

ROLE OF CHEMICAL ENGINEERING IN TRANSFORMING POLLUTANTS INTO USEFUL PRODUCTS

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Abstract

Lubricant oil is typically used to separate moving parts in a system. This has the benefit of reducing friction. However, once used they have special attention as if they're disposed of while not treatment, they cause serious pollution problems. This research project is to develop a method or technique to re-refine the used lubricant oil by applying the knowledge of Chemical Engineering. In addition, to save the environment from the pollutants. Because a small amount of lubricant-oil can pollute major amounts of water. The effect of human activity is started to destroy the plant, but with our knowledge and technique in Chemical Engineering, we can prevent that. Buying re-refined oil reduces our dependence on base oil, reduces the depletion of natural resources, and helps create jobs. By victimization and promoting the utilization of re-refined lubricants, you will accomplish the following:

- Preserve a non-renewable resource – oil.
- Protect the environment against pollution.

Introduction

Lube oils are only one of the many fractions, or elements, which will be derived from raw crude oil, that emerges from the wells as a yellow-to-black, flammable, liquid mixture of thousands of hydrocarbons crude oil deposits were shaped by the decomposition of plants and animals that lived concerning four hundred million years past. Because of climatically and geographical changes occurring at that point within the Earth's history. Make full oil is extracted from fossil oil, that undergoes a preliminary purification method (sedimentation) before it's wired into fractionating towers (Nadkarni, 2011). The fossil oil is transported from the well to the plant by pipeline or tanker ship. At the plant, the oil undergoes geological phenomenon to get rid of any water and solid contaminants, like sand and rock, that perhaps suspended in it (Bienkowski, 1993). Lubricant oils are used primarily for reducing friction between moving elements of assorted machinery or instrumentality, minimize material wear, and improve the potency of apparatus /machinery and for fuel and energy savings. Access to lubricants is crucial to any trendy society and not solely will lubrication scale back friction and wear by the interposition of a skinny liquid film between moving surfaces, but it additionally removes heat, keeps instrumentality clean, and prevents corrosion. One of its necessary applications includes gas and internal combustion engine oils (Widodo and Hanifuddin, 2016). Lubricating oils area unit wide utilized in industries to cut back friction and wear by interposing a skinny film of oil

between metallic surfaces. During traditional use, impurities like water, salt, dirt, metal scrapings, broken down additive elements, varnish and alternative materials will get mixed in with the oil or be generated in it due to thermal degradation or oxidation (Durrani and Panhwar, 2011). Therefore, the oil quality gradually decreases to a level that the used oil should be replaced by a new one (Baladincz and Hancsok, 2008). Disposing of the used oil pollutes the environment to a great extent. Due to the increasing necessity of environmental protection and the additional strict environmental legislation, the disposal and recycling of waste oils become important. As a result, the used oil desires correct management to form it a valuable product (Hani and Alwedyan, 2011). Used oil has been re-refined using many techniques such as chemical (acid/clay) treatment physical treatment by distillation and thin film evaporation and solvent extraction. Furthermore, waste lubricant oil may be regenerated into transformation fuel (Manasomboonphan and Junyapoon, 2012).

1.1 Used or Waste Lubricant Oil:

The name implies on any petroleum-based or lubricant oil that has been used. The oil keeps our cars machines running smoothly. However, during normal use, impurities such as dirt, metal scrapings, water, or chemicals, can get mixed in with the oil, so that in time, the oil no longer performs well. Also, waste oil refers to the engine oil, transmission oil, hydraulic and cutting oils after use. It is additionally referring to the degradation of the recent lubricating parts that become contaminated by metals, ash, carbon residue, water, varnish, gums, and other contaminating materials, in addition to mineral compounds that result from the bearing surface of the engines (Udonne, 2011). These oils should be modified and removed from the car after some thousand kilometers of driving as a result of stress from serious deterioration in commission. The amount of lubricating oils that are collected annually in Europe and the USA is incredibly massive, approximately 1.7 to 3.5 million tons. This large quantity of waste engine oils includes a vital impact on each economic and environmental aspects (Ogbeide, 2010).

1.2 Sources of Used Lubricant Oil:

By far the biggest supply for used oil in developing countries is lubricating oils from cars, combustion engines, and gearboxes. Apart from that, minor amounts area unit generated from hydraulic systems, transformers, and different various industrial applications. Due to increase of the automotive traffic in developing countries the quantity of used oil from cars raised steadily within the past (Widodo and Hanifuddin, 2016).

Environmental Impacts

2.1 Environmental Pollution:

It can have a devastating effect on the water environment, it spreads over the surface in a thin layer that stops oxygen getting to the plants and animals that live in the water. Also, the burning of used oil in kilns and incinerators produces a lot of ash and carcinogens inflicting environmental pollution. Waste oil may be a resource that can't be disposed of arbitrarily because of the presence of pollutants (Polmear, 2015).

2.2 Environmental Effects of Used Lubricant Oil:

1. Harms animals and plants.

2. Disrupts the food chain.
3. Takes a long time to recover.
4. Cause damage to the surface of ground soil.
5. Mixes with water resources.
6. Floats over water in the sea.
7. Spoiling the beautiful beaches and a great threat to the environment.

Treatment Methods

The idea of using used oil was bestowed within the year of 1930. At the start, the used lubricating oils were burnt to supply energy, and later these oils were re-blended to engine oils after treatment. Thanks to the increasing necessity for environmental protection and a lot of demanding environmental legislation, the disposal and use of waste oils have become important (Nagy, Baladincz, and Hancsok, 2010). The use of waste lubricating oils will be accomplished through 3 basic strategies, that are reprocessing, re-refining and destruction. Re-refining is that the use of distilling or processing processes on used lubrication oil to supply top quality base stock for lubricants or different crude oil products. The utilization of this methodology has multiplied enormously in developed countries, some countries reaching up to five hundredths of the country's want for oil (Udonne, 2011). It needs the conversion of waste oil to a product with similar characteristics to those of virgin oil. the method usually involves, however, isn't restricted to pre-treatment by heat or filtration, followed by either vacuum distillation with atomic number 1 finishing and solvent extraction (El-Fadel and Khoury, 2011).

Vacuum Distillation column

Dehydration

Heater

Filtration

Used oil

Condenser

Product

Residue

Fig.1 Block diagram of reprocessing of used lubricating oils (Andrews, 2008).

3.1 Filtration: to remove the solid particulates from the used lubricant oil (Andrews, 2008).

3.2 Dehydration: The used oil must be heated up till 100 °c to remove the water. Not only water also other contaminants in the oil such as waxes, suspensions, carbon, and oxide insoluble (Andrews, 2008).

3.3 Distillation: The dehydrated used lubricant oil should feed into a vacuum distillation to start the separation process the lighter key from the lubricant oil (Andrews, 2008).

The products obtained are as follows:

- **Light fuel and diesel:** It can produce enough diesel from the used oil feedstock to run all the burners and boilers.
- **Lubricating oil:** The bulk of the feedstock will distill off in the plant to produce a lubricating oil fraction.
- **Residue:** The non-distillable part of the feedstock. This residue is successfully used as bitumen extender for roads.

3.4 Extraction: Methyl Ethyl Ketone (MEK) is mixed with the distilled oil to increase the relative volatility of the key component in the mixture between the mixture (Andrews, 2008).

Testing Methods

4.1 API Gravity:

Determining the density, specific gravity and API gravity of the fluid is very important to classify the oil. The density of a substance is the relationship between the mass of the substance and how much space it takes up (volume). The level of impurities in the used oil is indicated by the density and specific gravity (Rand and Salvatore, 2003).

4.2 Color Test:

Color is a key indicator of quality in petroleum-based products and developing a color range is an important part of the refinement process (Rand and Salvatore, 2003).

4.3 Viscosity:

The viscosity of a fluid is an important property in the analysis of liquid behavior and fluid motion near solid boundaries. Also, the viscosity is the fluid resistance to shear or flow and is a measure of the fluid property (Rand and Salvatore, 2003).

Literature review

Lubricating oil is thick fatty oil used to make the parts of the car move smoothly. It has a high boiling point and low freezing point. Also, it has a high viscosity index and a high resistance to oxidation (Francois, 2006).

Lubricating oil creates a separating film between surfaces of moving parts to minimize direct contact between them, decreasing heat caused by friction (Whisman, 1978).

Waste or used lubricating oil refers to the engine oil, it's a mixture of metals, ash, carbon residue, water, gums, and other materials (Bergel'son, 2011).

Environmental effects of used oil can cause damage to the surface of ground soil, mixes with water resources, killing plants, floats over water in the sea, spoiling the beautiful beaches and a great threat to the environment (Rincon, 2005).

Re-finishing is the use of distilling or refining processes on used lubrication oil to produce high-quality base stock for lubricants or other petroleum products. The process typically involves, filtration, dehydration, followed by distillation and solvent extraction (Hur Lai, 1989).

A large variety of waste oils are often recycled and recovered during a variety of ways that, either directly or once some sort of separation and refinement. As per the waste management hierarchy, the primary choice is to conserve the first properties of the oil leaving direct employment. Different choices may embrace convalescent its heating price and/or mistreatment in different lower-level applications. Sure styles of waste oils, lubricants particularly, are often reprocessed leaving their direct employment. the employment of waste oils, once treatment, are often either as make full base stock love refined virgin base oil or as clean-burning fuel (Pilusa, 2013).

Discussion

Lubricants serve three primary functions in automotive stampings. They reduce friction in the forming process to improve formability of metals and reduce die wear, clean blanks to reduce dirt and prevent high spots on exposed surface panels and protect the engine metal and stamped parts from corrosion. In response to economic problems and environmental protection, there is a growing trend to regenerate and reuse waste lubricants. By proper recovery and refinement of it, a lot of valuable product can be obtained. The objective of re-refining is to remove the degraded additives and contaminants and to restore the properties of the oil identical to the standards. Also, all people think that re-refined oil is not suitable for better performance, but it acts as better engine oil. This process plants should not be working in the public sector refineries to control the pollution caused by the used engine oil.

The environmental problem is that a small amount of pure lubricating oil can pollute major amounts of water e.g. groundwater as well as the land on which it is spilled. Used engine oil itself contains several additives and is contaminated by impurities and residues resulting from the combustion process. Also, the burning of used oil in kilns and incinerators produces lots of ash and carcinogens causing environmental pollution. And the waste lubricating oil is a resource that cannot be disposed of randomly due to the presence of pollutants. Finally, in response to economic problems and environmental protection, there is a growing trend to regenerate and reuse waste lubricants. By proper recovery and refinement of it, a lot of valuable product can be obtained. The objective

of re-refining is to remove the degraded additives and contaminants and to restore the properties of the oil identical to the standards.

Conclusion

Re-refining of waste lubricants could result in both environmental and economic benefits. Re-refining of waste oil to manufacture base oil cost more than re-refine the waste oil for use as fuel. The energy required to manufacture re-refined oil from used oil is only one-third of the energy required to refine crude oil to produce base oil. Therefore, re-refining is considered by many as a preferred option in terms of conserving resource as well as minimizing waste and reducing damage to the environment.

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