UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FEASABILITY STUDY OF USING VEGETABLE OIL AS A CUTTING LUBRICANT ON CONVENTIONAL LATHE MACHINE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelors of Manufacturing Engineering Technology (Process and Technology) with Honour.

By

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I hereby, declared this report entitled Feasibility Study of Using Vegtable Oil as a Cutting Lubricant during Machining on Convential Lathe Machine is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honors. The member of the supervisory is as follow:

……

(Madam Umi Hayati Binti Ahmad)

DEDICATION

This report is dedicated to Madam Umi Hayati Binti Ahmad for without his early inspiration, coaching and enthusiasm, none of this would have happened. This dedication is especially dedicated to my parents Mr. Mohd Azman Bin Ibrahim and Madam Surida Binti Osman. I hope that this achievement will complete their dream that they had for me all those many years ago when they choose to give me the best education they could. This dedication is also dedicated to my beloved friends that have provided me with a strong love shield and always surround me and never lets any sadness enter inside.

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ABSTRACT

In machining, the occurrence of tool wear is a natural phenomenon which may lead to tool failure. The deformation during cutting at the interface between the tool face and work piece tends to generate high cutting temperature. This condition reduces the tool life and the surface quality of the work piece. The application of flood coolant to reduce the friction at the tool-work piece may create several environmental problems. The introduction of Minimum Quantity Lubrication (MQL) as an alternative technique which is the process of pulverizing a very small amount of oil (< 30ml/h) can be regarded as replacement of dry machining while it may also be considered as an alternative to flood cooling. The research focused on the feasibility of using canola oil as cutting lubricant through the use of MQL during machining on carbide tools. The effect of vegetable oil lubricant and cutting speed on tool wear and surface integrity. The application of this 'green machining' would improve the plant environment, reduce the pollution, minimize the industrial hazard, reduce the machining cost and prolonged the tool life.

ABSTRAK

Didalam proses pemesinan, kehausan mata alat adalah sebuah fenomena semula jadi yang akan mengakibatkan kegagalan mata alat pemotong. Pembentukan bahan semasa pemotongan di antara muka mata alat dan bendakerja akan meningktkan kenaikan suhu pemotongan yang tinggi. Keadaan ini akan menurunkan jangka hayat mata alat dan kualiti permukaan bendakerja yang dimesin. Penggunaan cecair penyejuk yang banyak dan berterusan bagi mengurangkan geseran antara mata alat dan bendakerja akan menimbulkan beberapa masalah pada alam sekitar. Pengenalan aplikasi kuantiti pelincir minimum (*MQL*) sebagai teknik alternatif yang menggunakan jumlah minyak pelincir yang sangat sedikit (30ml/h) boleh dijadikan pengganti bagi pemesinan kering dan juga sebagai alternatif untuk cecair penyejuk yang banyak. Dalam penyelidikan ini penggunaan minyak canola sebagai pelincir pemotongan dengan menggunakan *MQL* telah dinilai semasa proses mengisar. Mata alat karbida digunakan dalam kajian ini. Kesan dari penggunaan pelincir minyak canola dan halaju pemotongan terhadap hayat mata alat, kehausan mata alat, daya pemotongan dan integriti permukaan telah dikaji. Penggunaan terhadap pemesinan hijau akan mempertingkatkan kualiti alam sekitar, mengurangkan pencemaran, mengurangkan bahaya industri dari industri dan kos pemesinan dan yang lebih penting adalah peningkatan hayat mata alat.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

These days, many machining process should be done in light of the fact that the request of the specific item is high. Machining process is profoundly ask for making the item as indicated by its shape and size with the goal that it can work as planned. Machining is the critical procedure in the assembling procedure. Machining can be characterized as the way toward expelling material from a work piece as chip into wanted last shape and size. Machining additionally should be possible in numerous material, for example, metal, wood, plastic and so on. During the machining process, the interface between tool bit and the work piece has a tendency to create high cutting temperature. At that point this is the point at which the cutting liquid/coolant or cutting oil take part in the machining procedure. The present of cutting fluid or coolant is to decrease the cutting temperature and friction, additionally to facilitate the removal of the chip introduce during the process. In spite of the wide acknowledgment, when improperly control, cutting liquids may make a few natural issues such harming the soil and contaminating the water assets. According to (Lawal et al., 2012), it is accounted for that European Union alone using roughly 320,000 tons MWF (Metal Working Fluid) every year, no less than 66% should be disposed. The measure of amount cutting lubricant should be arranged. It is expanding a years by years due to high request of the machining process. Research study by (Sharma et al., 2015) on dry machining and minimum quantity lubrication found that utilization of cutting lubricant gravely impacts nature and human wellbeing both during it use and also

during the transfer. This demonstrate the cutting lubricant isn't a decent synthetic to our condition and furthermore to human body.

This study is to investigate other alternative chemical to replace the cutting fluid lubricant so that it can free from harmful substance that can effect whether the human or the environment. In this study, we will used vegetable based oil as cutting lubricant to investigate the surface roughness and tool wear.

Figure 1.1: Shows cutting fluid is used on machining process.

1.2 Background

Many vegetable oil is available out there. As we all know, vegetable oil is an organic oil that extracted from a plant. Example of vegetable oil is palm oil, corn oil, olive oil, coconut oil and etc. Reported studied by (Shashidhara and Jayaram, 2010), demonstrates that vegetable oil oils fundamentally comprise of triglycerides, which are glycerol atoms with three long chain fatty acid connected at the hydroxyl bunches through ester linkages. The figure beneath demonstrate the fatty acid compound structure.

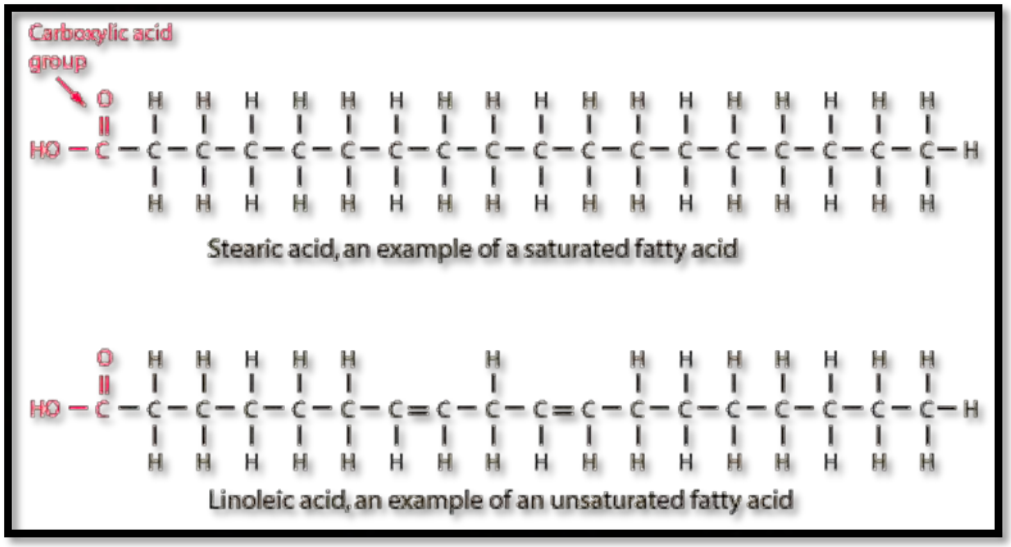

Figure 1.2: The fatty acid chemical structure

(Shashidhara and Jayaram, 2010) state that triglyceride structure gives attractive qualities to boundary lubrication. It is because of their long and polar fatty acid chains, which give high strength lubricant films that interface unequivocally with metallic surfaces, decreasing both contact and wear. Lubricant are utilized as a part of numerous differing territories; along these lines, their ecological adequacy has turned out to be progressively critical. Essentially cutting lubricant are partitioned into three primary group that is:

I. Neat cutting Oil
II. Water-Soluble fluid
III. Gases

The most common cutting fluid that industry use is the Water-soluble fluid. This is because the cost of the cutting fluid is lower and provide good result in machining process. Table below show the water-soluble category. It can be divided into three that is Chemical (Synthetic) fluids, Emulsifiable oils and Semi-chemical (Semisynthetic) Fluids. Figure 1.2 will show type of cutting in Water-soluble fluid category. In general, vegetable oils are exceptionally enticing substitutes for petroleum oil based since they are earth well disposed, sustainable, less dangerous and promptly biodegradable according to (Shashidhara and Jayaram, 2010).

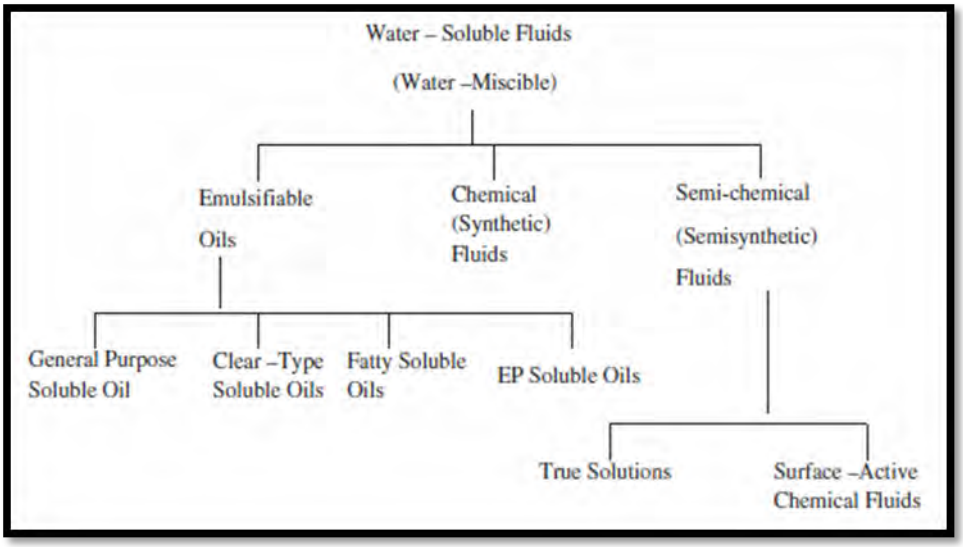

Figure 1.3: Classification of water-soluble fluid

(Adapted from (Lawal et al., 2012))

Many study and investigation are being done to develop new bio-based cutting fluid so that the cutting fluid can be environment friendly and also the increase in need for renewable and biodegradable lubricants is highly expected.

In this research, the aim is to analyses the canola oil with an additive as a cutting fluid and to find the surface roughness and the tool wear. We will compare the result, and see whether there is a major different or not compared to the main cutting lubricant use now that is Chemical (Synthetic) fluid.

1.3 Problem statement

At present, cutting fluid is being use without control as long the product that being machined is okay and can function as planned. Cutting fluids have been utilized as a part of machining procedures to diminish the temperature during machining by splashing the coolant into the machining zone straight forwardly on the cutting tool and the part. However, cutting fluids are earth disagreeable, expensive, and conceivably toxic (Safian et al., 2009). To achieve sustainable manufacturing, this are thing that we need to look and find a solution. The dry machining is one of the solution but dry machining will cause you large amount of money as the capital investment.

As cutting fluid are unpredictable in their composition, they may cause bothering or sensitivity. Microbial poisons are likewise produced by microscopic organisms and growths exhibit, especially in water-solvent cutting liquids according to (Lawal et al., 2012). This toxins and bacteria can cause harmful to the user in long term period. If the user are played with the cutting fluid every day, is not impossible that the user will get effected with the bacteria and can get dieses with it. However in this study, canola oil will be used as the cutting lubricant to perform machining process on conventional lathe machine. There a lot of things that we can compared to get the result.

1.4 Objective of research

The intention of this research study is:

a) To find an alternative cutting lubricant that environment friendly
b) To investigate the surface roughness and tool wear of mild steel and carbon steel machining process using vegetable oil as cutting lubricant.

1.5 Scope of research

In this research, things included and limitation of the project are being discussed. The area of study is surface roughness and tool wear. The machine that will be used is conventional lathe machine. This is due to easy preparation of the machine. This machine also can do different kind of process that we will use when running the experiment. The process that will involve in this experiment is turning and facing. The two process will use the same cutting tool and the same parameter. At the end of the process, the result of the tool wear is compared between the tool bit that are being used in this experiment.

After finish the tool wear analysis, the part will be examined on the surface roughness of the product. The surface roughness tester will be used to determine the value of the roughness on the surface. Then the part will be compared whether the canola oil cutting lubricant is good or the synthetic cutting oil is good. The amount of the lubricant that will be use is also will be the same.

The material that will being used in the experiment is mild steel and carbon steel. These two materials will undergo the machining process under parameter that have been set. This research will only focus the two main things that is surface roughness and tool wear.

CHAPTER 2
LITERATURE REVIEW

2.1 Minimum Quantity Lubrication (MQL)

2.1.1 Principle of MQL

Regular metal working fluid delivery framework give liquids to work zone in volumes which "surge" the work zone these liquids are sifted then recycled through the framework. Minimum Quantity Lubrication delivery framework gives low volumes of liquids to the process. Minimum Quantity Lubrication (MQL) passes by many names. It has been alluded to as "Minimal Quantity Lubrication", "Near Dry Machining" or "NDM", "Smaller scale Lubrication" or "Microlubrification", "Miniaturized scale Dosing", and now and then even gets inaccurately alluded to as "Mist Coolant." Minimum Quantity Lubrication (MQL) is an option to the utilization of conventional metal working liquids (MWFs) in machining.

According to (Delfini et al., 2011) Minimum Quantity Lubrication (MQL) is the utilization of cutting liquids of one moment sum normally of a stream rate of 50 to 500 ml/hour which is around three to four requests of extent lower than the sum ordinarily utilized as a part of surge cooling condition.

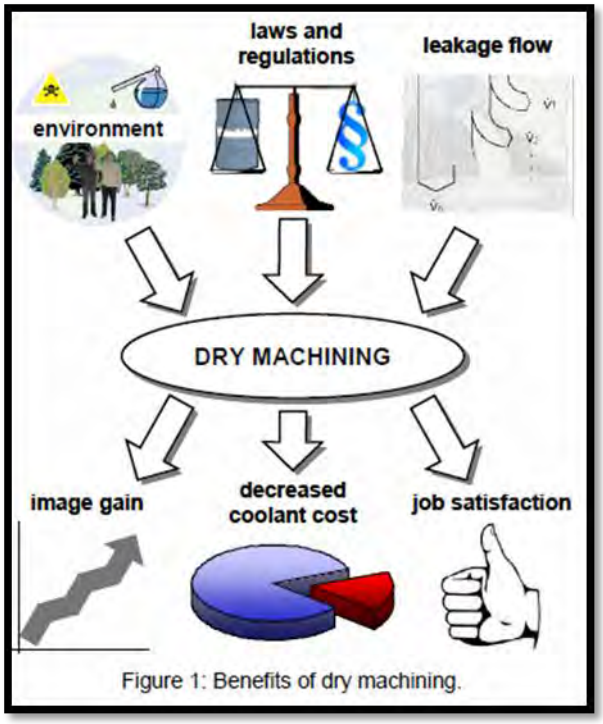

Figure 2.1: Benefit of Dry Machining
(Adapted from (Weinert et al., 2004))

The main purposes of a cutting lubricant in wet machining operations are to cool, to lubricate, and to remove the chips. The quantity of coolant used currently are getting more and more every single day. The MQL is introduced by manufacture to overcome the cutting lubricant used in the industry nowadays. A definition of MQL has not yet been specified in standards and guidelines. There is no fixed ways to do the MQL. It depends on how you see where the point that can reduce the amount of cutting lubricant used. Usually the type of cutting lubricant used in MQL is biodegradable oil that not harmful to the environment. (Weinert et al., 2004) also said the media utilized by a large straight oil, however a few applications have additionally used an emulsion or water. These fluid media are bolstered to the device as well as machining point in small amounts.

MQL is an low amount of lubricant strategy contrasted with the coursed oil method technique with emulsions. This implies utilizing clean oils that are fatty alcohol or ester based. Additives substances against contamination, e.g. biocides and fungicides, are not required by any stretch of the imagination, since microbial progress is just in a watery

stage. The immense lowering of lubricant volume utilize brings about almost chips and dry work piece. This enormously diminish well being risks created by the outflows of cutting ointment liquids in took in air and on the skin of representatives at their workshop. Cutting oil liquids don't spread all through the area around the machine, therefore making for a cleaner workshop. Expenses made by regular surge lubricant (e.g. maintenance, inspection, disposal of cutting fluid and preparation) are not any more an issue with MQL. The average percentages of these costs in the whole cost of wet processing are shown in Figure 2.1.

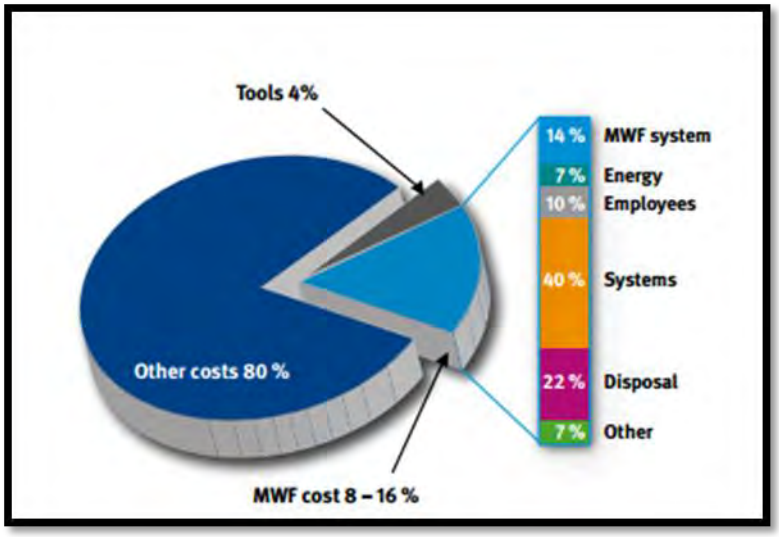

Figure 2.2: Metal working fluid cost in metal machining
(Adapted from (Deutsche Gesetzliche Unfallversicherung, 2010))

The cost-inflating aspects of conventional flood lubrication can be reduce when MQL is used. This results in:

I. Decreasing volume of metalworking liquid utilize
II. Lowering in the work load for watching and cutting lubricant maintenance
III. No need to plan and dispose of used cutting lunricant fluids use
IV. Lessening in the work required for cleaning the handled pieces
V. Simple to recycling the chip because of less oil ruining.