

# Study of Tribology Application and its Impact on Indian Industries

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## Abstract

*The Material cannot be used in raw form for useful purposes. They have to be shaped and formed into articles through different manufacturing process. In some cases the materials are suitably finished for commercial uses. In other cases neither surface finish nor the dimensions are satisfactory for the final product. However, the selection of best process for a given product requires knowledge of best possible production methods and Conditions. Tribology Contribute an important energy saving and resource conservation through reducing friction and wear. Proper lubrication and cutting oils are essential for manufacturing industry because lubricating and cooling capabilities enable them work effectively against shearing at the time of chip formation and chip removal flow.*

## Keywords

**Industrial Tribology, India, Green Lubricants, Automobile, Manufacturing**

## Introduction

Global Competition and demand for high profits has forced industry to reduce operating cost while increasing productivity. The most common way to increase productivity and cut cost is to ramp-up existing machinery and equipment above and beyond their optimum design limits. One must realize that demands, regulations and obligations about the environmental, ecological must be met and dealt with while continuing to produce competitive products, so that as per demand it is necessary for industries to Higher level of maintenance and process operation in machinery and equipments for all that requirement tribology and lubrication technology is most important Applications for industry [3].

Tribology is a combination of two Greek words -"Tribo" and "Logy", Tribo means rubbing and logy Means Knowledge. Tribology helps to increase life span of mechanical components [1]. Tribology plays a major role in cutting, a core technology with excellent manufacturing. Regarding cutting tools, various surface coating methods and material with superior friction and wear resistance characteristics have been developed and have enabled great stride in cutting tool performance.

Due to the very varied tribological conditions in different metal forming process the lubricants applied are quite different in different production processes. This Paper gives the overview of the Environmental problems regarding traditional applied lubricants and environmental friendly "eco- machining"[2].

## Area of applications

Tribology now becomes a field, today tribology play a critical role in diverse technological areas in advance technological industry such as individual components, assemblies or products, manufacturing process, Construction, exploration, natural phenomena etc. The ASME Research committee on lubrication in their report says the magnitudes of energy conservation that can be potentially be obtained in the four major areas of road transportation, power generation, turbomachinery and industrial process through progress in tribology[8].

## Methodology and concepts

Traditional oil test procedures have proven that with proper monitoring and regular lubricant change over intervals, machinery, operating equipment and lubricant life may be significantly extended [3]. New analytical and sensor technologies permit instant on site evaluation of lubrication performance and allow external or automatic intervention to enhance and prolong the optimum performance level of lubricant. Advances in machinery vibration detector fluid management control through proper proactive maintenance contributed the lubricant life extension.

Tribology and Lubrication in extreme environments necessary the planning and implementation on condition monitoring program. A proper coordination must be established between the fluid producer Machinery equipment and the end user. A line of direct communication between parties must be open and synergetic.

Metallurgical alloys used in bearings and gears are assembled and tested at specific operating speed and temperature. At elevated speed and temperature, these alloys will deform and expands in unpredictable and non-producible dimensions. This deformation will normally reduce clearances allowed for lubrication and change spherical rotation to 'erratic'. This in itself starves the lubrication points, generating more heat, more deformation, increased vibration and finally failure.

## Role of Tribology in industry

The industry today synthesizes lubricant molecules and play a major role in this field. BHEL was the first one to recognize it and started department of tribology for analyzing its journal and bearing failures used in rotating machineries.

Now Indian industries are focused on green Lubrication and green Machining process due to environmental issue and more

restrictive environmental regulation drives. The various green lubricants available are [4]

Highly unsaturated or high oleic vegetable oils (HOVOs)

Low viscosity polyalphaolefins (PAOs)

Polyalkylene glycols(PAGs)

Dibasic acid esters(DEs)

Polyol esters (PEs)

India has a large domestic and international market for industrial output. At the same time, she is rich in natural resources, skilled manpower and low-wage labour. India today has the world's third largest stock of scientific and technical manpower, after USA and USSR. Various industrial sectors and technological fields are gaining priorities in this transitory stage. One field which has gained recognition is industrial tribology and maintenance. This area is often neglected both in developed and developing industries thus presenting large pay-offs for problem solving. The recognition of the importance of tribology and maintenance is now wide-spread in Indian industry, although the term tribology is not always used. The build up of various indigenous capabilities in industrial tribology and maintenance takes place at different locations in the economic system. Such capabilities regard identification and diagnosis [9].

The term "Industrial Tribology" is concerned with the design of mechanical products and equipment, and their operation and maintenance with the objective-

- (i) To conserve material resources through reduction of wear,
- (ii) To conserve energy through reduction of friction,
- (iii) To increase the operating life of the equipment through maintenance engineering,
- (iv) To increase standards on product reliability and personnel safety.

In a developing country like India, the importance of industrial tribology is self-evident. In order to achieve increased productivity, one should take care to see that machines are kept in good operating conditions with minimum down-time [9].

### Tribology in Automobile

According to recent study cost of friction and wear in India is Rs. 78.67 and 55-60 % of equipment damage is caused by poor lubrication and severe wear. India has grown as the fourth largest Consumer of automobiles in world in 2013. Vehicle population has reached 21 Million in 2011-12. With this increase consumption of auto lubricants also increases. Better fuel efficient and higher energy conserving engine oils will become increasingly important in the face of saving of natural resources. The application of tribological principles is necessary for automobile, in order to reduce friction and wear with minimum adverse impact on environment. This task is not with the consideration of operating condition, speed, load and temperature.

Improvement in Tribology performance of engine can provide following benefits [5]

Increased power output

Reduced fuel consumption

Reduction in harmful exhaust emissions

Increased engine durability

Reduced Maintenance requirements and longer service intervals.

According to Survey 48 % of energy consumption developed in engine is done by friction loss (Table. I). With such large number of engine in service in India, even a small change in engine efficiency durability and emission level can have great impact on world fuel economy and environment.

Tire is also affected by the application of Tribology. Tire is the only contact of vehicle with the ground. All type of forces (Traction, cornering, braking etc.) is transmitted to the ground through this contact only. So it is prime concern for tire manufacture to deliver safety. Safety is measured at every step of tire manufacturing. The Treated designs are preferred not only for aesthetic reasons but also for better grip, good directional stability and control and easy removal of water which prevents aquaplaning at high speed. Traction properties of tire define its breaking, grip and high speed concerning performance. Silica technology in compounding when coupled with snow & ice friendly tread designs, good result on wet surface also. Test indicates the tires are maintained at the correct pressure the silica compound will reduce rolling resistance by 20% or more. This means less fuel is required to propel the vehicle forwards with 20% reduction in rolling resistance translating into a 5% reduction in fuel consumption.[6]

Table. I

Energy Consumption of Engine

Energy Consumption Area	Percentage
Friction Loss	48 %
Acceleration Resistance	35 %
Drive Train	7 %
Differential Gear	4 %
Transmission	3 %
Air Drag	3 %

### Tribology in Manufacturing Sector

Comparative analysis from the Table III shows the percentage of tribological, electrical and other issues in industries. It is observed that the percentage of tribological faults were the highest in 4 industries (31%) namely food/Agro industry, plastic industry, confectionaries and bottling industry.

Food/Agro industries had tribological fault about 4% due to fact that they are more into electrical work and pharmaceutical industry having 69 % of faults coming from electrical issues, both food and pharmaceutical are not into much mechanical work more of electrical. Confectionary/ Manufacturing industry

recorded highest downtime on tribological effect (55%) because their machines are more of tribo-elements like bearing, cutting tools, roller, shaft etc.

Table II

Industrial Production falling due to slower manufacturing Rate

(Source: Ministry of Statics & program Implementation)

% Growth Period of previous year	Dec 13	Dec 12	Apr-Dec 13-14	Apr-Dec 12-13
IIP	-0.6	-0.6	-0.1	0.7
Mining	0.4	-3.1	-1.8	-1.8
Manufacturing	-1.6	-0.8	-0.6	0.6
Electricity	7.5	5.2	5.6	4.6

it is clear indication (Table II) that most of faults occur in manufacturing industry due to tribological faults, it is necessary to effective maintenance of their machines to prolong their life span.[7]

The Indian Machine tool Industry growth directly linked to the growth of manufacturing/engineering sector. The Indian Machine engineering industry uses of all type of machine tools of more than worth of 35 Billion USD. Machine Tools industry manufactures both type of Conventional and Numerical Controlled (CNC) Products such as metal cutting and metal forming tools.

With the increasing in production rate and methods of machining, manufacturing Industries demands of lubrication fluids also increased regularly. Currently Indian lubricating market is the 5<sup>th</sup> largest market in the world in terms of consumption volume after US, china, Russia and Japan. The Indian lubricants market would grow considerably exceeding 7713 million USD by 2017 due to the major push from the automobile market in India.

Table III

Distribution of downtime period in Industries

Nature of Industry	Tribologic al Losses	Electrical Losses	Other Losses
Food/Agro Industries	5 %	72 %	23 %
Pharmaceutical	10 %	68%	22 %
Confectionary/ Manufacturing	55 %	30 %	15 %

Indian Industry present a full spectrum of technological capabilities with the using of latest technological methods and maintainance process in all kind of industries, there are various

new methods and techniques are introduced in manufacturing sector with the help of research and development Cell, number of industries are contribute in R&D for better quality product and industrial growth.

## V Conclusion

India has made magnificent growth in Science & Technology with using of various new techniques in industries. Demands for procurement and maintenance of machines, equipment are prime concern to get better productivity in low cost. so that tribology play an important role for better production, this paper shows from data and study, Indian industries are adopting new methods of lubrication techniques, Currently Industrial Tribology in developing stage therefore Indian Govt. and private sector industries are concentrate on Research and development and it will make great advancement in future with including of sub sector of tribology like GreenTribology, Nanotribology, Spacetriology, Computation and advancement reliable tools.

## References

- i. S S perry, W T Tysoe ; *Frontiers of fundamental tribological Research, Tribology Letters, Vol. 19 No. 3, July 2005*
- ii. Toshiyaki W. *The Role of Tribology in enviornmentally friendly MQL Machining; JTEKT Engineering Journal English edition 1007E,2010*
- iii. Y. Kimura. *Tribology as a Maintanance tool. In new direction in Tribology; World Tribology Congress: I M Hutchings Editor, London 1977.*
- iv *Ponnekanti Nagendramma, Savita kaul: Development of ecofriendly /biodegreable lubricants: A Review*
- v *Tung S C and Mcmillan M L: Automotive tribology overview of current advances and challanges for the future.*
- vi *Vivek Singh, Jyoti Vimal, Vedansh Chaturvedi : A Study on development of Industrial Tribology in India with future Prospects, IJMIE, ISSN No. 2231-6477, Vol. 2 Issue 4*
- vii *O E Simolowo, M B Adeniji: The Effect of tribological processes on productivity : A Case study of industries in Ibadan metropolis of Nigeria; The Pacific Journal of Science & Technology, Vol. 10, May 2009.*
- viii *Mervin H Jones, Douglas Scott :Industrial Tribology-The Practical Aspects of friction, Lubrication & Wear, Elsevier Scientific Publishing Company, Oxford, New York, ISBN 0-444-42161-0 (Vol. 8)*
- ix *O Granstrand, A K Raman, L S Sreenath: Evaluation report of project ind 014 and the industrial tribology, Machine dynamics and maintenance engineering centre (itmmec) at IIT, Delhi. Sept. 1981.*
- x *Report on Indian Manufacturing Industry- Technology Status and Prospectus (www.unido.org/technology)*