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Metal Melting Via Waste Vegetable Oil

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Abstract

1. *According to present scenario, the requirements for increasing technology as well as focus on optimize utilization of waste. Here we are dealing with waste vegetable oil, according to survey it is recommended that the cooking oil should not be reused for cooking purpose because it is unhealthy and cause several health problems like cancer, heart diseases, chocking of arteries and so on.*
2. *Waste vegetable oil is used in Babington burner so that the heat of combustion is utilized for several purposes like melting of metals in furnace, cooking, space heating and so on. For the same purpose we are replacing Babington ball by a simple copper tube of 5 mm diameter. At the one end of tube is squeezed upto .8 mm diameter which is similar to the hole diameter of Babington ball. Compressed air from the compressor entered from 5 mm diameter tube and exit through smaller hole of tube. At the same time waste oil is dropped at the exhaust of compressed air, then the drops which comes in front of small holes gets atomized. Now this atomized oil droplets has to be fired manually at once, then intense fire flame produce. We have made fire nozzle at an small inclined angle so that only those atomized droplets will be fired and remaining other droplets will be dropped due to gravity and recollect in a container . The arrangement are made so* that once flame produce, it will preheat the waste oil before burning. This result in excellent atomization and have better burning flame.

1. INTRODUCTION

Many vegetable oils like Soybean, Groundnut, Rapeseed, Palm, Olive etc. are wildly used for frying. But after heating above a critical temperature for deep frying, they become unfit for further cooking, as their further use may lead to cholesterol formation in human beings.

The problem with reusing oil is that it can create free radicals which cause ailments in the long run. According to diet consultant Mr. Naini Setalvad, 'Free radicals attach themselves to healthy cells and lead to diseases. These free radicals can be carcinogenic i.e. can cause cancer and also atherosclerosis which can lead to increase in bad cholesterol levels, blocking the arteries.'

Some other potential health risks of reusing oil include:

-Acidity

-Heart disease

-Alzheimer's and Parkinson's disease

-Irritable throat (due to inhalation)

Vegetable oil can be used as an alternative fuel in diesel engines and in heating oil burners. When vegetable oil is used directly as a fuel, in either modified or unmodified equipment, it is referred to as straight vegetable oil (SVO) or pure plant oil (PPO). Conventional diesel engines can be modified to help ensure that the viscosity of the vegetable oil is low enough to allow proper atomization of the fuel. This prevents incomplete combustion, which would damage the engine by causing a build-up of carbon. Straight vegetable oil can also be blended with conventional diesel o Recycled vegetable oil, also termed used vegetable oil (UVO), waste vegetable oil (WVO), used cooking oil (UCO), or yellow grease (in commodities exchange), is recovered from businesses and industry that use the oil for cooking .

2. HOW MANY TIMES CAN ONE REUSE OIL?

Says nutritionist Priya Kathpal, 'There is no set number to how many times one can reuse the oil as it depends on factors like which oil is used, how long the oil was heated, was it used for deep frying or shallow frying, what type of food was cooked in it etc…'

Though using a fresh batch every time is good, it is not really practical. But if done correctly, one can reduce the risk of negative effects that reused oil may pose.

3. RECYCLED VEGETABLE OIL

Recycled vegetable oil, also termed used vegetable oil (UVO), waste vegetable oil (WVO), used cooking oil(UCO),[7] or yellow grease (in commodities exchange), is recovered from businesses and industry that use the oil for cooking.

As of 2000, the United States was producing in excess of 11 billion liters (2.9 billion U.S. gallons) of recycled vegetable oil annually, mainly from industrial deep fryers in potato processing plants, snack food factories and fast food restaurants. If all those 11 billion liters could be recycled and used to replace the energy equivalent amount of petroleum (an ideal case), almost 1% of US oil consumption could be offset.[8] Use of used vegetable oil as a direct fuel competes

with some other uses of the commodity, which has effects on its price as a fuel and increases its cost as an input to the other uses as well.

4. AIM OF THE PROJECT

The aim of making this project is to use this waste vegetable oil for industrial purpose. Like space heating, melting of metals, furnace heating, etc. In this project we use this waste vegetable oil for either space or furnace heating.

As cost estimation mentioned above we can conclude that it is cheaper than petrol, diesel and also it does not harm environment as it does not contain sulphur and therefore problems associated with sulphurous acid aerosols would be reduced. So we can easily use it for our purpose.

Following are the properties of Vegetable Oil:-

a) Viscosities were significantly higher and densities were marginally higher compared to diesel.

b) Vegetable oil has lower calorific values.

c) The presence of molecular oxygen in vegetable oil raises the stoichiometric A/F ratio.

5. COST OF BIO-DIESEL

S. No.	Expenses	Cost/Month (Rs.)
1.	Raw material cost	637,500
2.	Electricity Cost	30,971
3.	Apparatus & Equipment Cost	2,670
4.	Miscellaneous Cost	33,500
5.	Recoverable Cost	144,000
	Total Cost	Rs. 560,641/-

Cost of Bio-Diesel for One Unit For 90% yield of biodiesel from the waste cooking oil.

Cost of Biodiesel for 1Kg. = Rs. 560,641 / 18,000 Kg = Rs. 31.14

Net Bio-Diesel Cost = Rs. 31.14/Kg. Cost of Waste Cooking Oil = Rs. 20/Kg.

Therefore net processing Cost = Rs. 11.14/Kg.

Assume 15% distribution cost, dealer commission etc.

Total Cost of Bio-Diesel of 1Kg. = Rs. 35.82/-

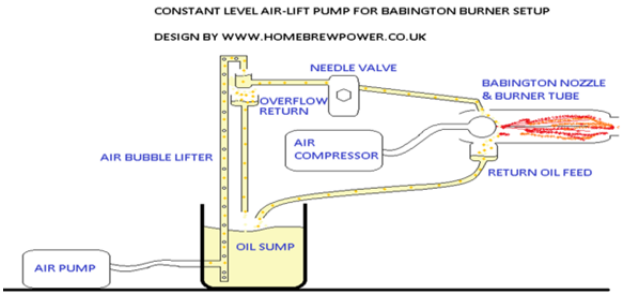
Hence On the basis of present work it can be concluded that the biodiesel conversion cost comes about 11 rupees per kg, hence with waste cooking oil net biodiesel cost comes at 35 rupees per kg whereas diesel cost without subsidies. Hence waste cooking oil biodiesel found to be a better alternative to petro diesel and in future help to acquire the energy security for coming generations and provide a safe passage for waste cooking oil.

6. BABINGTON BURNER

Babington Burner atomizing nozzles are used to atomize almost all combustible fuel sources. Fuels such as vegetable oil, WVO waste vegetable oil can be easily burn cleanly and cause no smoke Babington Burner Nozzles DO WORK and work perfectly when set up correctly!

Babington Burner Nozzles are also been used to heat outdoor swimming pools and hot tubs. Simple heat exchangers can be constructed to allow water heating to be achieved with a wide selection of waste oils.

If you require a different atomizing hole diameter to our standard 0.010" then do get in touch as we can manufacturer them to your specification. Also we are happy to supply our Babington Burner Nozzles with more than one atomizing nozzle is required.



The image above shows the principle of a Babington Burner Nozzle in operation. As a whale surfaces a thin film of water is pulled across its smooth back skin created by surface tension. When the whale exhales it atomizes the water covering its back. This is the same principle used in Babington Burner Nozzles to atomize waste oil.

7. CHANGES WE HAVE DONE

We replace the use of Babington ball by a simple copper tube of 5mm diameter. This tube is also used for carrying waste oil from container to the nozzle of compressed air. For obtaining compressed air, a reciprocating compressor is used.

8. COMPONENTS USED

1– Compressor

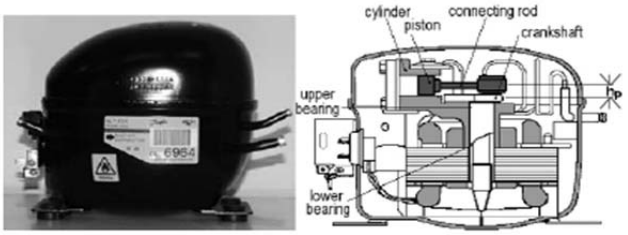


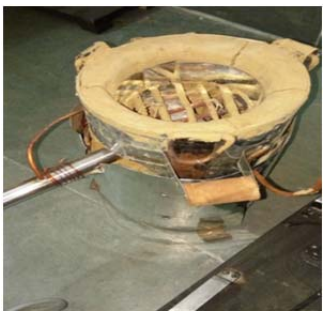
Figure 1. Picture and schematic draw of a hermetic reciprocating compressor.

Table 1. Main geometrical and physical parameters.

Radius crank-pin centre	r_c	7.5 *mm*
Radius of bearings	r_b	8 *mm*
Width of bearings	l_b	6 *mm*
Journal clearance	c_b	15 *μm*
Length crank pin	h_p	10 *mm*
Distance between bearings	L	80 *mm*
Inertia of motor-rotor		$I_x, I_y = 0.4\text{x}10^{-3}$; $I_z = 0.1\text{x}10^{-2}$ *kg.m²*
Diameter of piston	D_p	23 *mm* ($A_p = 415.5$ *mm²*)
Length of the piston	l_p	22 *mm*
Mass of the piston	m_p	0.043 *kg*
Lubricant viscosity	μ	0.005 *Pa.s*
Angular velocity	Ω	312 *rad/s* (2980 *rpm*)
Mass eccentricity of crank	e_c	5 *mm*

2– Copper Tube of 5 MM Diameter

3– Arrangement of small furnace, inside the wall of furnace copper tube is surrounded so that preheating of oil can be done.



9. WORKING

Waste vegetable oil is filled in a container, oil have to passed through a strainer. Copper tube of 5 mm diameter is used to carry oil to the furnace. Furnace is surrounded by the same copper tube so that the oil gets preheated.

Another arrangement is made in which hermetic compressor is used to compress the air so that pressurized air is passed through a .8mm diameter nozzle hole of copper pipe. The preheated oil droplets get dropped in front of compressed air nozzle, the oil gets atomized very well.

At the very beginning once atomized oils is fired externally, fire flame is produce. Heat of flame can be used for metal melting. Hence here Babington ball is replaced by a simple copper tube.

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REFERENCES AND BIBLIOGRAPHY

[1] "UK Biodiesel Processor Manufacturer and Fuel Supplier. Web. 18 May 2010.

[2] Benefits of Biodiesel. National Biodiesel Board, 2009. Biodiesel.org. Oct. 2009. Web. 17 May 2010.

[3] <http://www.biodiesel.org/pdf_files/fuelfactsheets/Benefits%20of%20Biodiesel.Pdf>. National Biodiesel Board. Biodiesel Performance. National Biodiesel Board, 2007. Biodiesel.org. National Biodiesel Board, 2007. Web. 17 May 2010.

[4] R. Babington: US Patent # 3,425,058 ~ Fuel Burner.

[5] E-mail. Schill, Susanne R. "Sweet Catalysis." Biodiesel Magazine. Jan. 2010. Web. 18 May 2010.

[6] <http://www.buffalobiodiesel.org/svo_emissions.pdf>. Yezzi, Mike B., and Flying Pigs Farm. "Information on Biodiesel." Message to the author. 5 May 2010.

[7] Buasri, A., Chaiyut, N., Phongprasit, K. (2008). Production of Biodiesel from Waste Cooking Oil Using Mixed Alcohol System. KMITL Science Journal, 8(2), 59-63. |

[8] Kerschbaum, S., Rinke, G., (2004). Measurement of the temperature dependent viscosity of biodiesel fuels. Fuel, 83, 287–291. |

[9] Lin, L., Cunshan, Z., Vittayapadung, S., Xiangqian, S., Minutesgdong, D., (2011). Opportunities and challenges for biodiesel fuel, Appl Energy, 88,1020–1031. |

[10] Haas, M.J., McAloon, A.J., Yee, W.C.,Foglia, T.A., (2006). A process model to estimate biodiesel production cost, Bioresource Technol., 97, 671-678. |

[11] Zhang, Y., Dubé, M.A., McLean, D.D., Kates, M. (2003). Biodiesel production from waste cooking oil: 2. Economic assessment and sensitivity analysis, Bioresource Technol., 90, 229-240.