

Generation of valuable gases from engine oil treatment with water in supercritical and steam state

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1. Introduction – The bad management of used oil causes serious problems of environmental pollution. In practise a waste rigorous control and choosing the suitable treatment according to the kind of oil is necessary. There are different valuations methods such us regeneration, recycling or energy upgrade. In this work the possibility of transforming the waste engine oils in valuable gases when they react with steam and supercritical water is studied.

2. Experimental – Fresh synthetic engine oil has been used in assays owing to its main composition being similar to used oil. Two HPLC Chrom Tech pumps bring oil in a tubular reactor which is inside an oven, they do it in a continued way. Outside the oven; effluent stream is cooled to room temperature and discharged through a pressure-regulating valve. Liquid and steam fractions are separated in a liquid-steam separator. The gases CH₄, H₂, CO y CO₂ are regularly analysed by GC-MS and CH₄, ethane, ethene, acetylene, propene, propane and butane by GC-FID. The produced gas flow is measured in a continuous way.

3. Results and Discussion – The research revealed the oil began to be gasified at 500°C and generated different products depending on the reaction temperature. Thus, at 750°C it mainly H₂ and CH₄ were obtained whereas at 550°C, CH₄ and other light hydrocarbons (C₂, C₃ and C₄) were obtained.

The pressure effect showed that carbon gas yield increased slightly when steam comprised to 50 bar, then it remained unchanged until 150 bar and decreased finally to higher pressures. This behaviour has been compared with the main compounds oil with the pressure: lineal hydrocarbons (dodecane [1]), cyclic paraffin (ciclohexane) and aromatics (phenol [2]) when they are alone.

The influence of reaction time was analysed at several temperatures in order to find the suitable conditions to obtain desired gases. At 750°C and 250 bar (fig.1), it shows how the CH₄ and C₂ predominate at the earliest moments. Over time the concentration of these gases decreased becoming H₂ and CO₂. This way, it is proved that H₂ and CO₂ concentration grow linearly in time.

4. Conclusions – Gasification with steam and supercritical water is a new method of taking advantage of engine lube oil which competes well compared with other existing methods.

5. References

- [1] A.M. Sanchez, N. Martin, M.J. Sanchez Montero et al. *J. Mater. Chem. A* (6), (2018) pp.1671-1681.
- [2] N. Martin, M.J. Sanchez Montero, C. Izquierdo, F.Salvador, *J. Supercrit. Fluids* (2), (2017) p.799.

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