FLUID LIFE
EQUIPMENT RELIABILITY SERVICES

Fluid Life's Approach for Detecting Coolant in Engine Oil

Craig Winterfield, Vice President – Laboratory Services, Fluid Life

Fluid Life, a reliability solutions provider with over 30 years of experience in oil analysis and lubrication, has developed a proprietary analytical method to detect and quantify the presence of coolant contamination in used (in-service) engine oil. This method was developed by Fluid Life in partnership with Dr. F.R. van de Voort, Professor Emeritus, McGill University.

Traditional methods of monitoring coolant ingress are comparatively unreliable or prohibitively expensive to perform routinely.

ASTM E2412 and JOAP FTIR methods are inexpensive and easy to perform. Unfortunately with a less than 15% detection rate in used engine oils these methods are unreliable indicators of the presence or absence of coolant contamination.

ASTM D7922 (Gas Chromatography) measures the concentration of ethylene glycol in used oil. This method provides excellent early warning but is considered prohibitively expensive to perform routinely and is normally triggered by the presence of coolant additive elements (sodium, potassium and boron). This analysis will not be triggered if the in-service coolant does not contain these elements. GC analysis is highly accurate but will not detect ethylene glycol after extreme conditions in the engine oil cause it to chemically degrade into glycolic acid, oxalic acid, formic acid or carbonic acid.

Fluid Life's proprietary Chemometric method is reliable, inexpensive and can be performed routinely on all engine oils to monitor glycol and coolant contamination.

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	Advantages	Disadvantages
FTIR: **JOAP or ASTM E2412**	• Inexpensive	• Unreliable. Less than 15%detection in used oils • Detects severe contamination only • Does not provide early warning • Does not detect coolant and oil breakdown or degradation products
Fluid Life Chemometric Coolant Analysis (Available Exclusively From Fluid Life)	• Inexpensive. Can be performed routinely • Reliable >90% detection • Detects sodium, potassium and boron-free coolants • Provides early warning	• Applicable to engine oils only • Severe Water contamination may interfere
Gas Chromatography ASTM D7922 (Triggered by Coolant Additives) (Available From Fluid Life)	• Low detection limit provides early warning • Highly accurate measurement of ethylene glycol concentration • Effective for most oil types including engine oil and hydraulic oil	• Prohibitively expensive to perform routinely • The analysis will not be triggered by some coolant types • Severe water or fuel contamination may interfere • Does not detect coolant and oil breakdown or degradation products

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Engine coolant is generally composed of ethylene glycol, additives and water. When subjected to normal operating temperatures these components may chemically degrade and react with engine oil to produce organic acids, glycol breakdown products and oil degradation products.

Fluid Life's Chemometric method detects the unique chemical signature of coolant components and degradation products in used (in-service) engine oil regardless of the source of contamination.

The presence of coolant additive elements (Na, K, B) is often used to indicate coolant ingress or trigger secondary analysis. This approach is flawed as these elements show poor correlation with the measured concentration of glycol in genuine in-service engine oils.

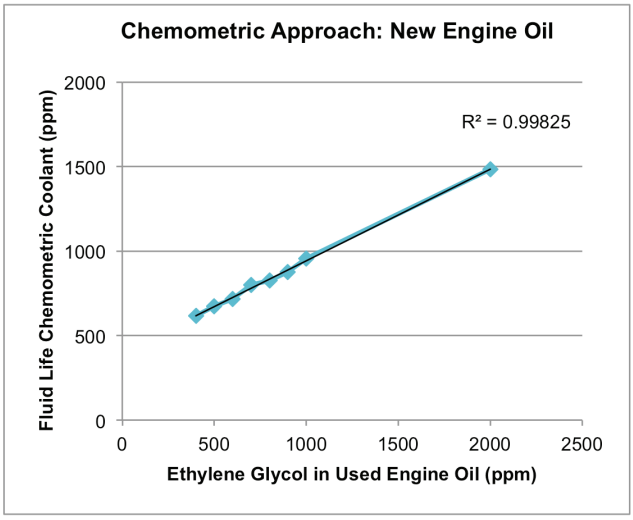


Figure 1. Correlation of Ethylene glycol using Fluid Life's chemometric Approach

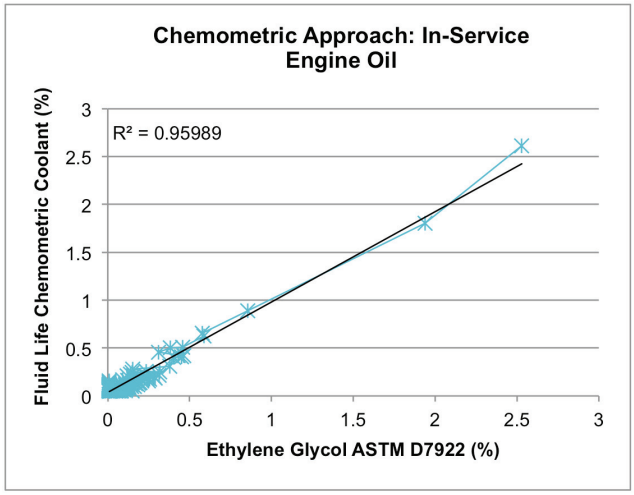


Figure 2. Gas Chromatography compared to Fluid Life's chemometric approach for in-service engine oils

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ASTM E2412 and JOAP FTIR based methods demonstrate poor correlation to the measured ethylene glycol concentration in used oils and are therefore not reliable indicators of coolant ingress. These methods have a high detection limit (poor sensitivity) and do not provide early warning of coolant ingress.

Chemometric analysis is cost effective, reliable and can be routinely applied to monitor all engine oil samples.

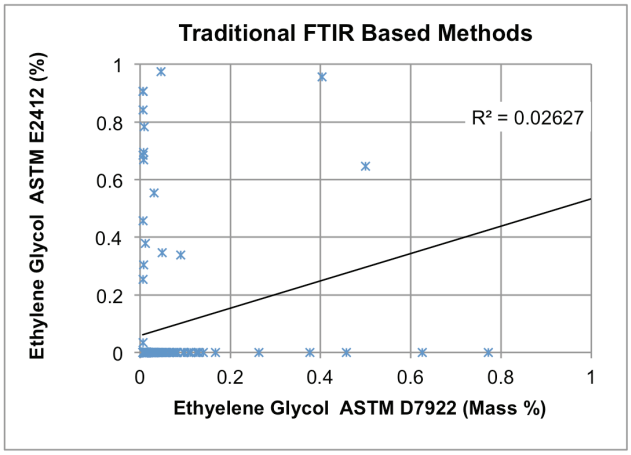


Figure 3. Poor correlation of traditional FTIR based meth-ods (JOAP and ASTM)

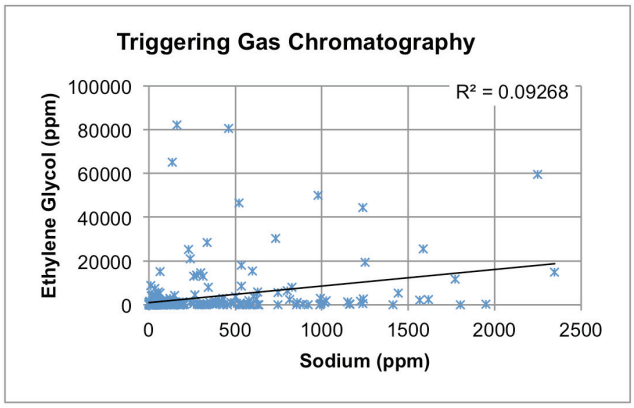


Figure 4. Poor correlation between Sodium and Glycol in used oils