Waters Lab Highlights

An Internal Communication of Applications and Techniques

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AIRCRAFT ENGINE LUBRICANTS

The analysis of lubricants used in aircraft engines for oxidation and thermal degradation products can be of extreme importance to aircraft companies, the airlines, and the military. Due to the high cost of many of these lubricants it is desirable to obtain as much use from them as possible while being able to know when they are becoming unsafe to use.

The separations shown here demonstrate a quick and convenient method for comparing lubricants from different suppliers. Also shown is the effects of degradation at high temperatures over time. Being able to monitor the breakdown of the additives and the formulation of friction polymers as described by Ali et al (1) would enable the user to determine the proper time to change the lubricant.

Figure 1, Oil A New, and Figure 2, Oil B New, shown here are supposedly the same grade of oil from two different suppliers. However, the chromatograms show some differences.

Figure 3 is Oil A spiked with 1% Dioctyldiphenylamine (DOPA), an antioxidant. The Tricresylphosphate (TCP), a high pressure lubricant additive, was identified by running the standard.

Figure 4 is Oil A after being subjected to 392°F for 24 hours. A comparison of this chromatogram to Figure 1 in the UV shows the formation of the higher molecular weight friction polymers.

Figure 5 is Oil A after being subjected to the same 392°F for 96 hours. In this chromatogram the breakdown of the additives as well as the combined buildup of the friction polymers is evident.

CHROMATOGRAPHIC CONDITIONS

Sample:	Lubricant, 0.5% (w/v) THF
Injection Volume:	100 µl
Columns:	Two 500A ULTRASTYRAGEL™
Mobile Phase:	1 ml/min THF
Detectors:	RI, 8X
	UV 254 nm 2 AUFS

1. Ali, A., Lockwood, F., Klaus, E.E., Derda, J.L., Tewksbury, E.V., Asle Transactions, 22, 3, 267, 1978.

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Lloyd Crossman

FIGURE 1

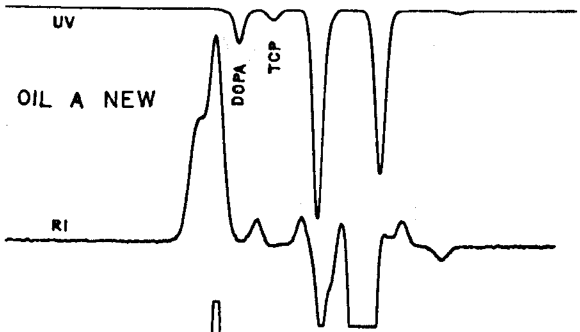

FIGURE 2

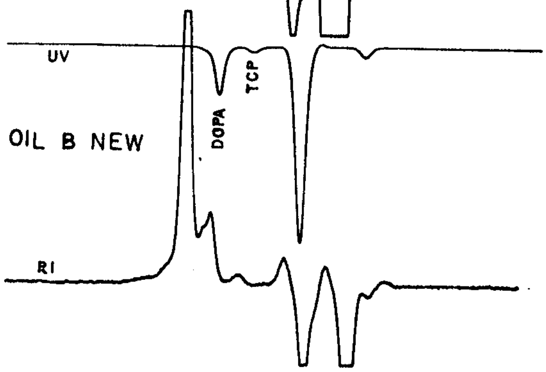

FIGURE 3

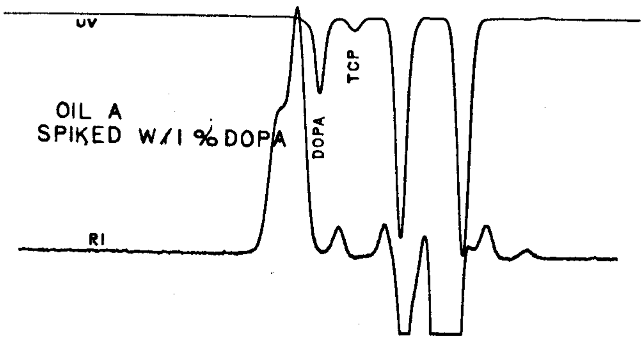

FIGURE 4

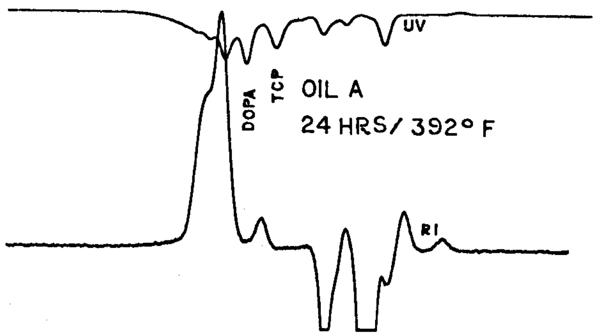

FIGURE 5