

## International Journal of Innovative Research in Science, Engineering and Technology

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# Study of Degradation of Lubricants Used on Beam Warping Machine

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**ABSTRACT:** The Indian Textile Industry, though one of the oldest in India, has not given due importance to lubrication. Lubrication system is critical in many industries and it is equally important 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. Present-day, textile machines are becoming more and more sophisticated and complex with the use of various types of drives, components moving at widely varying speeds and working under different loads. 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. It has been observed and confirmed that a majority of the problems and breakdowns on machines occur due to faulty lubrication. With the establishment of mass production, quality consciousness among the buyers & the competitive market of textiles, keeping the overall production cost under the reasonable control, is need of time. This 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:** Beam warping machine, lubrication, viscosity, contamination, spectrography.

### I. INTRODUCTION

Today's weaving preparatory machines give much faster production because of high speed of warping machine up to 1200 rpm. Lubrication plays important role in maintenance of weaving preparatory machine. 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 characteristic requirement of lubricant and their properties. The fluid lubricants are commonly used for reduction of wear, elimination of heat and corrosion etc.

### II. 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 of direct beam warping machine. Type of oil used is Castrol hydraulic 3. The samples collected are as follows:

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

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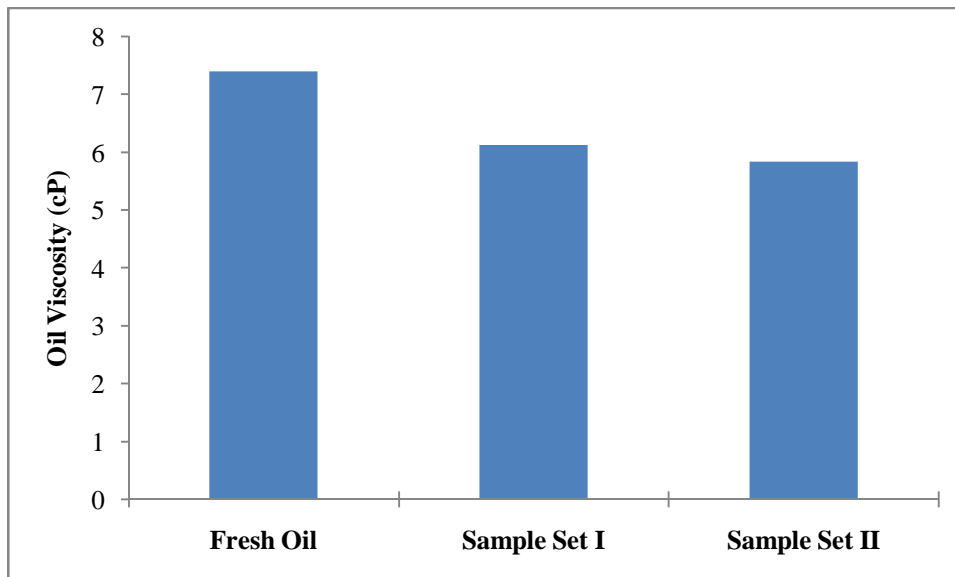
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## III. RESULTS & DISCUSSIONS

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

### 3.1 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 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.

### 3.2 Oil density:

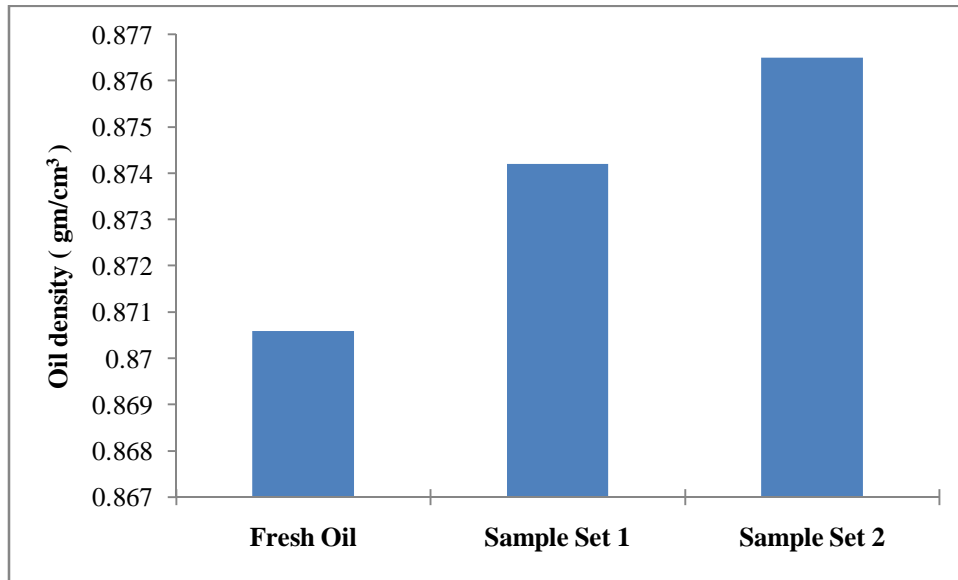
Oil density results obtained by testing selected oil samples are represented in Figure 2. Density is measured in  $\text{gm/cm}^3$ . It has been observed that oil density increases after certain period of time. The reasons behind the increase in oil density may be of addition of wear particles of metal contaminations.

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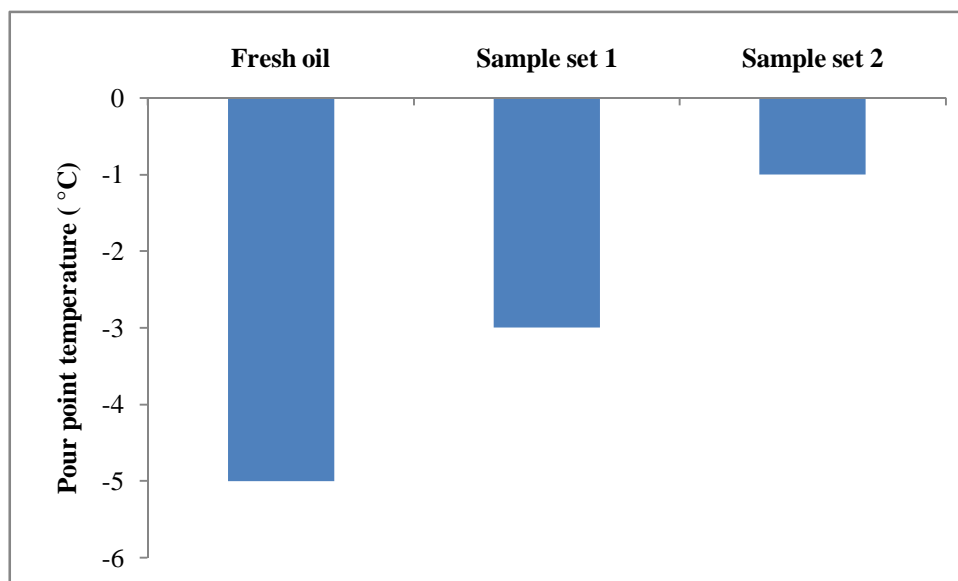
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**Figure 2: Density results of selected oil samples.**

### 3.3 Pour point:

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



**Figure 3: Pour point results of selected oil samples.**

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### 3.4 Oil flammability:

Flash point & fire point results obtained by testing selected oil samples are represented in Figure 4 and Figure 5.

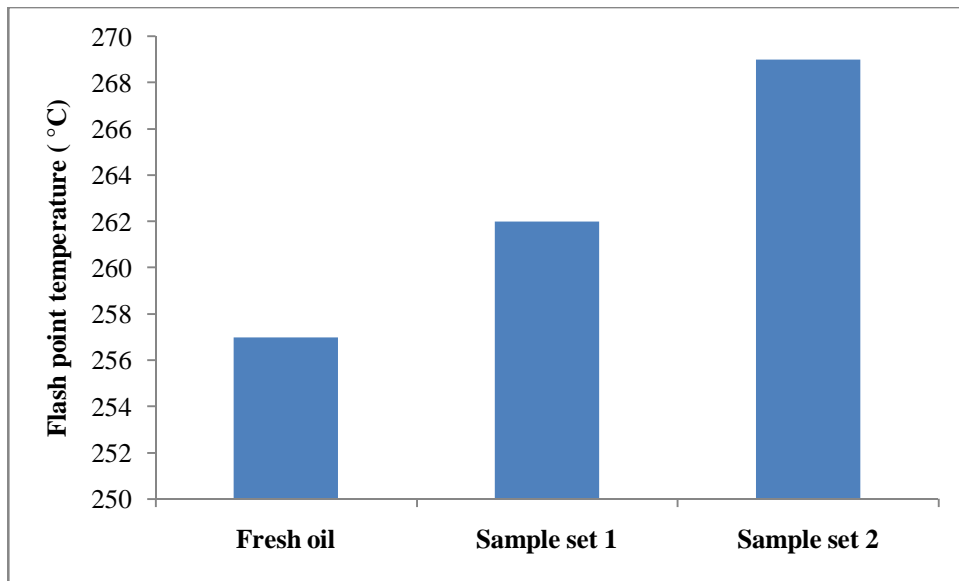


Figure 4: Flash point results of selected oil samples.

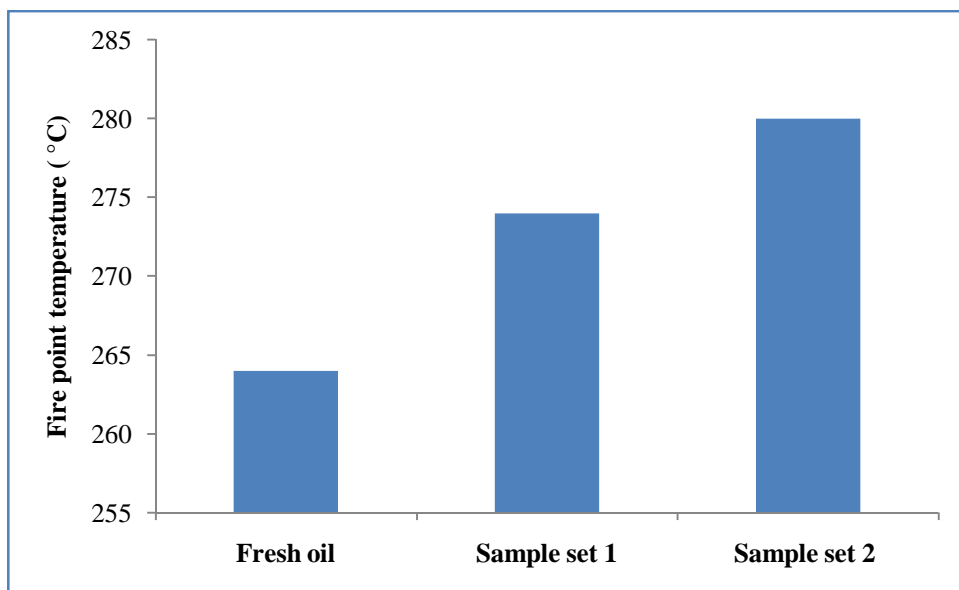


Figure 5 : Fire point results of selected oil samples.

It has been observed that flash and fire point of oil increases after certain period of time. Actually the flash and fire point should decrease, but due to addition of wear particles in oil, oil cracking, contamination, wrong mixing of oil etc. flash and fire point increases.

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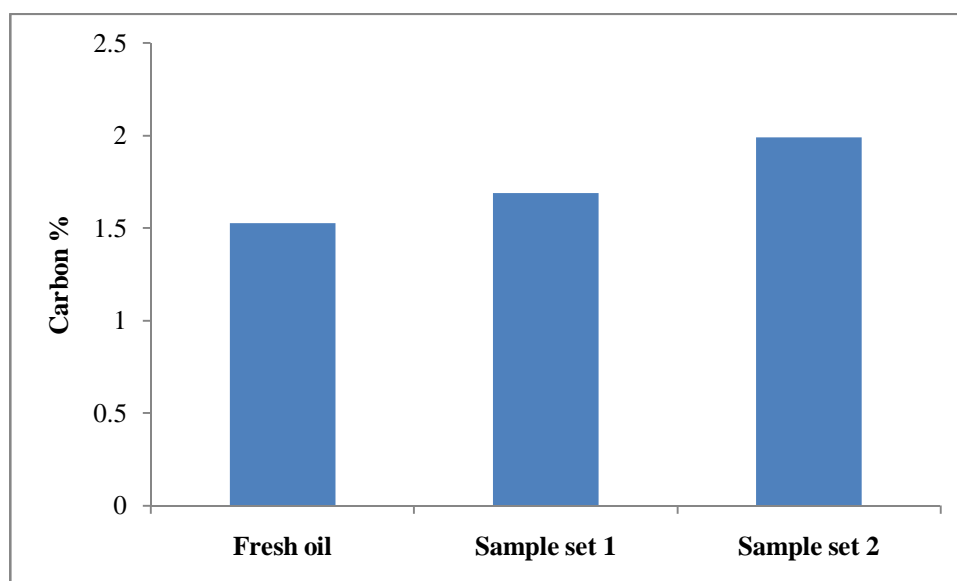
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### 3.5 Carbon residue test:

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.

### IV. SPECTROSCOPY

#### Direct beam warping machine

In case of direct warping machine overlapped spectroscopy graph is as shown in Figure 7 and Figure 8. This shows some changes. The peak observed in both graph 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.

#### Spectrum location

Spectrum location (cm <sup>-1</sup> )	Change in absorbency	
	Figure 7	Figure 8
675 - 1000	0.00 - 0.02	0.00 - 0.03
1400 - 1600	0.05 - 0.06	0.05 - 0.05
1670 - 1820	0.09 - 0.11	0.11 - 0.11
1620 - 1680	-0.01 - 0.01	0.00 - (-0.02)
2840 - 3000	0.18 - 0.17 & 0.29 - 0.28	0.19 - 0.17 & 0.29 - 0.28

**Table 1: Spectrum location of direct beam warping machine oil.**

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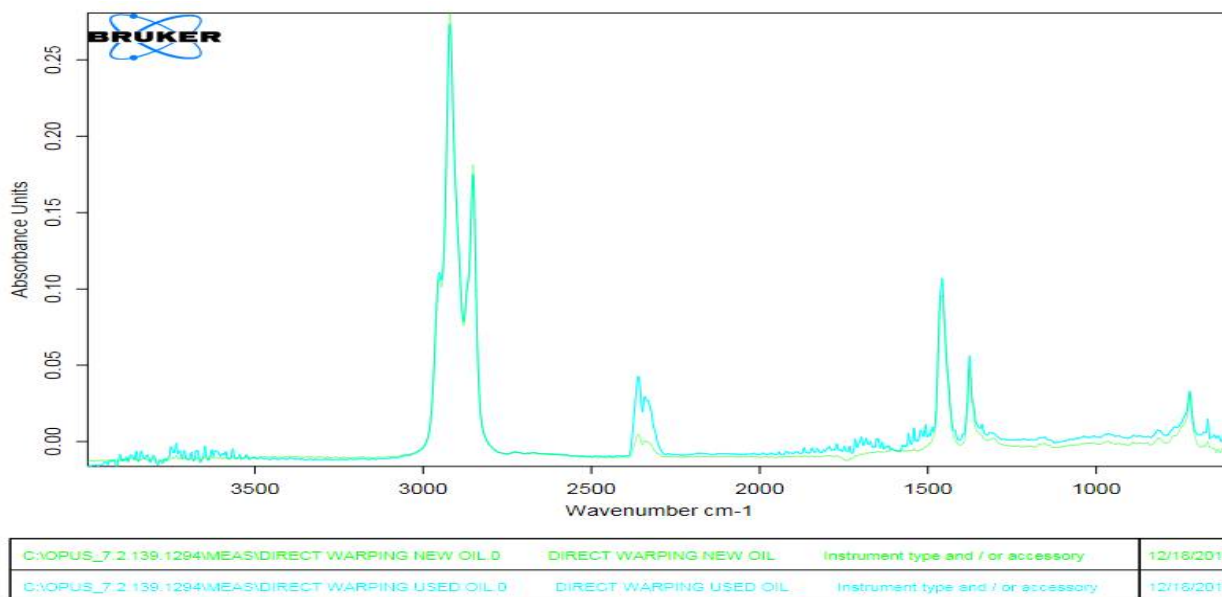


Figure 7 : Headstock zone - Overlap fresh and used oil sample 1.

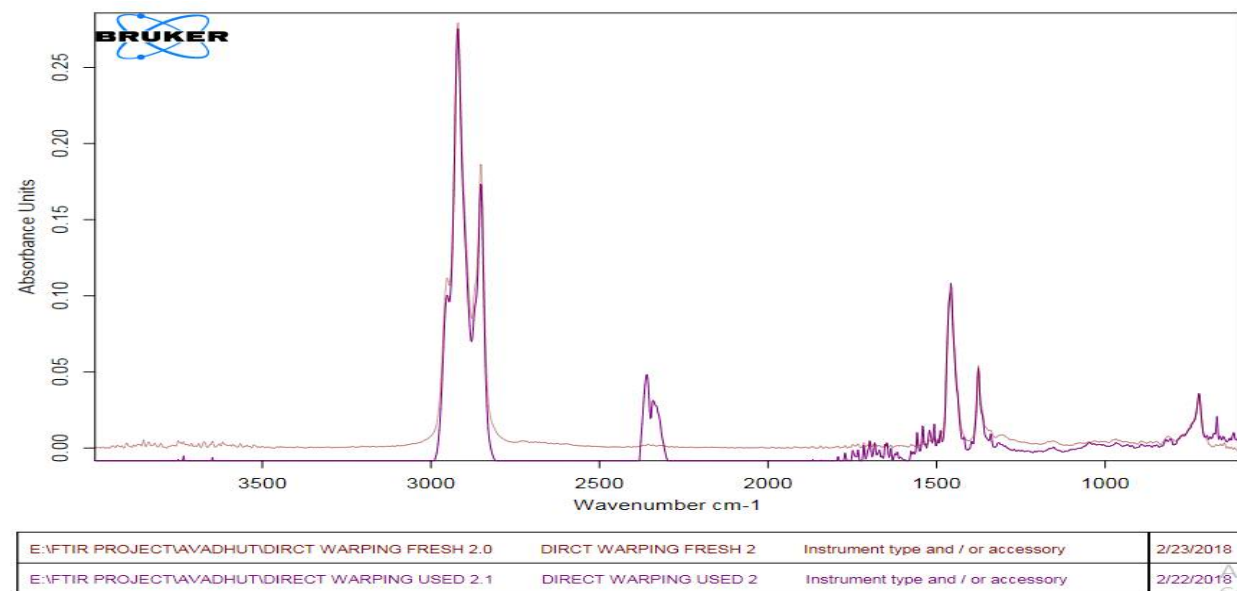


Figure 8 : Headstock zone - Overlap fresh and used oil sample 2.

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.

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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.

### V. CONCLUSION

A well balanced oil analysis program can monitor machine wear condition, oil contamination and oil degradation simulataneously. 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 direct beam warping machine shows that there is a considerable change in oil properties of 4 year used oil than 2 year used oil. The spectroscopy graph also shows change in absorbency level from this, the entire oil change frequency is predicted up to 6 years.

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### BIOGRAPHY

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