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Analysis of the Various Lubricants Used in the Different Machining Processes to Improve the Quality of Life of Products and Personnel's Hacks

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ABSTRACT: Machines are used in the world since ancient times for different purposes and applications. The machines are the assembly of two or more components that work simultaneously so there is the appearance of friction between the components which reduces the efficiency and life of the components so lubricants are used. Thus, the focus of the study is to analyze various lubricants used in the various machines which improve the life of components as well as the efficiency of machines. Different studies are done on the applications, types, and efficiency of lubricants. There are various lubricants available in the market which effectively affects the performance of any machine. Mineral oil, bio-lubricants, synthetic oil, aqueous lubricants, and solid lubricants are the different types of lubricants that are used in the industry. Thus, it can be said that there are new lubricants that have more efficiency and produces less pollution, and are easy to decompose without disturbing the cycle of the environment. The study will help in analyzing the different uses and properties of lubricants used in the industries to improve the efficiency of machines productions.

Keywords: Friction, Industry, Lubricant, Machine, Oil.

1. INTRODUCTION

A lubricant is a chemical that aids in the reduction of friction between edges in direct contact, hence lowering the heat created as the surfaces move. It may also be used to transfer forces, convey unwanted particles, or cool or heat the surface. Lubricity is the attribute of lowering friction. Lubricants are utilized for a variety of purposes outside of industrial ones. Preparing food (oils and fats used in frying pans and baking to avoid food sticking), ultrasonography examination, bio applications on people, and medical examination, are some of the other uses. It is primarily used to minimize friction and aid in the smooth and efficient operation of a device [1]–[3].

Lubricants have been employed for 1000 years in many applications. Calcium soaps were already discovered on the wheels of 1400 BC chariots. During the period of the pyramids, masonry blocks were slid on oil-impregnated timber. Lubricants there in the Roman period were made from olive oil, rapeseed oil, and animal fats. The adoption of metal-based machinery drove the expansion of lubrication during the Industrial Revolution. Initially based on natural oils, the need for such machinery switched to petroleum-based materials in the early 1900s. The Pneumatic Oil Company characterized the invention of air distillation of crude oil as a milestone. This method enabled the purification of relatively nonvolatile compounds found in several lubricants [4]–[7].

Lubricants typically comprise 90 percent base oil and fewer than 10% additives. Base oils can be vegetable oils or chemically synthesized fluids such as esters, fluorocarbons, silicones, hydrogenated polyolefins, and many more. Enhanced viscosity index, reduced friction and wear, resistance to corrosion and oxidation, contamination, higher viscosity, and other benefits are provided by additives [8]. Powders (dry graphite, molybdenum and tungsten disulphides, polytetrafluoroethylene (PTFE), and others), PTFE tapes used throughout plumbing, air cushion, and others are examples of non-liquid lubricants. Dried lubrication like graphite, molybdenum, or tungsten disulphide may also provide lubrication at high temperatures (equivalent to 350 °C) than aqueous and oil-based lubricants. Although there has been some interest in the low friction qualities of compacted oxide glazing layers generated at hundreds of ° C. in metallurgical sliding systems, practical use is still several decades away attributed to its physically unstable nature as their properties are as shown in Figure 1[9]–[11].

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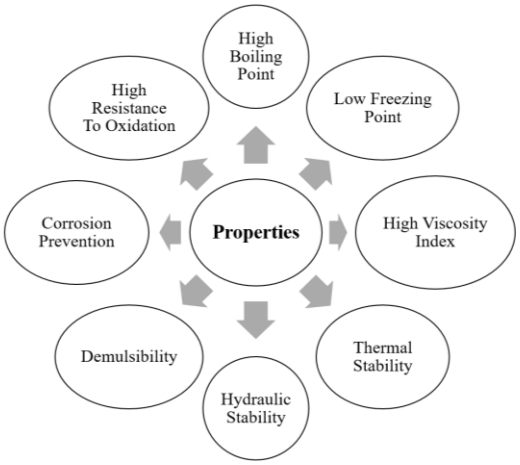

Figure 1: Illustrates the Properties of Lubricants That Are Considered While Selecting the Lubricant for Machines.

Thus as shown in Figure 1, there are various properties of lubricants used in the industries for different purposes. The lubricants are used for avoiding or reducing the frictional losses during the machining process between multiple machine components. The use of lubricants is done since the old time from the invention of the wheel to the present time. The lubricants are important due to their unique properties which enhance the working of machines and machine components. Thus, the study of different lubricants is necessary with their different types and properties to improve the efficiency of machines used in the industry as well as to improve the life of machining components.

2. DISCUSSION

Lubricants were consumed in an estimated 37,300,000 tonnes globally in 1999. Automotive uses dominate, especially electric cars, although lubricants are also used extensively in industrial, marine, and metalworking applications. While air, as well as other gas-based lubrication, are recognized, liquid lubricants, followed by solid lubricants, dominate the market. Lubricants are typically made up of a preponderance of basic oil with a range of additives to give desirable properties. Although lubricants are typically based on a single kind of base oil, mixes of base oils are often utilized to fulfill performance requirements. The application of lubricants is based on their area of application where different lubricants are used in industrial machines as shown in Figure 2.

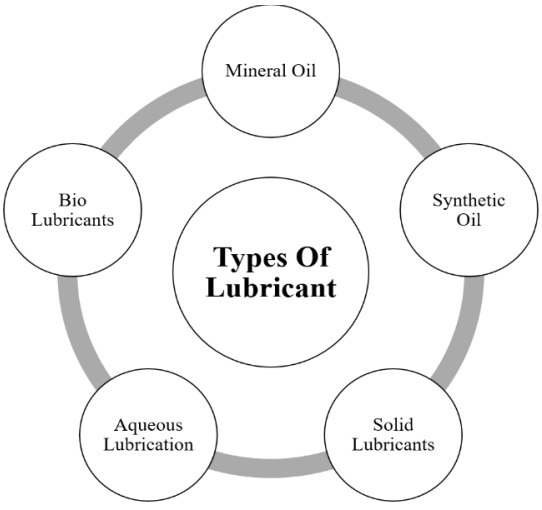

Figure 2: Illustrates the Different Types of Lubricants That Are Used In Various Industrial Applications.

2.1. The function of lubricants:

Table 1: Illustrates The Function Of Lubricants For Various Industrial Applications.

Sr. no.	Function	Details
1	Prevent corrosion	To avoid rust and corrosion, several lubricants are created with chemicals that establish chemical connections with surfaces or prohibit moisture. It prevents submerged corrosion by reducing rusting among two metal surfaces and avoiding contact between such surfaces.
2	Anti-tack or anti-stick coatings	Anti-sticks or anti-tacks coating are intended to diminish a particular material's sticky state (stickiness). Although the latex, hoses, and wiring and connection sectors are the main users of anti-tack compounds, practically every business employs some sort of anti-sticking chemical. Anti-sticking agents vary from lubrication because they are intended to minimize a compound's intrinsic adhesive properties, whereas lubricants are intended to reduce friction between two surfaces.
3	Transmit power	Hydraulic fluid lubricants are used as working fluids in hydrologic power transfer. Hydraulic fluids account for a significant share of all lubricants manufactured worldwide. Another notable use for transmitting power using lubricants is the traction converter in automatic transmissions.
4	Seal for gases	Lubricating oils will consume the clearance among moving components by capillary force, closing the gap. This effect is useful for sealing pistons and shafts.
5	Reduce friction	Lubricant-to-surface friction is often substantially lower than surface-to-surface friction in a lubricated system. As a result, using a lubricant minimizes total system friction. Reduced friction reduces heat generation, reduces the creation of wear particles, and improves efficiency. Lubricants might contain polar components known as friction modifiers, which chemically attach to the metallic surface to minimize friction even if there is inadequate mass lubricant available for hydrodynamic lubrication, such as when starting a vehicle engine. As with polyester oils, the base oil itself may be polar and hence naturally capable of binding to metal surfaces.
6	Protect against wear	Lubricants protect against wear by keeping moving components separate. Lubricants may also include anti-wear as well as intense pressure compounds to improve their resistance to wear and fatigue.
7	Keep moving parts apart	Lubricants are commonly utilized to keep moving elements in a system apart. This separation reduces friction, wear, and surface fatigue, as well as heat generation, operational noise, and vibrations. Lubricants do this in a variety of ways. The most frequent method is to create a physical barrier by separating the moving elements with a fine coating of lubrication. This is similar to hydroplaning, which occurs when a car tire separates from the road surface when driving over standing water. This is referred to as hydrodynamic lubrication. When the interface pressure or temperatures are high, the fluid layer becomes significantly thinner, and part of the forces are passed between the surfaces via the lubricants.

8	Carry away contaminants and debris	Lubricant circulation systems offer the advantage of transporting internal debris and external impurities put further into the process to a filtration where they could be eliminated. Lubricants for devices that create debris or impurities regularly, such as automotive engines, generally contain detergent and dispersion additives to aid in particulate and contamination to and removal from the filter. The filter will become clogged with time and will need to be cleaned or replaced, which is why it is recommended to change the oil filter during the same interval as the oil. In closed systems, such as gearboxes, a magnet may be used to trap all iron particles that are produced. Because the oil in such a circulatory system might only be as pure as the filters can make it, it's indeed frustrating there was no industry norm by which customers can easily judge the filtering capabilities of various vehicle filters. Poor car filters severely diminish the machine's (engine's) life and make the systems inefficient.

Thus, there are different properties of lubricants that affects the functioning of liquids as well as a selection of the type of lubricant in the machines. Table 1 illustrates the functions of different lubricants as shown in Figure 2 used in the various machine components. Thus, using lubricant is necessary for different machines depending on their work to improve the life of the component and the productivity as well as efficiency of the machine. So the study is necessary for the analysis of different lubricants used in the industries for different machine components.

3. CONCLUSION

Lubrication is an important part of any machine and machining process so the use of lubricant is necessary to improve the efficiency of such machines. The industries are mostly working on different types of machines where the components are lubricated with lubricants to reduce their frictional losses in the machine. Different studies are carried out on the different types of lubricants and fluids that are used to improve the life of machine components as well as affect the productivity of the machine. It is been observed that there are various types of lubricants used in the different types of machines depending on their area of application. Thus, the bio-lubricants are effective lubricant which is eco-friendly and efficient as well. The study will help to know the importance of lubricants in machining and industries and their effect on productivity.

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