International Journal of Recent Engineering Research and Development (IJRERD)
ISSN: 2455-8761
www.ijrerd.com || Volume 02 – Issue 07 || July 2017 || PP.198-202

Some methods of heating high viscosity fuel

Van Vang Le, Dao Nam Cao, Anh Tuan Hoang
Ho Chi Minh University of Transport
No.2, D3 Road, Binh Thanh District, Ho Chi Minh city, Vietnam

Abstract: This paper presents some methods of heating biodiesel biodiesel (biodiesel / bio-oil) to improve the disadvantage of pure biodiesel fuel is high viscosity and low evaporation compared to natural Whether traditional diesel. Fuel-fired, steam, hot or electrically heated hot-air systems are analyzed for aspects such as structure, engine utilization, and economic efficiency. The results of this study are designed to design and manufacture a complete biodiesel biodiesel fuel system for inland water engines that meet the engine operating conditions and ensure fire safety.

Keywords: heating method, heavy fuel, high viscosity

1. Introduction

In view of the environmental pollution and energy security of each country, diversifying energy sources and reducing dependence on fossil fuels is one of the top priorities for countries. The use of biodiesel fuel on conventional diesel engines is currently receiving great attention from nations as biodiesel fuel is generally of a similar nature to conventional diesel and when used, the engine No significant changes in texture. However, in order to be able to use biodiesel fuel (biodiesel/bio-oil) on vehicles, measures should be taken to improve its properties such as viscosity reduction, Evaporation, blending for this fuel. One of these measures is the use of bio-oils/biodiesel heater. The hot-air, steam, heat-oil or electrically heated hot-air systems are introduced in terms of structure, engine utilization, and economic efficiency. The results of this study are designed to design and manufacture a complete biodiesel biodiesel fuel system for inland water engines that meet the engine operating conditions and ensure fire safety.

2. Some methods of heating heavy fuel

2.1. Method of heating fuel by steam

The use of water and steam is considered to be the most effective and the most widely used of the types of heat liquid is available with high heat transfer efficiency and is easy to control. However, its main limitation is that at temperatures above 100^{o}C it starts to boil, becoming steam and thus can only be used as a pressurized system - limited when processed and used to ensure Safe operation. In order to boil fuel by steam, it is necessary to arrange the steam generator to meet the requirement, namely the boiler. Boiler steam supplies the fuel boiling needs of 60% to 80% of total steam output. After work the steam will condense into condensate, providing back to the boiler. Slightly after leaving the boiler needs to ensure the requirements:

- Having the temperature and pressure suitable for the intended use;
- The content of harmful substances in the vapor must be within the permitted range;

However, in the process of using the boiler to generate the fuel boiler, it is recognized that in the waste gas there is mixed with a quantity of lubricating oil, the exhaust gas of the machine makes the quality of condensate water return to the boiler reduced. In addition, due to the boiler water is always loss (steam, evaporation, discharge water) should provide additional water for boilers. The amount of water that contains the salts and gases that cause scale to the boiler. Because of these reasons, the quality of the vapor will decrease after a period of use, so it is necessary to inspect the potable water.

The most commonly used tube layout is the chicken intestinal tube system

In the chicken intestinal rehydration system, steam is fed to the chicken intestinal tube, which is superheated through the main steam pipe. After passing the heat a large portion of the steam turns into condensate, condensate is returned to the boiler hot water. The downside to hot-tube heat-up is that it is possible for the tube to run in the oil reservoir that is flooded with condensate. When the joints (weld joints) are broken or pipes break or the holes in the pipe appear, the oil will penetrate inside the pipe.

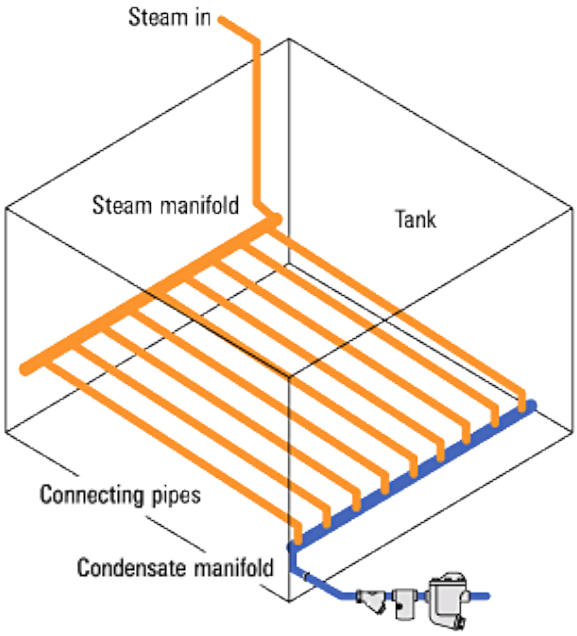

Figure 1. Heating fuel system by steam

Steam-assisted heating methods are often applied on oil tankers for the purpose of heating fuel oil in combination with fuel FO in tanks prior to being supplied to the machine. However, with small diesel engines, the layout of the steam boiler is very difficult. In addition, each tank requires different heating temperatures, which results in difficulty controlling the temperature of the steam (or pressure). Also, on some heavy-duty HFO engines, the IFO must first mount the temperature sensing device or the viscosity of the fuel just before it is delivered to the engine. Electricity or steam with high temperatures to ensure rapid warm-up.

2.2. Method of heating fuel by thermal liquid

Thermal oils or heat transfer fluids are widely used to carry heat energy during the fuel boiling, metal working, and machine tool cooling applications. They are mainly used in high temperature systems and equipment where the optimum operating temperature of the thermal oil or liquid is 150ºC and 400ºC. This method is safer and more effective than using steam, electricity, or other direct heating methods.

The first use of thermal oil systems was started in the late 1930s. They were used because of the high efficiency and heat transfer rate. However, the heat used is unstable if the temperature rises higher than the preset temperature during long periods of operation. This leads to the broken heat pipe and consequently some of the oil heat is oxidized and the heat is unstable. As a result, some thermal oil system incidents are endangering the mining and use process. However, in practice, the thermal oil system is less complex, easier to design and safer than steam-powered systems, maintaining and stabilizing the temperature well for applications that have already Selected.

Since the use of thermal oil systems, so far there has been much progress in this technology and today's thermal oils are better heat stable, non-toxic and can produce higher temperatures.

The use of thermal oil as a heat transfer medium can be based on a number of reasons, but one of the main motives is the use of a non-pressure system other than a pressure-operated steam system and possibly Causes risks from high pressures and installation costs and common inspection requirements increase.

Heat transfer oils are classified into two main groups: Cooling, cooling and anti-icing are used to cool internal machinery, process equipment or engines. Heating oil and thermal oil are used for heat transfer or heat transfer as required.

Heat transfer oils can be classified by chemical structure into three main groups:

- Synthetic substances;
- Heat oil;
- Other silicone;

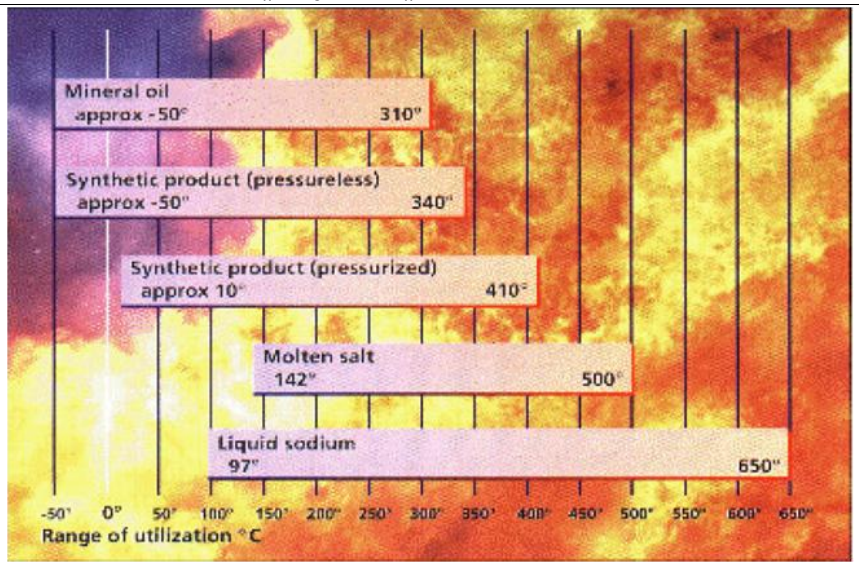

Figure 2. The classification of temperature working of heating fluid

a. Synthetic substances

Synthetic substances, also known as aromatic compounds, are man-made fluids, specially designed for heat transfer applications. These include structures based on benzene molecules and include diphenyl oxide / biphenyl fluids, diphenyleneshanes, dibenzyltoluenes, and terphenyl. They are formed from organic and inorganic alkaline compounds and used in diluted form with concentrations ranging from 3% to 10%. Synthetics have many advantages in terms of high temperature and heat transfer compared to hot oils or other conventional substances. Synthetics can obtain safe operating temperatures within the 400ºC range, while non-synthetic materials stabilize only heat up to a maximum temperature of 300ºC. In fact, synthetic materials with a temperature of about 340 degrees Celsius are two to three times more expensive than hot oils with a temperature of about 300 degrees Celsius.

b. Heat oil

Crude oil contains a large mixture of organic compounds, ranging from very light hydrocarbons to very high molecular weight molecules. Heat oil is made from lubricants after removing lubrication and further refining of viscosity-modifying substances, the stability to make oil heat the same as heat transfer fluid.

Fluids of the major general temperature operating range of petroleum liquids range from - 20ºC to less than 300ºC. Heat oil has significant advantages over synthetic in terms of cost and processing. In addition, oil-based fluids do not form hazardous toxins, do not have bad odors, so hot oils can be easily handled. However, hot oils are less thermally stable at high temperatures because they contain a certain degree of unsaturated (double bond) and may cause chemical reactions than petroleum products. Refined and easily oxidized.

c. Other types of silicon

Silicon-based fluids and, to a greater extent, glycol hybrid liquids, mainly used in specialized applications, require compatibility between process and product. The performance and cost factor of this group is more detrimental when compared in the temperature range with synthetic materials and hot oils making the selection of silicones and other special fluids difficult.

Liquid thermal systems are safer than steam systems and maintain a more accurate temperature. More important is the low cost of designing and manufacturing a thermal oil burner.

Generally a heating oil system consists of a furnace, heat exchanger, expansion tank, vent and pump system. Expansion tanks can be coated with an inert gas such as nitrogen to prevent oxidation of the liquid, but in many cases it releases into the atmosphere.

From the figure above, it can be seen that a typical thermal oil system is a closed circulation system, where heat is transferred from the thermal oil for heating through the heat exchanger. Heat exchanger for a particular process can be carried out in various forms, from a typical plate heat exchanger for liquid to heat transfer fluid or a hot plate to heat transfer fluid For solids ... etc. The types of heat exchangers selected for an application depend on the process. The design of the heat exchanger should maximize the heat transfer efficiency in the system. There are nine important factors to consider when designing a thermal oil system:

choosing a furnace size, choosing a pump, expansion tank design, insulation material, piping systems, flow control equipment. , Temperature control, thermal fluid selection and electrical equipment.

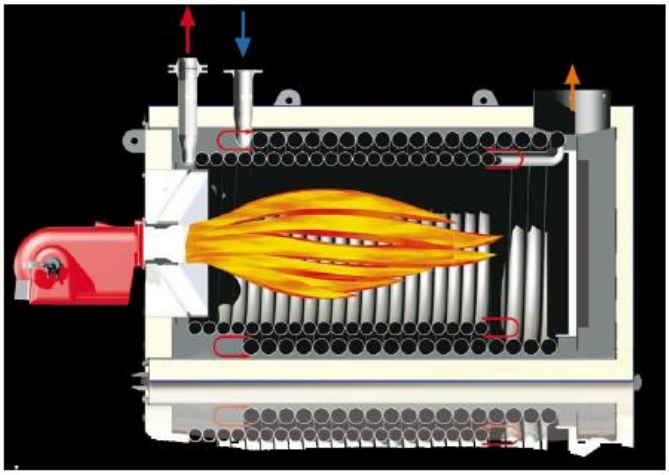

Figure 3. Thermal oil boiler

2.3. Method of heating fuel by electricity

For electrically heated systems, it is made by contacting the oil with electrical conductors, mainly conductors. This method overcomes the shortcomings of the steam heating method in the tube. The method of heating fuel by electricity can be carried out either directly or indirectly. Direct fueling by placing direct-line contact thermostats in direct contact with the fuel to be heated or fuel flowing through the ignition device. Direct indirect welding usually uses a type of heat transfer device in the fuel tank. The indirect method can change the temperature from the outside of the tank by using the tank wall as the medium for transferring heat to the fuel inside the tank.

a .Heating directly

Direct woofer is a method of placing lead-type thermocouples in direct contact with the fuel to be heated. The heater is placed below the lowest fuel level in the tank. The advantage of direct flushing is that it achieves almost 100% warming efficiency. This is because all the heat generated is directly absorbed fuel. This helps to speed up the heat and minimize the thermal delay. No intermediate heat transfer area can reduce heat loss. The disadvantages of direct heating systems such as liquid surface limits, surface area require large space. In addition, the direct heating process must ensure that the elements are compatible and do not corrode or leak the electricity due to the heat transfer with the direct heater. Therefore, the heater must be designed so that it is not exposed to air during operation as this may result in the destruction of the heater due to the high ambient temperature at the same time the appliance The reheat must be placed at a certain distance from the bottom of the tank to avoid sludge accumulation in the tank which may limit heat transfer.

b. Heating indirectly

Indirect heating uses a method of transferring heat to the fuel tank. This method can change the temperature from the outside of the tank by using the tank wall as a heating medium. The biggest advantage of the indirect heating method is that the heating is carried out without removing it from the tank. In addition, indirect fuel heating allows the density of the fluid contact with liquids during the reheat to be reduced by spreading heat over the larger surface area. At the same time, the possibility of overheating can be limited by limiting the temperature of the heat transfer medium. However, this method encountered some disadvantages such as increased heat loss and thermal latency.

3. Conclusion

By analyzing fuel-backfiring systems, it may be possible to convert domestic fleets to use biodiesel fuel without the need to improve many of the inherent structures of the system. Biomass biodiesel heating systems can improve the properties of fuels such as viscosity reduction, evaporation, and blending of the fuel, which can meet the needs of use. Pure biodiesel fuel on inland vessels not only for river ships, transport ships, generators on ships but also for passenger ships, service ships ... to reduce water pollution. However, large scale trials and policies are needed to encourage the use of pure biodiesel fuel on inland watercraft in particular and

on diesel engines in general. The domestic fleet in Vietnam is very large with a total capacity of about 7,154,000 horsepower fleet, of which the number of fishing vessels is 132,000, the ship transports about 1700 ships and about 200 ships. Thus, with the number of ships and capacity on if the gradual use of pure biodiesel fuel will bring great economic efficiency.

Passenger ships or service vessels may use an electrically pure biodiesel fuel reheat system as the requirement for passenger safety is high. For coastal fishing boats or river ships, it is possible to use a direct fuel boiler with exhaust gas. This method has the advantages of simple, high efficiency and has the disadvantage that the reliability is not high, difficult to regulate. Adjust the temperature in the fuel tanks and combine with the electrically heated unit to aid in cold start. For vessels fitted with steam boilers, the system can be used to heat fuel via steam. This method is more reliable and easy to regulate the temperature of the fuel system before it is delivered to the engine so it can be used on board ships equipped with boilers. The method of heating pure biodiesel with hot oil can be combined with petroleum oils because the thermal efficiency of this method is the highest. Thus, warming biodiesel fuel for direct use on inland waterways will diversify fuel sources and reduce pollutant emissions.

References

[1] A.M.Kanury (1975), Introduction to combustion Phenomenon. Gordon and Breach, Science Publishers – New York.

[2] N.A. Chigier (1977), Progress in Energy and Combustion Science, Pergamon Press, Oxford, New York.

[3] Cen Kefa, Fan Jianren (1988), A numerical Mode for the turbulent Fuluctuation anh diffusion of Gas – Particle Flows and its Application in Freeboaed of a Fluidized bed, Science Publication, Zhejiang.

[4] Brett – Littlechild.R (1960), Latent Heat Cooiing and Waste Heat Recovery, Proc. D.E.U.A.

[5] S.L Nadaf, P.B Gangavati. " A review on waste heat recovery and utilization from diesel engines" International Journal of Advanced Engineering Technology, V/Issue IV/Oct.-Dec.,2014/31-39.

[6] Bhupendra Singh Chauhan, , Naveen Kumar, Yong Du Juna, Kum Bae Lee "Performance and emission study of preheated Jatropha oil on medium capacity diesel engine" April 2010.

[7] Basel I. Ismail, Wael H. Ahmed. "Thermoelectric Power Generation Using Waste-Heat Energy as an Alternative Green Technology Recent Patents on Electrical Engineering" 2009, 2, 27-39 27 1874-4761/09

[8] Crane D.T., Jackson G.S., Holloway D. "Towards optimisation of automotive waste heat recovery using thermoelectric". SAE International, 2001 (2001-01- 1021)

[9] Feng Yang , Xiugan Yuan, Guiping Lin "Waste heat recovery using heat pipe heat exchanger for heating automobile using exhaust gas"Applied Thermal Engineering 23 (2003) 367–372.

[10] H. Teng, G. Regner, C. Cowland, "Waste Heat Recovery of Heavy-Duty Diesel Engines by Organic Rankine Cycle Part I: Hybrid Energy System of Diesel and Rankine Engines," SAE Int. Publication 2007-01- 0537 (2007).

[11] Hou Xuejun, "Analysis of Exhaust Gas Waste Heat Recovery and Pollution Processing for Z12V190 Diesel Engine" Research Journal of Applied Sciences, Engineering and Technology 4(11): 1604-1611, 2012

[12] Hussain QE, Brigham DR, Maranville CW. "Thermoelectric exhaust heat recovery for hybrid vehicles", SAE Paper no. 2009-01-1327, Presented at SAE World Congress & Exhibition April 2009, Detroit, MI, USA, Session: Advanced Hybrid Vehicle Powertrains - Hybrid Engine & Emissions, Thermo- Electric Conversion (Part 1 of 6).

[13] Vaja and A. Gambarotta, "Internal combustion engine (ICE) bottoming with organic rankine cycles (ORCs)", Energy, 35 (2) (2010) 1084-1093.

[14] J. S. Jadhao, D. G. Thombare "Review on Exhaust Gas Heat Recovery for I.C. Engine" International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 12, June 2013.

[15] Janak Rathavi, Mr. Amitesh Paul, Dr. G.R. Selokar "Experimental study of waste heat recovery technique to increase efficiency and to decrease hazardous emissions in CI engine" International Journal of Computational Engineering research. Jan-Feb 2012. Vol. 2. Issue No.1.204-213

[16] Jasdeep S. Condle "Analysis of a novel waste heat recovery mechanism for an I C engine" A report the degree of Master Of Science Michigan Technological University 2012.