Comparative Study of Different Vegetable Oil during turning in terms 0f Cutting Force and Power Consumption.

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Abstract

Cutting fluids used in machining are environment hostile, noxious and expensive. They may produce several environmental problems such as polluting the water resources, damaging the soils affecting the operators health. Now day's researchers are trying to eliminate the poisonous fluids without affecting the performance.Curiosity in vegetable oil is rising Minimum quantity lubrication system uses very minute amount of cutting fluid. Combining of MQL and vegetable- may result into less amount of environment friendly cutting fluid to improve the output .This save money as well as protect the environment. This paper concentrates on fabrication of low cost, simple MQL system and to evaluate performance of various vegetable oil based on cutting forces, temperature. The experimental results shows that vegetable oil outpaces the mineral-based fluid

1.INTRODUCTION

According to King et al (2001), cost associated with the cutting fluids was between 7% to 17% of the total production cost.[1] Moreover mineral based cutting fluids may harmful to the soil and water resources, affecting severe environmental imact.The operator may suffer from dermatitis breathing disorders and disease like cancer also.[2] [3] .Protection of earth, global warming, and pollution are burning issues at international levels. It is mandatory for each country obey the international laws relating the protection of the earth. Minimum Quantity Lubrication arose as substitute for dry machining and flood cutting. The use of the mineral oil is possibly perilous. They are exhausting and contribute to global warming. Vegetable oils can be cultivated, genetically modified hence renewable, recyclable and harmless. They possess high viscosity, boiling point and flash point. Vegetable oil consists of triglyceride i.e. tri esters of the long chain of the fatty acid. The triglyceride

desirable quality of the boundary lubrication structure of the vegetable oil provides. desirable quality of the boundary lubrication.[6]

Figure 2.1 Experimental set up

2 EXPERIMENTATION

Experiments are conducted on AISI 4130 MS bar. Uncoated carbide tipped single point cutting tool is used for the testing. Investigation is done for three cutting conditions namely dry cutting, flood cutting and MQL cutting.

Experimental Condition	Description
Parameter	Cutting speed V (m/min)= 34.27,53,79.73 Feed Rate ,f (mm/rev)=0.35,0.40,0.45 Depth of cut ,d(mm)=0.5,1,1.5
Coolant Condition	Dry, Flood cut-1 L/hr., MQL-50ml/hr.

Table 1-Experimental conditions

Blassocut-4000, soyabean oil, sunflower oil, groundnut oil and coconut oils are used as cutting fluid during MQL cutting. Cutting forces are measured with the help of lathe tool dynamometer. Power consumption is calculated from product of cutting forces and velocity at respective case. Figure 2.1 shows experimental set up consisting of medium duty lathe and MQL system. Table 1 shows experimental conditions and selected machining parameter.

3. Result and Discussion

3.1 Cutting Forces

Variations of cutting forces at various speed, feed and depth of cut is shown in figure 3.1.increase in depth of cut, increases the cutting forces. As depth of cut and feed rate increases, increased tool work contact length result into higher frictional forces. This results in increase of cutting forces. However, as the speed increases the cutting forces decreases.

The adhesion between cutting tool and work piece is more in dry cutting. Hence cutting forces seems to be at higher at dry cutting. For flood cutting bond between tool and work piece is less hence there is decrease in cutting forces. MQL uses high velocity coolant jet, invading on tool –work interface hence adhesion is lowest. Machining with MQL

yielded improved results related to dry and flood cutting.MQL shows approximately 9 % and 5% reduction in cutting forces as compared to dry and flood respectively.

All the vegetable oil molecules are dipolar in nature; they have more affinity towards metal surface hence form more strong lubricating film, thus gives more lubricating effect than mineral-based oil Blassocut-4000. Sunflower. Oil shows 6 to 7 % more cutting forces as compared to soyabean oil. Soyabean oil lubricate the interface as well as protects the sharpness of tool .There is reduction in cutting forces for soyabean oil by 8%, 15%, 6% and 12 % as compared to Blassocut, groundnut oil, sunflower oil and coconut oil respectively.

Power Consumption

Power play very important role in any industry, efforts are made to reduce the power consumed during any machining process..

Result showed that dry cutting has higher power consumption, 6 to 10 % more than flood cutting. Soyabean Oil shows 8% reduction in power consumption as compared to mineral based Blassocut-4000Use of MQL reduced power by 10%.with more lubricity, soybean offers less resistance for cutting force, has less consumption of power.

CONCLUSION

Based on the results of the experiments and analyses carried out the following general Conclusions are drawn:

There is remarkable reduction in cutting forces about 5% to 10 % in case of MQL as compared to Dry cutting. At least 10% reduction in cutting forces is observed for

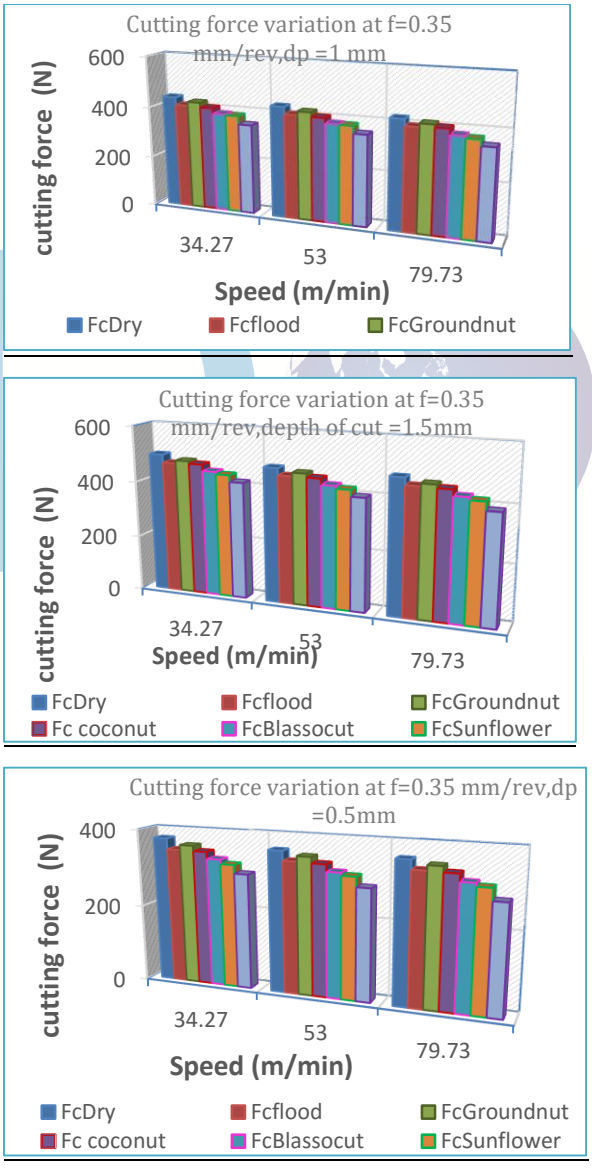

Fig 3.1 Cutting Force variation at different speed

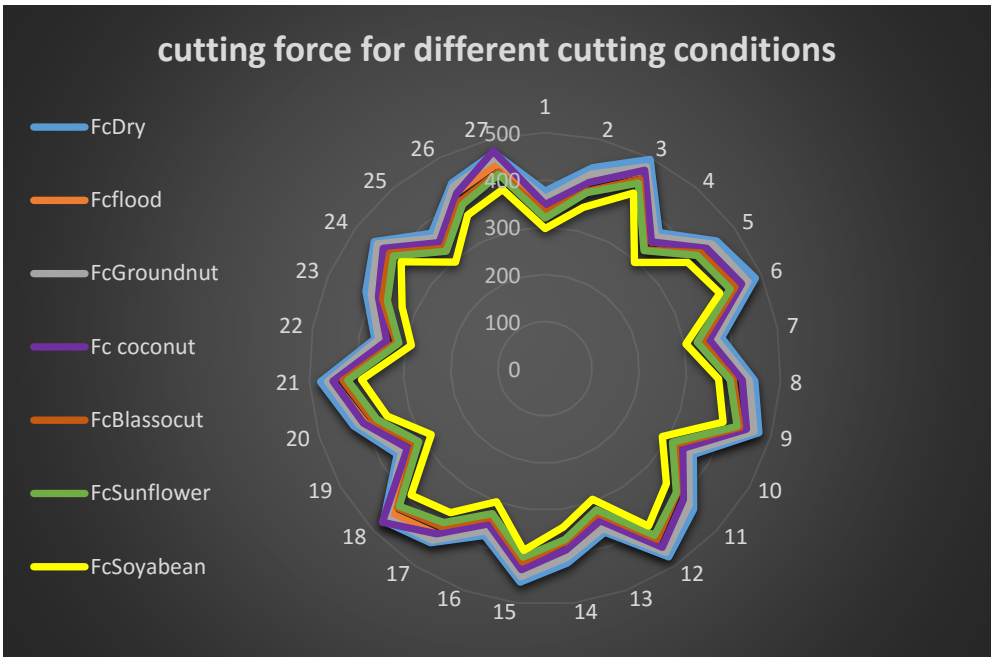

Fig 3.1 Cutting Force variation at different cutting condition

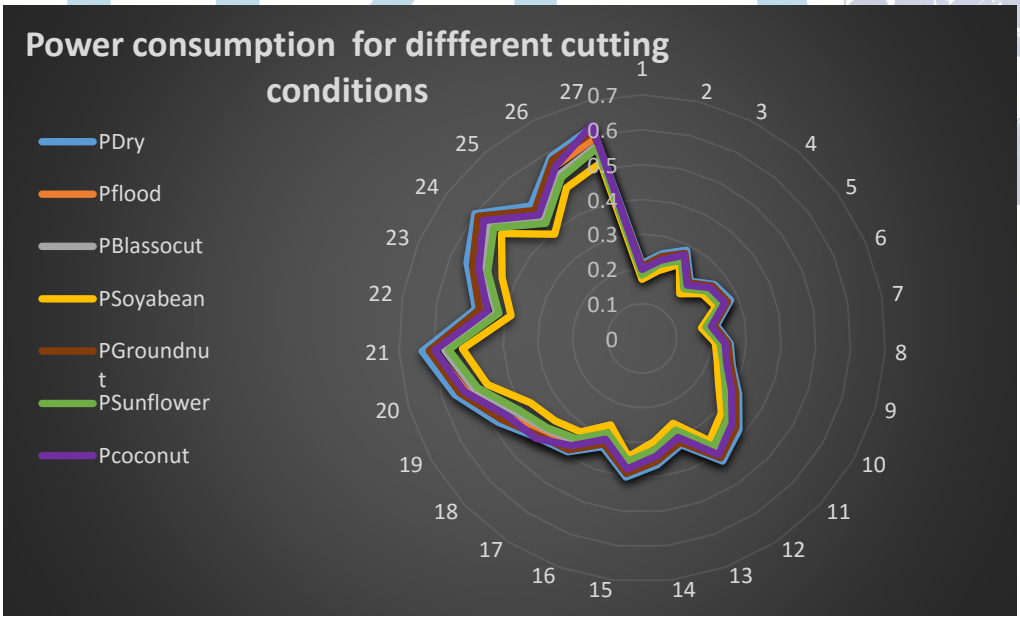

Fig 3.1 power consumption at different cutting condition

MQL when compared with flood cutting. Cutting forces are reduced due to decrease in friction in case of MQL cutting.Use of Soyabean oil results into decrease in cutting forces as compared to mineral based oil Blassocut-4000.8-10% reduction in cutting forces is observed as compared to Blassocut. During turning using ground nut 15 % more

cutting forces are developed but less than dry cutting. Turning with Sunflower oil shows comparatively less cutting forces as compared to flood and dry cutting.

There is extensive difference in surface roughness produced by dry, flood and MQL cutting conditions. There is an average 5% reduction in roughness values for MQL as compared to flood cutting.

Result shows that surface roughness values are less in case of soybean oil as compared to other oil .Blassocut has 8% more rough than ground nut, sunflower and coconut oil by 14.8% 16.54% 18.6% respectively.

Power consumptions is highest for dry cutting. Soyabean oil offered very less power consumption as compared to Blassocut and other vegetable oil.

MQL technique is at the present emerged as substitute for dry and cutting not only in terms of performance but also it is cost effectiveness and environment friendliness.

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