

# Regeneration of Base-Oil from Waste Oil by Conventional Acid-Treatment

<sup>1</sup>A.L. Rathod, <sup>2</sup>P. B. Shingwekar

<sup>1,2</sup> Department of Chemical Technology, Sant Gadge Baba Amravati University Amravati-444602 (M.S.) India

## ABSTRACT

*The lubricating oils used by vehicle engines have to be replaced at least every 10000 km and 3000km for cars and motorcycles respectively. This oil is labelled as used engine oil. Such used lubricating oil becomes unfit for further use for two main reasons: accumulation of contaminants in the oil and chemical changes in the oil.*

*Mismanagement of used engine oil has a serious environmental problem, most of used oil is handled improperly, and some is dumped into sewers. Some is dumped into the ground or is poured into dirty roads or is dumped in deserts, where it could contaminate surface and ground water, it is also used for heating purposes resulting in air pollution. All of these are adversely affecting the environment.*

*Recycling of used oil became the need of hour due to economic, environmental, health and legal reasons. Using used engine oil as a source of energy or feedstock for chemical industries is a good option for any country, importantly for India, as it would conserve both the valuable natural resources as well as foreign exchange.*

*There are two options available, either recovering the heating value of used oils in a combustion process by using as a fuel or re-refining used oil to recover lube oil base stock to formulate the fresh lubricants. The objective of re-refining is to remove all the contaminants and restore the oil to its original condition. In this study on conventional acid treatment was done to recover used engine oil collected from different sources. The recovery of regenerated base-oil was found to be in between 67 to 70 percent from this experimental study.*

**Key words:** *Used engine oil, re-refining, recycling, environment, natural resource.*

## 1. INTRODUCTION

The lubricating oils used by vehicle engines have to be replaced at least every 10000 km and 3000km for cars and motorcycles respectively. This oil is labelled as used engine oil. Such used lubricating oil becomes unfit for further use for two main reasons: accumulation of contaminants in the oil and chemical changes in the oil. The main contaminants in the used oil are...

- **Water:** Fuel burns to CO<sub>2</sub> and H<sub>2</sub>O, these are normally passes out through the exhaust when the engine is hot, but when cold it can accumulate in the oil. This leads to sludge formation and rust.
- **Soot and carbon:** Soot and carbon make the oil black. The formation of soot and carbon is due to the incomplete combustion.
- **Lead:** Tetraethyl lead, which used to be used as an anti-knock agent in petrol, accumulates into the oil. Used engine oil may contain up to 2% lead, but now days lead comes from bearing wear and is likely to be in the 2 - 12 ppm range.
- **Fuel:** Unburnt gasoline or diesel also accumulate into the lubricant, again especially during start-up.
- **Road dust:** This enters into the engine along with the air.
- **Wear metals:** Iron, copper and aluminium accumulates in the oil due to normal engine wear.
- **Oxidation products:** Some of the oil molecules, at elevated temperatures, may oxidize to form complex and corrosive organic acids.
- **Remains of decomposed additives.**

There are two for recycling used engine oil:

- Recovering the heating value of used oils in a combustion process by using as a fuel and
- Re-refining used oil to recover lube oil base stock to formulate the fresh lubricants.

Various studies are underway to deal with the used lube oils to find out the sustainable process to recover the oil part of the used engine oil or to convert it into valuable fuels in an environment friendly way.

“Used oil is a valuable resource because it has lubrication value and heat value.

Although motor oil becomes contaminated during use with materials that reduce its ability to adequately lubricate engine parts, oil part of it still maintains its basic oil properties. If treated well to remove contaminants, the used oil can be used as a lube oil base stock (LOBS) to formulate new lubricating oil. This act has a potential to conserve valuable resource from being wasted. The re-refined use oil can be used for formulation of variety of lubricants not just motor oils, such as hydraulic oils, metal working fluids, marine lubricants, compressor oils, heat transfer oils, process oils, and greases.

## 2. EXPERIMENTAL WORK:

The process is started with dehydration of used engine oil. The oil is heated up to 150<sup>0</sup>C; meanwhile temperature is maintained at 105<sup>0</sup>C for 30 mins to let the water content evaporate. Above 105<sup>0</sup>C other volatile matter are removed such as unburned fuel or organic solvents which might have been mixed into the used oil.

The dehydrated used oil is cooled and transferred in the glass flask where temperature is maintained between 30 to 40<sup>0</sup>C. At this temperature 10% concentrated sulphuric acid is added. This mixture is stirred for 3hrs so that the acid reacts with the impurities in the used oil and forms sulphates.

This mixture is settled in the separation flask for 24 hrs. then the settled acid sludge is removed from the bottom of the flask. The remaining oil-acid layer is transferred in another flask. Lime is added to this oil-acid mixture to neutralize the mixture, this mixture is stirred and maintained at 150<sup>0</sup>C. The oil is separated by filtration. This clear layer of treated oil is ready to be blended with lube oil bas stocks (LOBS) for formulation of lube oils.

The major disadvantage of this process is the generation of acid sludge and oil-soaked gypsum filter cake, which have to be disposed off under certain precautions. Also, during the handling of the oil there is always a danger of spillage.

## 3. CONCLUSION

This process of recycling of used engine oil has all possibilities of emitting poisonous gases like sulfur dioxide to the atmosphere. In addition, sulfuric acid has a negative impact on the processing equipment. However, while many variables have been studied in this work, there are many other factors that need needs to be investigated, such as temperature, pressure, settling time, mixing, separation etc.

Further research is required in order to take re-refine environment friendly process which can be further taken to commercial stage.

## 4. REFERENCES

- 1) Warmate, A. G., Ideriah, T. J. K., ARI, I. T., Inyang, U. U., & Ibaraye, T. (2011). Concentrations of heavy metals in soil and water receiving used engine oil in Port Harcourt, Nigeria. *Journal of Ecology and the Natural Environment*, 3(2), 54-57.
- 2) Kayode, J., Oyediji, A. A., & Olowoyo, O. (2009). Evaluation of the effects of pollution with spent lubricating oil on the physical and chemical properties of soil. *Pac J Sci Technol*, 10(1), 387-390.
- 3) Rincon, J., Canizares, P., & Garcia, M. T. (2007). Regeneration of used lubricant oil by ethane extraction. *The Journal of supercritical fluids*, 39(3), 315-322.
- 4) Odjegba, V. J., & Atebe, J. O. (2007). The effect of used engine oil on carbohydrate, mineral content and nitrate reductase activity of leafy vegetable (*Amaranthus hybridus* L.). *Journal of Applied Sciences and Environmental Management*, 11(2).
- 5) Bridjanian, H., & Sattarin, M. (2006). Modern recovery methods in used oil re-refining. *Petroleum & Coal*, 48(1), 40-43.
- 6) Jha, M. K. (2005). Re-refining of used lube oils: An intelligent and eco-friendly option. *INDIAN CHEMICAL ENGINEER*, 47(3), 209.
- 7) Bhaskar, T., Uddin, M. A., Muto, A., Sakata, Y., Omura, Y., Kimura, K., & Kawakami, Y. (2004). Recycling of waste lubricant oil into chemical feedstock or fuel oil over supported iron oxide catalysts. *Fuel*, 83(1), 9-15.
- 8) Institute of Petroleum. (1988). *Standard Methods for Analysis and Testing of Petroleum and Related Products 1988: Methods IP 1 to 261* (Vol. 1). John Wiley and Sons.
- 9) Latif, H. A., & Khalid, A. A. (1980). Studies on reclaiming spent lubricating oils. *Fuel*, 59, 715-717.