

A DESIGN AND IMPLEMENTATION OF BIO-OIL PRODUCTION FROM WASTE LEATHER

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ABSTRACT - There is an increase in the production and consumption of leather as the day goes by. All things need to be disposed after their usefulness, as waste. The needs to manage this waste from leather become more apparent. So these play a vital role in environmental pollution. But if these wastes are further processed by pyrolysis, valuable energy such as pyrolytic oil, char and gas can be obtained which can meet the crisis of energy. The problems faced by the increasing in leather waste and the increasing fuel crisis can be eliminated by making a system which can decrease the pollution due to Non-biodegradable things and increasing the availability of the alternative fuel. This was made by converting the waste materials into useful alternative oil by means of pyrolysis process.

KEYWORDS- Leather waste, pyrolysis, bio-diesel

1. INTRODUCTION

1.1 LEATHER WASTE:

The leather processing industry produces large amounts of solid organic wastes in the form of un-tanned (trimmings, fleshing, splits) and tanned (trimmings, splits and shavings) waste from raw hides and skins, semi-processed leather, as well as sludge as a result of wastewater treatment. If these solid wastes are not properly treated and disposed of, they can cause environmental damage to soil and groundwater as well as emissions of odour and poisonous greenhouse gases into the atmosphere. This website includes various options for different fractions [icm1] of solid wastes generated by the leather industry. These options have been successfully implemented by UNIDO. Results and lessons learned are included in this part of the Leather Panel website. Leather is one of the most widely traded commodities globally. The growth in demand for leather is driven by the fashion industry, especially footwear. Apart from this, furniture and interior design industries, as well as the automotive industry also demand leather. The leather industry has a place of prominence in the Indian economy due to substantial export earnings and growth. The Indian leather industry accounts for around 12.93 per cent of the world's leather production of hides/skins.



SKIN READY FOR LEATHER PROCESS

The country ranks second in terms of footwear and leather garments production in the world and accounts for 9.57 per cent of the world's 1 footwear production. Leather tanning is without a doubt one of the oldest human activities. In the beginning, skins obtained from hunting and livestock breeding could be used for clothing or tents, but they became stiff at low temperatures, while they rotted with heat. It was probably then that attempts were made to render them more flexible and stronger by rubbing in animal fats, the first rudimentary tanning process is mentioned in Assyrian texts and in Homers Iliad.

1.2 INDIAN LEATHER INDUSTRY:

The leather industry occupies a place of prominence in the Indian economy in view of its massive potential for employment, growth and exports. There has been an increasing emphasis on its planned development, aimed at optimum utilization of available raw materials for maximizing the returns, particularly from exports. The exports of leather and leather products gained momentum during the past two decades. There has been a phenomenal growth in exports from Rs.320 million in the year 1965-66 to Rs.69558 million in 1996-97. Indian leather industry today has attained well merited recognition in international markets besides occupying a prominent place among the top seven foreign exchange earners of the country. The leather industry has undergone a dramatic transformation from a mere exporter of raw materials in the sixties to that of value added finished products in the nineties. Policy initiatives taken by the Government of India since 1973 have been instrumental to such a transformation. In the wake of globalization of Indian economy supported with liberalized economic and trade policies since 1991, the

industry is poised for further growth to achieve greater share in the global trade. Apart from a significant foreign exchange earner, leather industry has tremendous potential for employment generation. Direct and indirect employment of the industry is around 2 million. The skilled and semi-skilled workers constitute nearly 50% of the total work force.

Table 1: The estimated employment in different sectors of leather industry.

SECTOR EMPLOYMENT	TOTAL
Flaying, curing & Carcass Recovery	8,00,000
Tanning & Finishing	1,25,000
Full Shoe	1,75,000
Shoe Uppers	75,000
Chappals & Sandals	4,50,000
Leather Goods & Garments	1,50,000

1.3 STRUCTURE OF INDUSTRY

The leather industry is spread in different segments, namely, tanning & finishing, footwear & footwear components, leather garments, leather goods including saddlery (seats for ride like horse riding seat) & harness (support), etc. n. The leather industry is classified into two major sectors i.e. the processing of animal skin into leather and manufacturing of leather goods such as shoes, bags, handbags & baskets, traditional hats(Karakul), apparels/garments, sport goods by small & medium but unorganized sector. For the processing of animal hide; availability of livestock, location, environment, & weather for upbringing of farm animals is highly favorable in the country while in the latter area small & medium production units with low production capacities are operating and the opportunity exists for expansion.

Table 2: The estimated production capacity in different segments is as under

PRODUCT	CAPACITY
Leather	
Hides	64 million pieces
Skins	166 million pieces
Footwear & Footwear Components	
a) Shoes	100millionpairs
b) Leather shoe uppers	78 million pairs
c) Non-leather shoes/ chappals etc	125 million pairs
Leather Garments	6 million pieces
Leather Products	70 million pieces
Industrial Gloves	40 million pairs
Saddlery	6000 pieces

2. METHODS AND MATERIAL

2.1 PYROLYSIS TECHNOLOGY

Pyro: heat, lysis: breakdown into pafis. Pyrolysis is chemical reactions in which large molecules are broken down into smaller molecules.

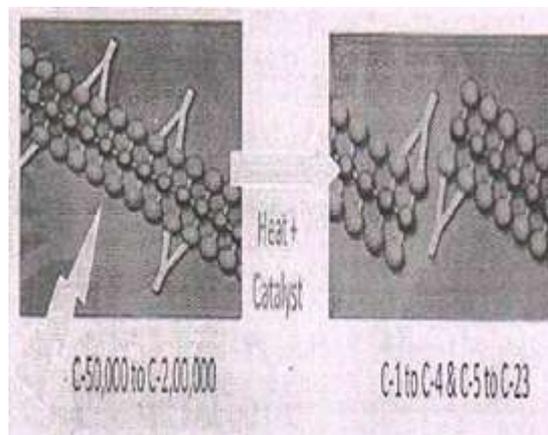


Fig -1; pyrolysis process

Simplest example of pyrolysis is cooking in which complex food molecules are broken down into smaller & easy to digestible molecules. Waste plastic and tire are long chain molecules or polymer hydro carbon. Pyrolysis technology is the industrial process of breaking down large molecules of plastic/tire into smaller molecules of oil, gas and carbon black. Pyrolysis of waste plastic or tire takes place in absence of oxygen, at about 350-550 degree C and reaction time is about 15-90 minute.

2.2 PYROLYSIS OIL:

Pyrolysis oil is sometimes known as bio crude oil or bio oil, is a synthetic fuel under investigation as substitute for petroleum. It is extracted by biomass to liquid technology of destructive distillation from dried biomass in a reactor at a temperature of about 500 degree Celsius with subsequent cooling. Pyrolysis oil (bio oil) is a kind of tar and normally contains too high level of oxygen to be a hydro carbon. As such is distinctly different from similar petroleum products

2.3 PYROLYSIS OIL CHARACTERISTICS:

The oil produced in a pyrolysis process is acidic, with a PH of 1.5-3.8. The acidity may be lessened by the addition of readily available base components. Little work has been done on the stability of bio oil acidity that has been altered with base components while the exact composition of bio oil depends on the bio mass source and processing conditions a typical composition is as falls water 20- 28 %, suspended solids and pyrolytic lignin 22-36yo, hydroxyl-acetaldehyde 8-120, levoglucosan 3-8%, acetic acid 4-8%, acetol 3-6%, sellubiosonl-2%, glycol 1-2 %, formic acid 3-6%. The

water molecules are split during pyrolysis and held separately in other compounds within the complex with the pyrolysis liquid. The distinction is significant, as the "water" in pyrolysis oil does not separate like standard fossil fuels.

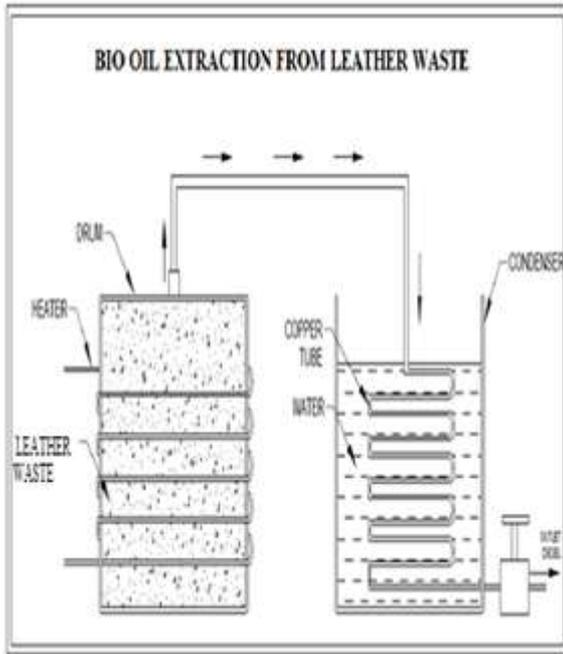


Fig- 2: 2D Diagram of bio-oil extractor

2.4 MANUFACTURING PROCESS

Manufacturing processes are the steps through which raw materials are transformed into a final product. The manufacturing process begins with the creation of the materials from which the design is made. These materials are then modified through manufacturing processes to become the required part. Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing.

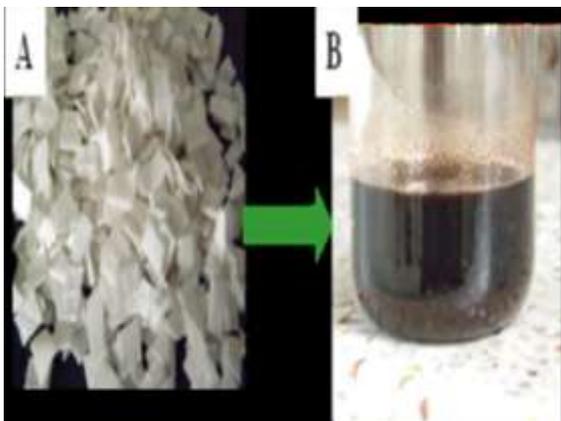


Fig-3: pyrolysis of leather waste; (a) shredded leather plates, (b) pyrolytic oil from leather

CONCLUSIONS

The biodiesel energy content is affected by which oil it is produced out of. The results indicated that the different FAME in each different biodiesel does affect the energy output. There are many different types of fatty acids and different oils have different percentages of these fatty acids in them. Based on the results of my experiment, the ideal fatty acid methyl ester that will make the perfect biodiesel should be from a fatty acid with a number between 15-22 carbon atoms in the carbon chain and saturated bonds between them. This report investigates the parameters of pyrolytic fuel from leather. The results of this work can be summarized as follows:

The production of the pyrolytic fuel from non-biodegradable solid wastes (leather) was done by heating them in inert atmosphere in a fixed bed reactor and condensing them in an optimum temperature. The optimum temperature for extracting oil from pyrolysis process was observed 600°C for leather. The optimum reaction time was observed to be 40 min for leather. There are some impurities in the produced pyrolytic oil. So if refinement is done then the properties of the oil can be changed and can make these oils more valuable and more suitable.

REFERENCES

- [1] Sinag, A.; Gulbay, S.; Uskan, B.; Uçar, S.; Ozgurler, s.b. Production and Characterization of pyrolytic oils by pyrolysis of waste machinery oil. *J. Hazard. Mater.* 2010, 173, 420-426.
- [2] FAO, World statistical compendium for raw hides and skins, leather and leather footwear 1979-1997, 1998
- [3] Dry, M.E. High quality diesel via the Fischer-tropsch process- A review. *J. Chem. Technol. Biotechnol.* 2002, 77, 43-50.
- [4] Uçar, S.; Karagöz, S.; Yanık, J.; Sağlam, M.; Yuksel, M. copyrolysis of scrap tires with waste lubricant oil. *Fuel process. Technol.* 2005, 87, 53-58.
- [5] Scheirs, J.; kaminsky, W. Feedstock Recycling and Pyrolysis of Waste Plastics: Converting Waste Plastics into Diesel and Other Fuels; Wiley: Chichester, UK, 2006; Volume 27, pp. 2-785.
- [6] Ludlow-Palafox, C.; Chase, H.A. Microwave induced pyrolysis of plastic wastes. *Ind. Eng. Chem. Res.* 2001,40, 4749-4756.
- [7] Canakci, M., and J. Van Gerpen. 1999. "Biodiesel production via acid catalysis." *Trans ASAE.* 42:1203-1210. cago SanFr: The McGraw-Hill Companies, Inc, 2008.
- [8] ASTM D 6751. ASTM's Standard Specification for Biodiesel Fuel (B100) Blend Stock for Distillate Fuels.

[9] Isler A, Sundu S, Tuter M, Karaosmanoglu F. Transesterification

reaction of the fat originated from solid waste of the leather industry. *Waste Manag* 2010;30:2631-5.

[10] Colak S, Zengin G, Ozgunay H, Sari O, Sarıkahya H, Yuceer L. Utilisation of leather industry pre fleshings in biodiesel production. *JALCA* 2005;

100(3):137-41

[11] Cardone M., Prati M.V., Rocco V., Seggiani M., Senatore A and Vitolo S., 2002. Brassica carinata as an alternative oil crop for the production of biodiesel in Italy: engine performance and regulated and unregulated exhaust emissions. *Environmental Science and Technology* **36(21)**, 4656-4662.

[12] Çanakçı M., 2007. Combustion characteristics of a turbocharged DI compression ignition engine fueled with petroleum diesel fuels and biodiesel. *Bio-resource Technology* **98(6)**, 1167-1175.

[13] Gerpen J.V., 2005. Biodiesel processing and production. *Fuel Processing Technology* **86(10)**, 1097-1107.

[14] Singh S.P. and Singh D., 2010. Biodiesel production through the use of different sources and characterization of oils and their esters as the substitute of diesel: A review *Renewable and Sustainable Energy Reviews* **14(1)**, 200-216.