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Biodiesel from Chicken Feather Meal

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Abstract
Introduction:
Biofuels are the major contributors of energy sources and an alternative fuels to fossil fuels. As the vegetable derived oils are becoming scarce even to human needs, we definitely have the need to find the alternative routes. Chicken feather meal consists of processed chicken feathers which has an approximate of 12% fat content, which could be used to make biodiesel and a good low cost raw-material for biodiesel production.. As the amount of chicken waste is continuously increasing industries have to focus on collecting chicken feather meal to make biodiesel.
Objective:
To study the Product yield by transesterification of chicken feather meal at different pH concentration and temperature.
Methodology:
Chicken feathers waste was obtained from a poultry processing unit, Tenali, A.P. Fat was extracted byheating at 100 ºC and filtered under vacuum followed by transesterification reaction followed by separation of two phases. Yield of biodiesel was determined by mass of biodiesel to mass of raw material ratio.
Results:
The extracted fat was found between 175 g to 300g from 1kg of chicken feather meal. Acid value was found out byvolumetric titration, whereas the viscosity by viscometer. Biodiesel yield ranging between 62% and 75% was obtainedby optimizing the pH concentration and temperature.
Conclusion:
The use of chicken feather meal as a cheap raw material for the production of biodiesel is a good strategy.Bio-diesel can blend with diesel at 20 percent with 80 percent of diesel to meet the current needs. It will become a major fuel resource in near future.

INTRODUCTION

Chicken feathers are waste products of the poultry industry. Chicken feather meal is processed at high temperatures with steam. This feather meal is used as animal feed and also as fertilizer. Chicken feather meal has high percentage of protein and nitrogen.A lot of waste feathers in billions of tons were generated each year by poultry units, and it was a great solid waste problem. 8 billion–plus broilers produced each year by the U.S. poultry industry leave behind some 4 billion pounds of waste feathers[1]. Chicken feather meal has a 12% fat content, which could be used as a nonfood feedstock to make biodiesel. Another advantage of this process, is there won't be lack of chicken-feed, because the fiber is taken from the central quill part. It leaves the fluffy feathers available to force-feed livestock. Feather fiber is quite cheap, and the gas tank equivalent would cost around $200. The amount of this waste is continuously increasing with the increase in fowl meat production[2]. Fossil fuels are degenerating quickly; there is a need to search an alternative fuel to meet the requirements of the demand around the globe. Biodiesel promises the best option to overcome from this is one of the best available resources that have come to the forefront recently[3,4]. In this paper, a detailed review has been conducted to highlight different related aspects to biodiesel industry. These aspects include, biodiesel feed stocks, extraction and production methods, properties and qualities of biodiesel, problems and potential solutions of using vegetable oil, advantages and disadvantages of biodiesel, the economic viability and finally the future of biodiesel[5].

MATERIALS AND METHODS:

Materials:
Commercially available feather meal, Hydrochloric acid, Potassium hydroxide (KOH), Diethyl ether and ethanol, Methanol (HPLC grade), phenolphthalein.
Methods:
Extraction of fat from chicken feather meal:
Chicken feather meal was obtained from three different poultry processing units, Tenali, Andhra Pradesh, India. Feather meal was washed several times with distilled water to remove dirt and extraneous impurities. 100g of feather meal in 1000ml of distilled water was stirred at 90ºCfor about 30 min on magnetic stirrer with hotplate and then cool to room temperature. Separate the extracted fat on the top layer from the bottom water layer by centrifuge at 10000 rpm for 30 min[7].
Production of Biodiesel
The fat layer was mixedwith 10ml of 1% potassium hydroxide solution andcentrifuge at 10000 rpm for 30 min to remove the free fatty acids and then heatedto 80ºC to remove water.The obtained fat was weighed and stored. 100g of this fat was heated to 50ºC for about 15 min to make the homogenized solution. Dissolve 10 grams of potassium hydroxide in 50 ml of methanol and add this solution to homogenized fat and place it ona shaking incubator (Thermo scientific, USA)for 2 hrs.at 60ºC, 300 rpm. The mixture was placed in a separating funnel and left overnight for the removal of glycerol, settled at the bottom[8,9,10].
Purification of Biodiesel
Crude biodiesel was placed in a rotary evaporator at 50ºC to evaporate the methanol. Then the crude biodiesel is

subjected to washing to remove excess catalyst by adding 50mL of a 0.1 N HCL solution, followed by distilled water and then the Biodiesel was heated at 80ºC to evaporate the water present and identification of the functional groups was done by FTIR analysis.

Acid Value ((ASTM D664) and Kinematic viscosity (ASTM D445)

1 ml of the biodiesel was dissolved in a 10 ml of isopropyl alcohol and titrated with a 0.1 M potassium hydroxide by adding 2-3 drops of phenolphthalein indicator.A small portion of Biodiesel was placed in a viscometer at 40°C to measure the kinematic viscosity[11].

Methanol and sediment tests

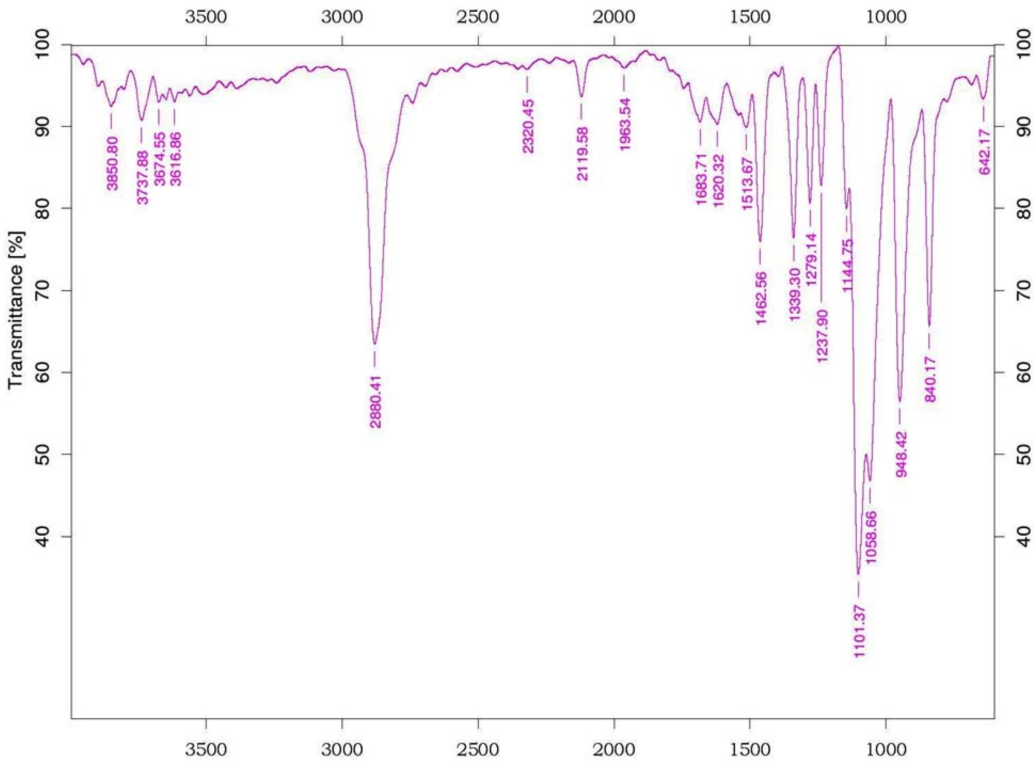
Dissolve 10 ml biodiesel in100ml of methanol, Biodiesel of good quality leaves a clear phase. Sediment test is performed by mixing 10ml of biodiesel with 10 ml of water. Biodiesel of good quality leaves no sediment particles after centrifuge at 2000 rpm for 10 min

RESULTS AND DISCUSSION

Figure-1 Biodiesel showing the clear bright phase after Methanol test

Biodiesel Yield And Quality

The amount of extracted fat recovered from various feather meals of broiler chickens we evaluated, ranged between 175g to 300g per Kg of chicken feather meal. The yield was found to be 30%. The biodiesel quality was assessed by specified ASTM methods.Acid value of biodiesel was measured by volumetric titration was 2.2 mg KOH g-1 .According to biodiesel standard ISO 14214 the acid value must be below0.50mg KOH g^{-1}.The property of kinematic viscosity is very important for a biodiesel as the efficiency relates to combustion of fuel. According to ASTM D6751 the acceptable viscosity range is between 3.5-5.9 mm^2s^{-1}. Our results showing the values of kinematic viscosity ranged between 7.65mm^2s-^{1}and 12.33mm^2s^{-1}. The pH of biodiesel was ranged between 7.23 and 8.00. Biodiesel should be bright, clear in appearance and free from waterand sediment[12,13]. The methanol test showing the results of our biodiesel was fully dissolved by forming a clear phase. Removal of methanol by rotary vacuum evaporator and removal of catalyst particles by thorough washing and heating the biodiesel at 90 ºC to evaporate water leads to get a better quality of biodiesel with clear phase[14].Our FTIR results providing the FTIR spectrum reveals the existence of the absorption bands C═O: Carbonylic compounds (aldehydes, acids, etc.) are the strong C═O: stretching absorption band in the region of 1963–1513 cm-1. C─O─C (Ethers): These stretching vibrations produce a strong band in the 1237–900 cm-1 region. C─H: absorption bands characteristic of the vibrations of C─H bonds, at 2880 cm-1.



CONCLUSION

In our present work biodieselproduction from chicken feather meal, which is a waste ingredient of poultry processing unit, provides us a new cheap raw material to produce biodiesel. Although the acid value and kinematic viscosity range of the biodiesel was little higher than the specifications of ASTM and European biodiesel quality standards, It would be possible to optimize the conditions in terms of yield and purity. However, Bio-diesel can blend with commercial diesel at 20 per cent with 80 per cent of diesel to meet the current needs. It will become a major fuel resource in near future.

REFERENCES

1. Kondamudi, Narasimharao, et al. "A green process for producing biodiesel from feather meal." Journal of agricultural and food chemistry 57.14 (2009): 6163-6166.
2. Alptekin, Ertan, and Mustafa Canakci. "Optimization of pretreatment reaction for methyl ester production from chicken fat." *Fuel* 89.12 (2010): 4035-4039.
3. David Pimentel1,3 and Tad W. Patzek2, 2005,Ethanol Production Using Corn, Switchgrass, andWood; Biodiesel Production Using Soybean andSunflower, Natural Resources Research, Vol. 14.
4. Fukuda, H.; Kondo, A.; Noda, H. J. Biodiesel fuel Production by transesterification of oils. BiosciBioeng. 2001, 91, 405–416.
5. D. Ramesh, A. Samapathrajan, P. Venkatachalam, Production of biodiesel from jatrophacurcas oil byusing pilot biodiesel plant.
6. Sadeghinezhad, E., et al. "A comprehensive literature review of bio-fuel performance in internal combustion engine and relevant costs involvement."*Renewable and Sustainable Energy Reviews* 30 (2014): 29-44.
7. Bhargava, K. K., and J. B. O'Neil. "Composition and utilization of poultry by-product and hydrolyzed feather meal in broiler diets." *Poultry Science* 54.5 (1975): 1511-1518.
8. Miao, Xiaoling, and Qingyu Wu. "Biodiesel production from heterotrophic microalgal oil." *Bioresource technology* 97.6 (2006): 841-846.
9. Dhiraj, D. and Mangesh, D., Biodiesel Production from Animal Fats and its Impact on the Diesel Engine with Ethanol-Diesel Blends: A Review, International Journal ofEmerging Technology and Advanced Engineering, 2(10),179 (2012)
10. Bhatti H.N., Hanif M.A., Qasim M. and RehmanA.,Biodiesel production from waste tallow, Fuel, 87 (13-14),2961-2966 (2008)
11. Dias, J. M., Alvim-Ferraz, M. C. and Almeida, M. F.,Production of biodiesel from acid waste lard, BioresourceTechnology, 100(24), 6355-6361 (2009)
12. Srivastava, A. and Prasad, R., Triglycerides-based diesel fuels, Renewable and Sustainable Energy Reviews, 4(2),111-133 (2000)
13. Kondamudi, N., Strull, J., Misra, M. and Mohapatra, S. K.,A Green Process for Producing Biodiesel from Feather Meal, Journal of Agriculture and food Chemistry, 57(14),6163-6166 (2009)
14. ASTM D 6751-6802, Standard Specification for Biodiesel Fuel (B100) Blend Stock for Distillate Fuels, (2004)