of the chemical structure R-COOR', where R and R' are either alkyl or aryl groups. The most common method for preparing esters is to heat a carboxylic acid with an alcohol while removing the water that is formed. A mineral acid catalyst is usually needed to make the reaction occur at a useful rate. Esters can also be formed by various other reactions. These include the reaction of an alcohol with an acid chloride or an anhydride. The chemical structure of the alcohol, the acid, and the acid catalyst used in the esterification reaction.

Transesterification

Transesterification is a process where an ester is transformed into another through interchange of the alkoxy moiety. Since the reaction is an

equilibrium process, the transformation occurs essentially by simply mixing the two components. However, it has long been known that the reaction is accelerated by acid or base catalysts.

RCOOR' + R'OH < RCOOR" + R'OH

MATERIALS

Sal oil, HCL, Ethyl hexanoyl, Sodium, Sodium hexanaote, Tuolene, Thermometer, Round bottle flask, Magnetic stirrer, Dean and Stark trap, Condenser, Heating mental , Fullers earth .

EXTRACTION OF OIL

Sal seeds were collected from sal plant. Sal oil was extracted by using cold pressing method. It was extracted in centre for aromatic plants Selaqui (CAP).

Esterification method- 40 gm of sal oil was taken and dissolved in about 100 ml of tuolene with the help of glass rod and then cooled to 10 degree centigrade .Then 40 gm of anhydrous aluminum chloride was slowly added over a period of one hour. the temperature was allowed to rise to 0 degree centigrade and reaction was maintained at that temperature for 12 hours with constant stirring .All the contents were to be poured in to the water containing 10% of HCL. Upper layer was washed repeatedly with water to remove acidity. The entrained water in the upper layer was removed by dean and stark trap. The tuolene was distilled off and lost traces were removed under vaccum. The vaccum dried product was percolated over fullers earth to remove organic acidity to obtain pale yellow product. Physio chemical characteristics show that it is heavy viscosity lubricant having moderately high viscosity index and pour point comparable to that of a mineral oil .Iodine oxidation stability is poor and deposit forming tendency is very high and therefore it is not suitable as a lubricant except for very moderate operations.

RESULTS

Characterization of extracted oil and modified esterified oil was done by using FT-IR and other properties were determined. FT-IR are shown in Fig.-1and 2.Fig 1shows FT-IR of sal oil and while fig-2 is for modified oil by esterification.

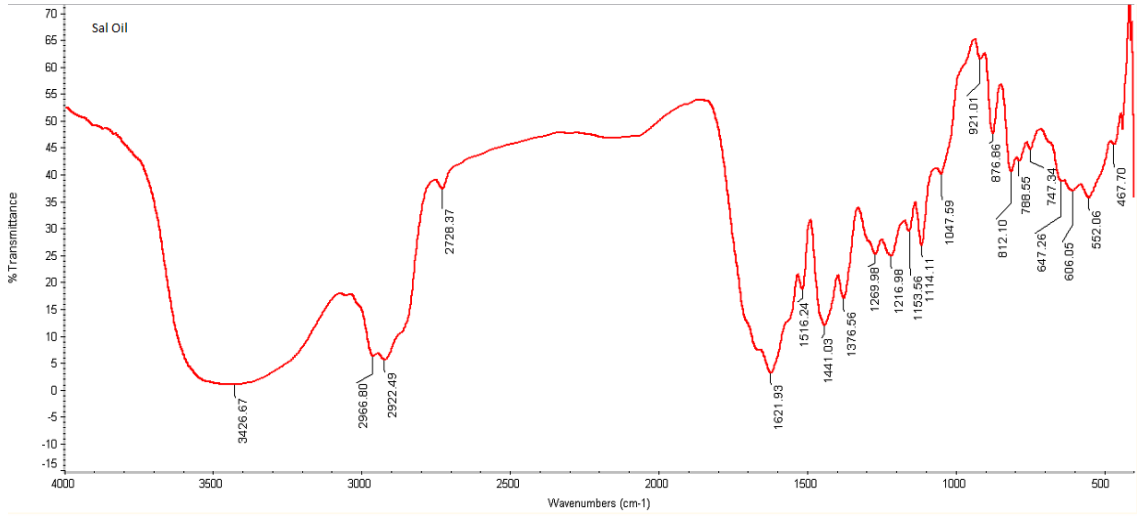

Fig.:1. Shows FT-IR of sal oil

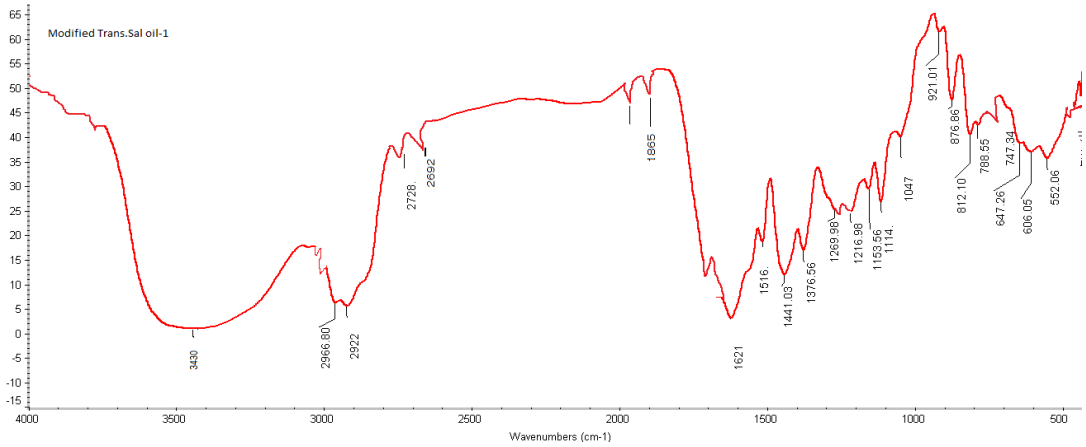

Fig.: 2. FT-IR of modified oil by esterification

The various functional groups so far identified in the sal oil modified esterification represented O-H group of an alcoholic group (3556-3430 cm^{-1}), and C-H of a normal alkenes chain group correspond to (2922-2960cm^{-1}). The value corresponding to (2692-2728cm^{-1}) indicates that the compound contains aliphatic C=O. The values corresponding to (1704-1865cm^{-1}) correspond to C=O group of an ester. The values corresponding to (1516-1441 cm^{-1}) correspond to normal CH_2 group, and the value corresponding to (1376cm^{-1}) indicates CH_3 group. Also the normal C-H bonds have been found as per the values identified include a range (650-1000cm^{-1})

Determination of Physical properties- Other Properties like kinematic viscosity, cloud point and pour point, flash point and fire point were also determined which have shown slightly improvement in these properties. Overall by esterification , sal oil or any other oil can be modified for improving its properties and can be used in blending with petrol or diesel.

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