

# A Review on Lubrication System Used For Machining Process

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**Abstract**— The enormous reduction in the quantity of lubricant compared to the circulated quantities of conventional metalworking fluid systems is the key feature of MQL. In contrast to conventional flood lubrication, minimum quantity lubrication uses only a few milliliters (ml) of lubrication per hour for the machining process. Minimum quantity lubrication today uses such precise metering that the lubricant is nearly completely used up. Typical dosage quantities range from 5 ml to 50 ml per process hour (tool cutting time). This review paper explores the research study on the use of MQL and flooded lubrication system used for machine process by using natural lubricants like Jatropa. The used of lubrication is necessary for dissipated the maximum heat generated from the machining process, the analysis of this heat generated is proposed to carry out by using ANSYS software.

**Keywords**— Lubrications, MQL, Flooded, Machining, Jatropa, Vegetable oil, Tool life.

## 1. INTRODUCTION

Machining is one of the most essential processes in the manufacturing industry which involve a controlled elimination of material from the substrate by using a cutting tool. In the machining operation plastic deformation of the work piece material and friction between tool-chip and tool-work piece interface, lots of energy abounding is converted into heat. During this machining of low strength alloys, this heat generation is less but when ferrous and other high strength alloys are machined, lot of heat is generated which increases with a consequent increase in the cutting speed. The distribution of heat generated during machining is shown in Fig. 1.1. This heat generate, if not dissipated successfully, may affect the surface finished quality and reduce the life of tool and hence generally affected performance of the process. Thus, though high speed machining is popular in many operations for higher production output, the consequences of heat generation during machining operation needs to be minimized. Different techniques were evolved for the effective elimination of heat generated from the surrounding area of the machining. One of those techniques evolves the used of coolant in the form of fluid during the process.

For last some decade's years, coolants, commonly known as metal working fluids (MWF) continued to be profitably for the heat removal until it was realize that these fluids are a hazardous to the environment and to the health of the operator person working with it. Some researchers had created a waste disposal problem and add to the cost of the mechanized. These negative consequences of the flood cooling promoted the researchers to change to those technologies which involve least usage of the cutting fluids [2].

Many alternatives options were developed to reduce the quantity of cutting fluid used. Some such techniques that came into focus were:

- A. Dry Machining
- B. Cryogenic Cooling
- C. Coated Tools
- D. Minimum Quantity Lubrication
- E.

### 1.1.1 Dry Machining

The use of cutting fluids is harmful to environmental and also health effects, machining in many situations is carried out without using any cutting fluid. This is probable only at low cutting speeds and easily machine able materials like aluminium. Generally, dry machining is not appropriate in cases where superb surface finish and high dimensional accuracy is needed. This is so because dry machining involves generation high heat from the cutting surface and this built up layer of chips over the tools due to its unstable nature breaking of chips and takes away a bit of tool material due to its high adhesive nature leads to tool wear. The broken segments of machine tool when stick to the machined surface deteriorates the surface finish. Thus, dry machining devoid of any lubricating and cooling improvement is not preferred in general cases of machining.

### 1.1.2 Cryogenic cooling

Cryogenics is defined as work with materials at temperatures minus than  $-150^{\circ}\text{C}$  ( $123\text{K}$ ). Mainly fluid nitrogen is used as for cryogen material. It is an odourless, nontoxic gas and colourless, It constituting about four-fifth of the atmospheric gases. Its boiling point -  $198.79^{\circ}\text{C}$  and melting point is  $-210.01^{\circ}\text{C}$ . These characteristics make liquid nitrogen (LN<sub>2</sub>) as the most suitable gas for the cryogenics applications [3]. During machining, the cryogenic coolant is supplied to the machining area (cutting zone) where heat generation is prone to be maximum. The coolant absorbs heat and lowers down the maximum temperature reached thus contributing in tool life enhancement.

### 1.1.3 Coated Tools

In order to avoid the practice of cutting fluids during machining process, currently coated or layered tools are attainment popularity. In this process the tool insert are provided with a coating which can serve the following purposes. It should possess low thermal conductivity so that it does not allow heat to enter into the bulk material of the tool. Mostly titanium based coating materials are used for coating. Generally the, materials are used are like TiAlN, TiN, TiAlCrN etc.

### 1.1.4 Minimum Quantity Lubrication

The main intend of minimum quantity lubrication (MQL) is to gather the benefits of cutting fluids without getting hazardous effects to the human being and affected the life of the cutting tools. It included the use of least quantity of cutting fluid with a typical mass flow rate of cutting fluids is between 50-500 ml/h which is directly applied to the cutting zone thereby avoiding the need of fluid disposal as it happens in flood cooling. Since MQL involves significantly lesser amount of cutting fluid, this phenomenon is popularly referred to as 'near dry machining' or 'micro lubrication' or 'spatter lubrication' [2].

## 2. LITERATURE REVIEW

Imtiaz Ahmed Choudhury et.al. Investigated for a critical Assessment of lubrication techniques used for the machining processes. The critical assessment during the used of lubrication is deeply studied during the machining operation. The machining operation needed the lubrication for its proper working; the vegetable oil is used as lubrication in the machining operation, also the factors affecting the performance of machining processes is studied [1].

Dr.S.S.Chaudhari et.al. carried out research work on the role of MQL in the tool wears during the machining work. The experimental study is presented for the finding the role of minimum quantity of lubrication during the machining operations. The results of study show that the use of MQL can improve life of tool [2].

Lincoln Cardoso Brandao et.al. made the experimental study on the temperature and heat flow during the tapping process. The study presented the different types of cooling system included flooded and minimum quantity of fluid. The thermocouple is embedded for measuring the temperature of cooling system on the surface of work piece and convective heat transfer rate is studied for different two lubrication systems [3].

Sunday Albert Lawal et.al. presented review on the use of MQL lubrication system for machining processes. The machining performance of various types of vegetable oil based lubrication system is study for conclusion. The study of result established that vegetable oil-based cutting fluids as a good metalworking fluid [4]

Carlos Henrique Lauro, et.al.carried out the experimental work for define the heat flow in the drilling operation by using the finite element approaches. The heat generated in the high speed cutting zone causes the damaged the cutting tool. A flooded lubricant system and the minimal quantity of lubricant (MQL) were applied to investigate the ability to remove heat from the cutting zone and to compare with dry tests. The results of study concluded that, MQL is best suited lubrication system [5].

Youssef Iskandar carried out the investigative work on the MQL lubrication system used in the machining of composites. Minimum Quantity Cooling Lubrication (MQCL) is used for the carried the experimentation on the machining. The air and lubrication is used for the machining operation. The injected nozzle is used to impinging air and lubrication. The experimental results are validated with the computational results for concluding [6].



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#### 5. CONCLUSION

Lubrications plays very vital role during the machine process. The machine process needs very proper lubrication otherwise then it affected the tool life and workpeice. The dry lubrication is not suitable for high speed operation. This review papers presented the review study on the lubrication study based on the use previous experimental studies.

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