

## Used lubricating oil recycling using a membrane filtration: Analysis of efficiency, structural and composing

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### ABSTRACT

Three kinds of polymer hollow fiber membranes—polyethersulphone (PES), polyvinylidene fluoride (PVDF), polyacrylonitrile (PAN)—were used for recycling of used lubricating oil. The efficiency of membrane separation was characterized by means of the membrane rejection and the physical and chemical properties of the oils. The separation and analytical methods, for example, Fourier Transform Infrared (FTIR), UV-visible absorption spectra, column chromatography, etc. were employed to illustrate the separation mechanism and the potential structures of used lubricant oil so as to assess the differences between the used lubricating oil and the permeate. Results show that the membrane process can not only remove metal particles and dusts from waste lubricant oil, but also improve its liquidity and flash point. Further, the ultrafiltration membrane (PAN) has higher rejection than microfiltration membranes (PES and PVDF). The results of FT-IR and UV absorption spectra show that waste lubricant oil has almost 90% long chain saturated hydrocarbons, which are originally from the base oil. The middle polarity compositions may be lactones, esters, aldehydes, ketones, carboxylic acids, which may come from the oxidation of base oil and additives during the use of lubricating oil. Moreover, the molecules of the retentate contain aromatic rings as the basic unit in structure. The conjugated aromatic rings in the unit are mainly composed of two rings and three rings, whose connections are “linear order”, namely cata-condensed. Overall, it will provide much more reference data for optimizing the regeneration processes of used lubricant oil.

*Keywords:* Hollow fiber membrane; Used lubricating oil; Column chromatography; UV-Vis spectrum; IR spectrum

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