Elemental Analysis of Industrial Lubricants

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ABSTRACT— *As the most fundamental test used in oil analysis today, elemental analysis can detect between 15 and 25 different elements that are related to wear metals, contaminant metals and oil additives. In our work we have realized a spectrometric emission analysis for the characterizations of the contamination of the industrial lubricants which are of type iso 100 and iso 32, they are used for the lubrication of the reciprocating and rotary compressors respectively.*

Keywords: oils, lubrication, compressor , emission spectrometry.

1. Introduction

Collecting periodic oil samples from the equipment to be monitored is a good practice. The selected spectrometer should have the ability to perform sample analysis for trace levels of metals worn from moving components, as well as for extraneous additive element and contamination levels. The ensuing data can be used as a measure of identifying whether the wear is normal or a potentially severe issue in its early stages...

2. Methods and materials used:

We carried out this study on two reciprocating compressors and two rotary compressors. The two reciprocating compressors are identical and the same for the two rotary compressors.

For each compressor and after a definite duration of operation (one year), we took a sample of lubricating oil for a spectrometric analysis using a Rotroil spectrometer.

The oils studied are of TORADA ISO 100 and TORBA ISO 32 type which are petroleum derivative oils, manufactured by RA1Z-SONATRACH and used for the lubrication of reciprocating and rotary compressors respectively .

The emission spectrometry analysis makes it possible to rapidly determine the concentrations, expressed in ppm (particles per million) by mass, of the various elements present in the oils in the form of additives (calcium, magnesium, etc.), particles metal wear (iron, nickel, chrome, tin, copper, aluminum ...), or various solid contaminants (atmospheric dust, silicone ...).

The rotroil spectrometer complaint to the requirements of the ASTM D6595-00 Standard Test Method for determination of Wear Metals and Contaminants in Used Lubricating Oils or used Hydraulic Fluids by rotating Disc Rotary Electron Emission Spectrometry .

The effective analysis range of emission spectroscopy is particles with size smaller than 8 ~ 10 μm it fails to measure large-size wear particles produced from heavy wear of the equipment [8, 9].

Figure 1.*Rotroil GNR spectrometer.*

3. Results and discussion:

The results of spectrometric analysis are given in the table1.

Table 1. *The results of the emission spectrometry analysis*

Metals wear program	Torada ISO100 fresh	Torada ISO 100 N°1	Torada ISO 100 N°2	Torba ISO 32 fresh	Torba ISO 32 N°1	Torba ISO 32 N°2
Ag	0	0	0	0	0	0
Al	4	3	4	3	3	6
B	1	0	0	0	0	0
Ba	1	1	2	1	1	2
Ca	0	1	0	0	1	55
Cd	0	0	0	0	0	0
Cr	0	0	0	0	0	0
Cu	0	0	1	0	0	1
Fe	0	0	0	0	0	0
Mn	0	0	0	0	0	0
Ni	0	0	3	0	0	1
Pb	0	0	0	0	0	0
Si	3	6	10	3	4	4
Sn	0	0	0	0	0	0
Ti	1	0	5	0	0	3
V	3	0	3	1	1	3
Mg	1	1	1	1	1	1
Mo	17	23	33	7	18	25
Zn	0	0	0	0	0	0

The results of spectrometric analysis shown in figures2 and 3 repectively.

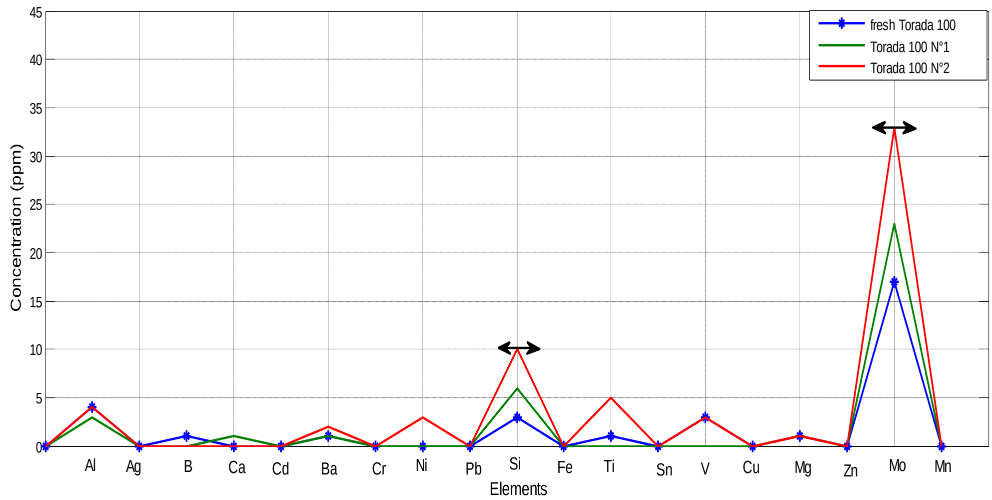

Figure 2. *The concentrations of the different elements present in the Torada ISO100*

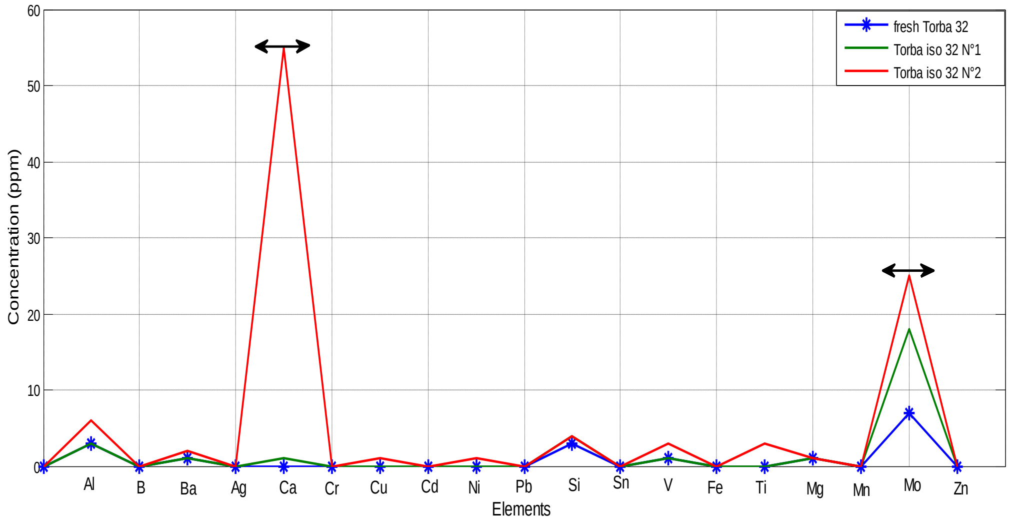

Figure 3.*the concentrations of the different elements present in the Torba ISO 32*

According to figures 2 and 3, which represent the results of the spectrometry analysis of the oils studied, we notice that there is not a big difference between the concentrations of the elements present in the fresh torada iso 100 and the torada iso100 in service and the same for the torba iso 32, but we can mention some remarkable element :

- Calcium in Torba iso 32 oil N°2: Possible sources of calcium are detergents or dispersant additives.
- Silicon in the torada iso 100 oil N°2: the origin of silicon in this oil is atmospheric dust because the compressor that we brought him this oil work in a dusty zone.
- Molybdenum in all the oils studied: the origin of molybdenum in these oils is the additives extreme pressure.

The concentrations of the metal wear particles (iron, nickel, chromium, tin, copper, aluminum, etc.) are normal in all the samples but we can mention some element and their possible origins :

- Aluminum: pistons,bearings, pumps, thrust washers.
- Neckel: Bearings, turbine blades, valves train.
- Titanium: bearing hub, compressor blades.

4. Conclusion:

According to the results of the spectroscopic analysis, the wear due to the normal operation of the compressor is considered acceptable whereas, the remarkable elements of this analysis, are in relation with the operating conditions of the compressors, such as the dust , heat, humidity ..

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