

Study of Performance of Lubricants Used on Sizing Machine

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ABSTRACT: Lubrication system of any machine is critical in the Textile Industry. The basic problem in the lubrication of Textile machinery is that the product comes into intimate contact with the machine parts and any contamination of the product or the lubricant cannot be tolerated. The new machines are designed with a view to work them at very high speeds over long periods without major break- down. Lubrication, therefore, is becoming more and more critical in maintaining both the efficiency and reliability of machines and thereby, the quality of the finished product. A majority of the problems and breakdowns on machines occur due to faulty lubrication. Cost effectiveness can be achieved only when the effective maintenance with lubrication is given prime importance. Effective performance of machine requires careful selection of lubrication system, the lubrication which gives long life to machine.

KEYWORDS: Sizing machine, lubrication, viscosity, contamination, spectrography.

I. INTRODUCTION

Today's weaving preparatory machines give much faster production because of their high speed. Lubrication plays important role in maintenance of modern sizing machines. Good lubrication practices give high speed as well as high efficiency. The advancement in the environmental condition of industrial machinery working such as high temperature, high pressure and dynamic condition has demanded the new characteristically requirement of lubricant and their properties. The fluid lubricants are commonly used for reduction of wear, elimination of heat and corrosion etc.

II. RELATED WORK

Yuegang Zhao explains in his book that Spectroscopy is a technique for detecting and quantifying the presence of elements in a material. Spectroscopy utilizes the fact that each element has a unique atomic structure. When subjected to the addition of energy, each element emits light of specific wavelengths or colors. Since no two elements have the same pattern of spectral lines, the elements can be differentiated. The intensity of the emitted light is proportional to the quantity of the element present in the sample allowing the concentration of that element to be determined. The light has a specific frequency or wavelength determined by the energy of the electron in transition. Since many transitions of different energy are possible for complicated atoms which have many electrons, light of many different wavelengths is emitted. If this light is dispersed by using a dispersing element such as a prism, a line spectrum will result.

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III. MATERIAL & METHODS USED

The material and equipment used for the various types of oil and its testing are as follows. Oil samples are collected from headstock zone & dryer zone of sizing machine. Type of oil used is MOBIL SHC 632 for headstock zone & Kuber synthetic Gemcp gear oil for dryer zone. The samples collected are as follows:

- 1) Fresh oil.
- 2) Sample set I – Four years used oil and
- 3) Sample set II – Seven years used oil.

IV. RESULTS & DISCUSSIONS

To study the extent of lubricating oil degradation, testing of the following oil properties were carried out.

IV (A) OIL VISCOSITY:

Viscosity results obtained by testing given oil samples at 25°C are represented in Figure 1. Viscosity is measured in centipoise (cP).

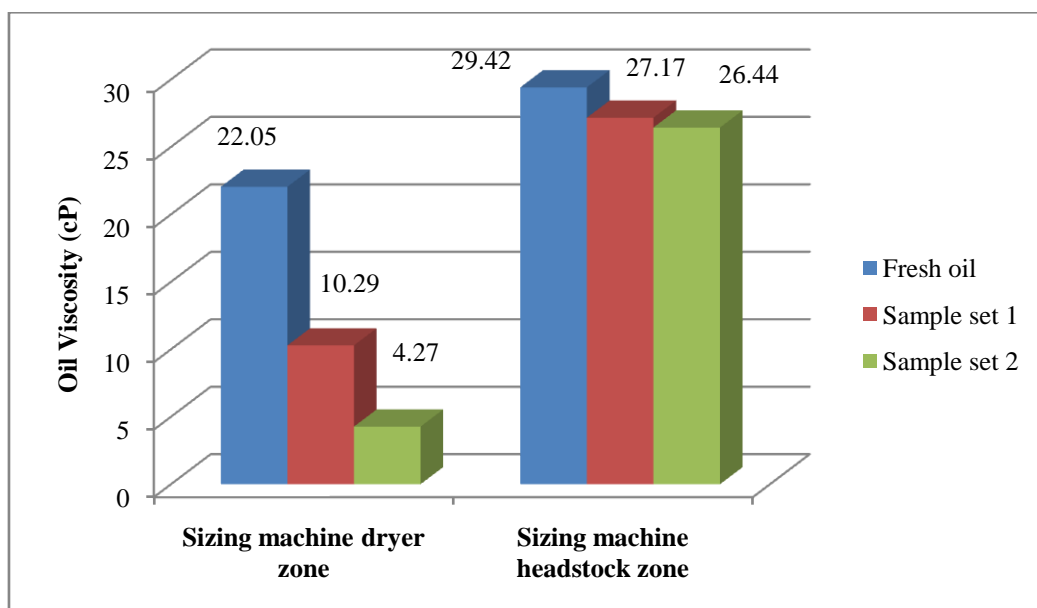


Figure 1: Viscosity results of selected oil samples.

It has been observed that oil viscosity decreases after certain period of time. The reasons behind decreasing oil viscosity may be one or more of the following. When the temperature of oil increases the particle moves faster and begins to move away from each other due to which viscosity of oil decreases. In addition lubricant also dissipates heat. This means the lubricant will sometimes be overheated. Overheating can cause the light ends of lubricant to vaporize or the lubricant itself to decompose. This can cause certain removal of additives from system, which affect the viscosity. When temperature greatly exceeds, the larger molecules will break apart into smaller molecules. This thermal cracking also referred as thermal breakdown, causes decrease in viscosity.

The concentration is amount of substance dissolved in a specific volume, because of temperature, heat dissipation and thermal breakdown. Concentration decreases which results in decreasing oil viscosity. The particle of same substance has an attractive force. Same substance has strong attractive force while other substance has weak attractive force, because of addition of contaminants it will affect the attractive force and cause decrease in oil viscosity. Due to

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various motions in gear box, shear force acts on lubricant which cause thinning of lubrication film resulting in decrease of viscosity. During actual working and during maintenance work such as cleaning, the foreign particles get added to lubricants which hampers viscosity.

IV (B) OIL DENSITY:

Oil density results obtained by testing selected oil samples are represented in Figure 2. Density is measured in gm/cm³.

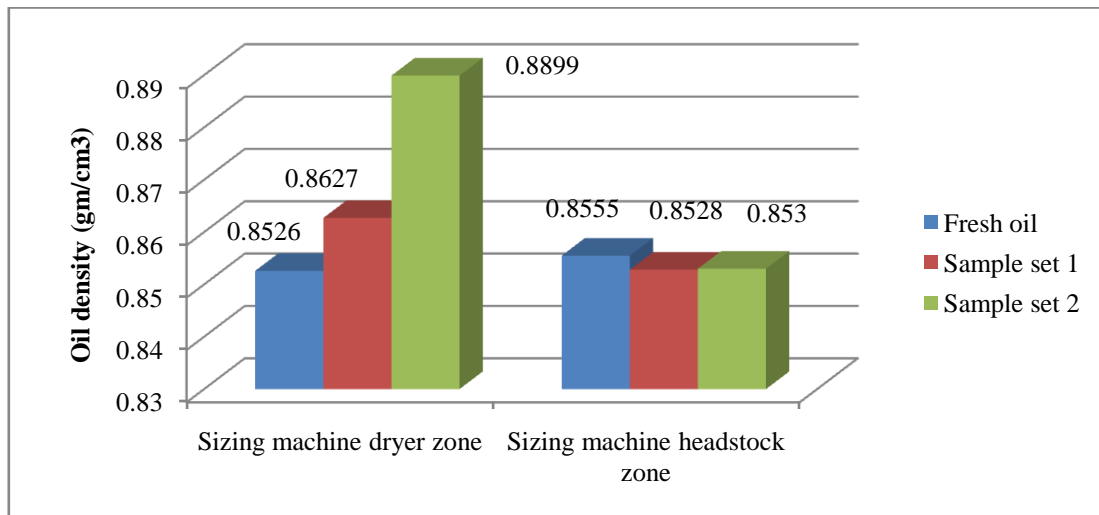


Figure 2: Density results of selected oil samples.

From Figure 2 it has been observed that oil density increases after certain period of time. The reasons behind the increase in oil density may be of addition of wear particles of metal contaminations.

IV (C) POUR POINT:

Oil pour point results obtained by testing selected oil samples are represented in Figure 3.

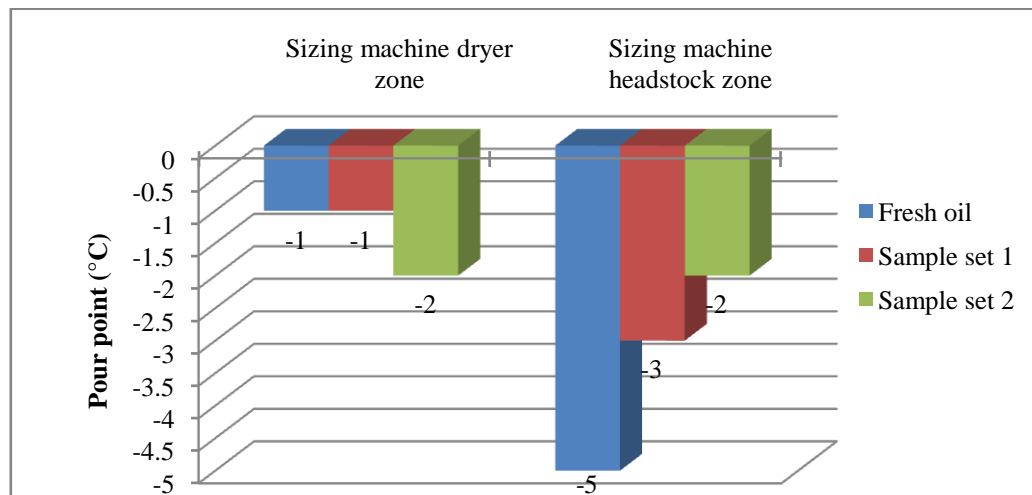


Figure 3: Pour point results of selected oil samples.

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It has been observed that oil pour point increases after certain period of time. The reasons behind the increase in oil pour point may be one or more of the following - cooling rate, formation of large crystal during solidification, temperature, improper additives or contaminants present in oil etc.

IV (D) OIL FLAMMABILITY:

Flash point results obtained by testing selected oil samples are represented in Figure 4.

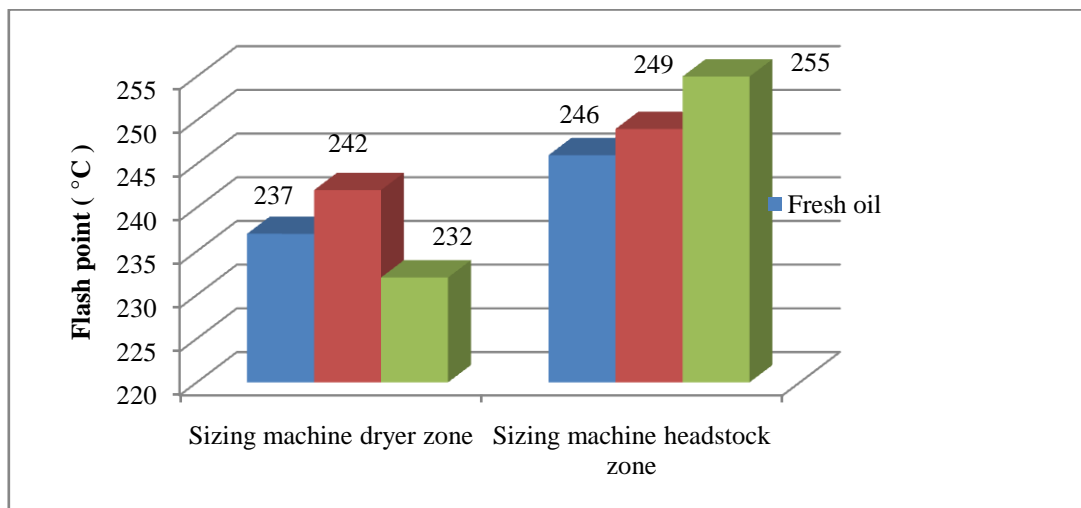


Figure 4: Flash point results of selected oil samples.

It has been observed that flash point of oil sample in drying zone was decreased after certain period of time. It may be due to addition of wear particles in oil, oil cracking, etc. For headstock zone sample it is found to be increased due to contamination, wrong mixing of oil etc.

Fire point results obtained by testing selected oil samples are represented in Figure 5.

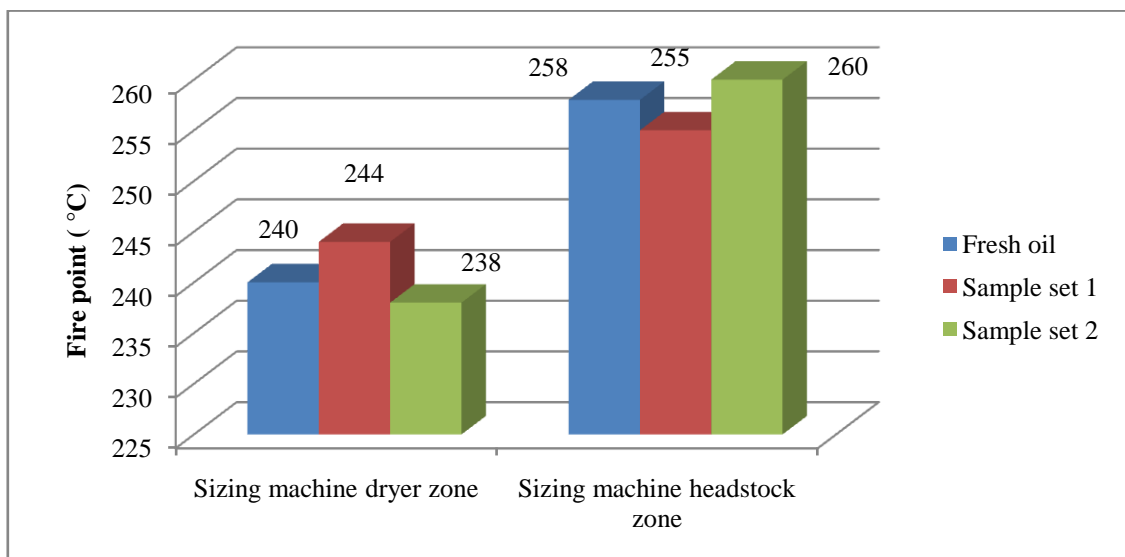


Figure 5 : Fire point results of selected oil samples.

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It has been observed that fire point of oil sample in drying zone was also after certain period of time. It may be due to addition of wear particles in oil, oil cracking, etc. For headstock zone sample it is found to be increased due to contamination, wrong mixing of oil etc.

IV (E) CARBON RESIDUE TEST:

Carbon percentage results obtained by testing selected oil samples are represented in Figure 6. Results are expressed in %.

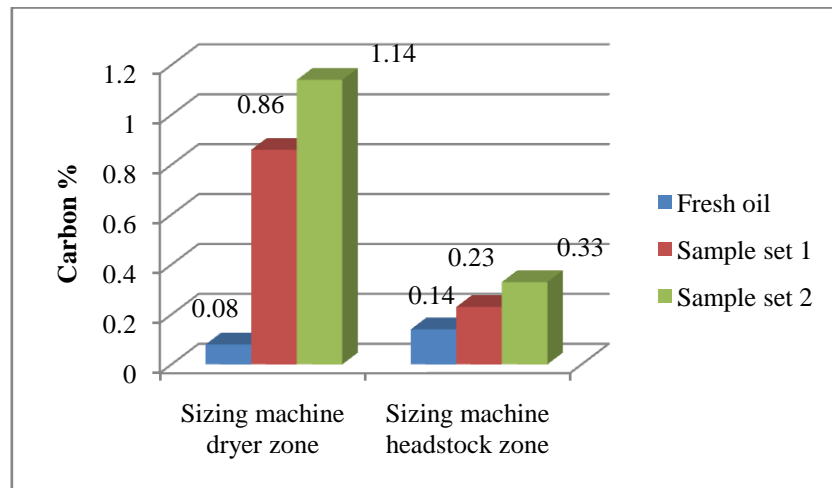


Figure 6: Carbon % results of selected oil samples.

It has been observed that oil carbon percentage increases after certain period of time. The reasons behind increase in carbon percentage may be oxidation, micro dieseling, additive depletion, contamination etc.

V. SPECTROSCOPY

For sizing machine overlapped spectroscopy graphs of headstock zone oil samples are as shown in Figure 7 and Figure 8.

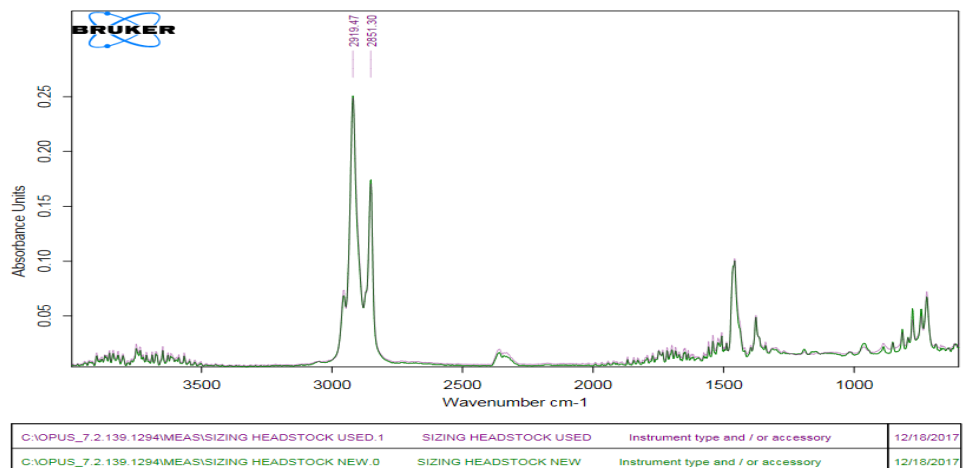


Figure 7 : Headstock zone - Overlap fresh and used oil sample 1.

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For sizing machine (headstock zone) overlapped spectroscopy graphs for oil sample set I are shown in Figure 7. It is observed that both the spectra are overlapping one another, which means no degradation in oil sample after 4 years has taken place as compared to fresh oil.

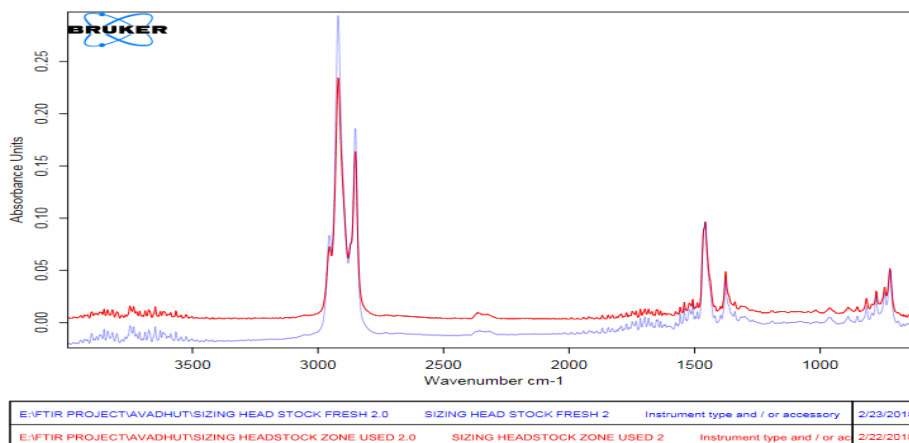


Figure 8 : Headstock zone - Overlap fresh and used oil sample 2.

For sizing machine (headstock zone) overlapped spectroscopy graphs for oil sample set II are shown in Figure 8. It is observed that both the spectra are having little difference in absorbency level, which means there is some degradation started in oil sample used for 7 years as compared to fresh oil.

Spectrum location

Table 1 : Spectrum location of sizing machine oil (headstock zone).

Spectrum location (cm-1)	Change in absorbency	
	Figure 7	Figure 8
675 - 1000	0.06 – 0.07	0.04 -0.05
690 – 900	0.02 – 0.03	0.00 – 0.01
1400 - 1600	0.05 – 0.05 & 0.10 – 0.10	0.04 – 0.05 & 0.09 – 0.09
2840 – 3000	0.17 – 0.17 & 0.25 – 0.25	0.18 – 0.16 & 0.29 – 0.24

The peaks observed in both graphs are same so no any added functional group is present in sample. In this graph very small change in absorbency is observed which shows initial phase of oil degradation.

Overlapped spectroscopy graphs of dryer zone oil samples are as shown in Figure 9 and Figure 10.

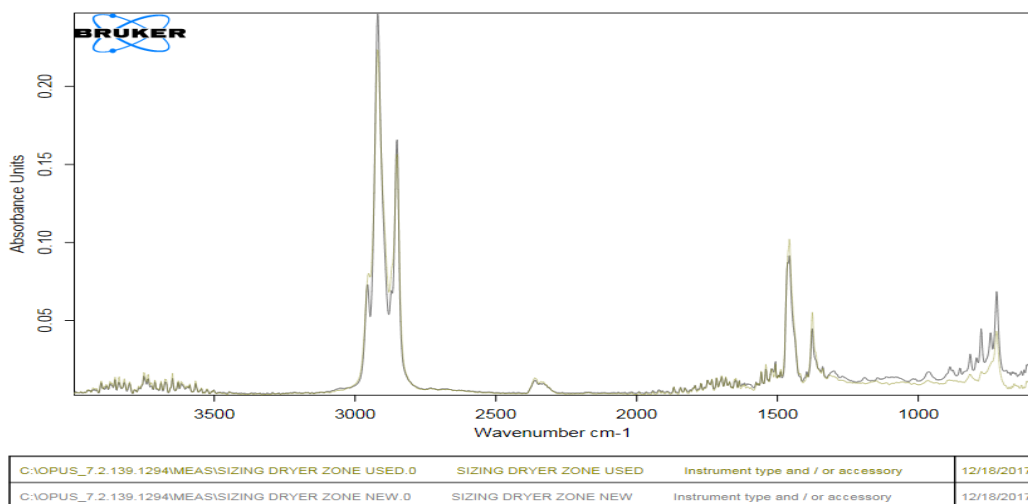


Figure 9 : Dryer zone - Overlap fresh and used oil sample 1.

For sizing machine (dryer zone) overlapped spectroscopy graphs for oil sample set I are shown in Figure 9. It is observed that both the spectra are almost overlapping one another, which means no degradation in oil sample after 4 years has taken place as compared to fresh oil.

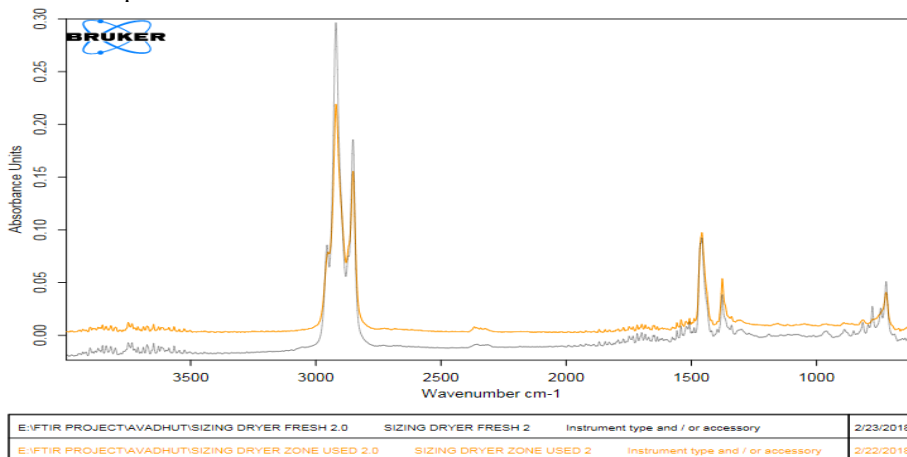


Figure 10 : Dryer zone - Overlap fresh and used oil sample 2.

For sizing machine (dryer zone) overlapped spectroscopy graphs for oil sample set II are shown in Figure 10. It is observed that both the spectra are having little difference in absorbency level, which means there is some degradation started in oil sample used for 7 years as compared to fresh oil.

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Table 2 : Spectrum location of sizing machine oil (dryer zone)

Spectrum location (cm ⁻¹)	Change in absorbency	
	Figure 9	Figure 10
675 - 1000	0.06 – 0.04	0.06 – 0.05
690 – 900	0.03 – 0.02	0.00 – 0.01
1400 – 1600	0.05 – 0.06 & 0.09 – 0.10	0.04 – 0.05 & 0.09 – 0.10
2840 – 3000	0.16 – 0.15 & 0.24 – 0.21	0.17 – 0.14 & 0.29 – 0.21

For sizing machine (dryer zone) overlapped spectroscopy graphs are shown above. These spectrum shows little changes. The peaks observed in both graphs are same so no any added functional group is present in sample. In this graph very small change in absorbency is observed which shows initial phase of oil degradation.

Reasons for change in absorbency:

1. Heat absorption capacity: During the actual working the heat generation takes place which affects the absorbency capacity of molecules.
2. Molecular forces or bond strength decreases: Because of heat generation the bond strength between molecules decreases which causes change in absorbency.
3. Addition of water or increase in acid number: Because of continuous action, breakdown of molecules takes place and free – OH group gets attached to the free branch of carbon. The absorbency capacity of original compound and newly formed compound is different.
4. Addition of unsaturated group: Addition of unsaturated compound like alkene or alkyne causes change in absorbency level.
5. Color change due to addition of fine particle: Because of continuous working, addition of worn-out metal particles, addition of contaminant causes change in color of oil.
6. Intensity: The intensity is nothing but intensity of IR radiation. The change in intensity of IR radiation at the particular testing time causes difference in absorbency.
7. Opaque: Some time the oil under testing shows opaque nature which avoid penetration of IR radiation and causes change in absorbency level.

VI. CONCLUSIONS

A well balanced oil analysis program can monitor machine wear condition, oil contamination and oil degradation simultaneously. There are many different approaches to implement an oil analysis program, depending on the application and maintenance objectives. The result presented by fresh and used oil of headstock zone and dryer zone of sizing machine shows that there is a considerable change in oil properties of 7 year used oil than 4 year used oil. The spectroscopy graph also shows change in absorbency level.

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BIOGRAPHY

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