

Boric Acid Role in Different Cutting Fluids in CNC End Milling by Measuring Surface Roughness

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Abstract

Since the past years various manufacturing operations which includes the machining of metals uses various types of collants and lubricants which are composed of chemicals and other pollutants factors. This collants and lubricants which are used, very dangerous and hazardous to the nature and human. This operations includes manufacturing operations like turning, milling, drilling, forming and grinding, forming, sheet métal operations etc. heat generated in the cutting zone results into bad work piece quality and more tool wear. Hence there is need to find and use the alternative coolants and lubricants which will reduce the hazards machining cost and other cost and, factors. In this paper boric acid is mixed with different oils coconut oil, soluble oil and potassium chloride and this mixture is used as cutting fluid and experimentation was done and performance was calculated and results are compared with the conventional and cutting oil without boric acid. Based on the experimental data we can say that boric acid and coconut oil showed that using better performance. New coolants potassium chloride is used in this project that gives more weightage.

Keywords: Boric Acid, Cutting Fluid, Lubricant, Machining, Quality

I. INTRODUCTION

Automobile industry, shipbuilding aerospace, textile and other manufacturing industries uses End milling and has wide applications in a different manufacturing sector. In the recent trends industries are trying to minimize the errors occurring in the end milling operation, attempts are going on high level. These errors could be due to the problems in machine tools, cutters and the machining process itself. Of these, the error due to cutting force is one of the major problems for precision machining. Therefore, in milling operations, cutting forces and specific energy are important parameters by which the performance can be assessed. It is also important to minimize the cutting forces of milling process since it is intermittent cutting process, which can lead to undesirable vibrations, resulting in poor surface finish.

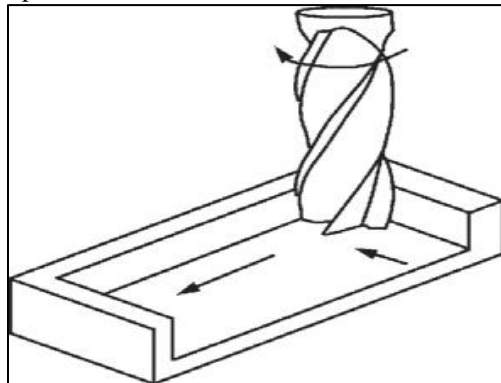


Fig. 1: Schematic Diagram of End Milling Operation

The objective and main goal of the present work is to check the performance and effects of boric acid particles in vegetable and other cutting fluid because boric acid is characterized by its high temperature thermo physical property. The heat generated at the primary zone is our primary aim so that quality will improve and study the process performance. Using CNC end milling machine different experiments were done as a comparative performance analysis of boric acid assisted End Milling with conventional flooded coolant.

II. SURFACE ROUGHNESS

Each new generation of manufacturing component is lighter in weight, used more exotic materials and process has higher horse power output, increase efficiency and lower defects than previous one. One of the secret to successful components of any machined or any other is ability to machine within the tolerance in the workshop. Some of the, most yet at least regulated machining specifications for components are the various surface finishes. The quality of machined surface is characterized by the accuracy of its manufacture with respect to the dimensions specified by the designer .some components surface finish can only be accurately measured with surface texture analyzer /roughness taster and all workshops should regularly the component and then produced to ensure their achieving required specification. Company manufactures typically specify surface finish with both Ra. or Rz. values and R_t readings. These values are measured in millionths of inch (10^{-6} inches, μ or microns or micrometer out of these we have taken Ra value to measure. Every machining operation leaves characteristic evidence on the machined surface. This evidence in the form of finely spaced micro irregularities left by the cutting tool. Each type of cutting tool leaves its own individual pattern which therefore can be identified. This pattern is known as surface finish or surface roughness. Surface roughness, often shortened to roughness, is a measure of the texture of a surface. It is defined as the arithmetic average of the deviation of the surface irregularities from the mean depth.

III.SYSTEM DEVELOPMENT

The various instruments and machines used in the experimentation are as follows.

- Taylor Hobson surface finish taster
- Batliboi vertical milling machine

Batliboi vertical milling machined centre was used for end milling of EN-8 material. Below fig. 2. Shows the experimental set up for machining

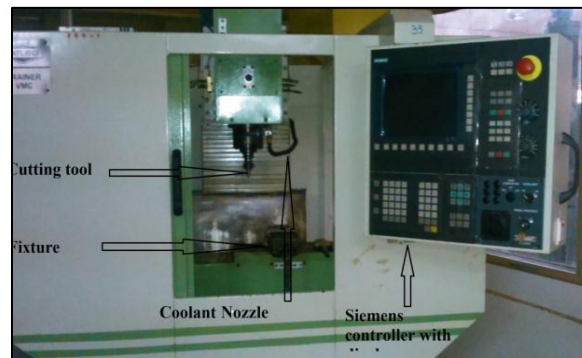


Fig. 2: Schematic Diagram of Machined Used

The experimentation was carried out under different input condition for different cutting fluid and results were tasted.

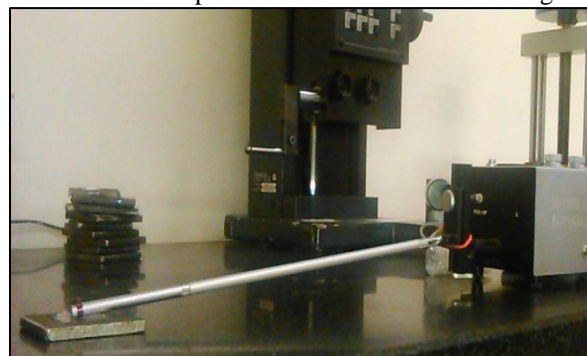


Fig. 3: Taylor Hobson Surface Roughness Taster

The above equipment was used for measuring the surface Roughness taster having Uncertainty of measurement ± 0.001 mm. The experiments procedures were carried out in the following.

- First the capability of coconut oil and boric acid were studied
- By selecting En-8 as workpiece and HSS End mill cutter as tool machining was done.
- Depth of cut, feed and speed were fixed up and machining was done.
- After that using Taylor Hobson surface finish taster surface finished value were checked.
- Results obtained were set up on the graphs.

Table – 1:
Experimental Investigation Table

Tool material	Workpiece material	Condition
K 10 HSS 14Ømm	En-8 Steel 50×50×5 mm	Boric acid in Soluble oil
		Boric acid in vegetable oil
		Potassium chloride and boric acid in vegetable oil

The numeric values of experimentation for various speed, feed, depth of cut and input cutting fluids environment are shown in the table 2

Table – 2:
Machining Parameters

Levels	Speed(RPM)	Feed(mm/min)	Depth of Cut(mm)
1	800	20	0.2
2	1000	25	0.25
3	1200	30	0.3

IV. PERFORMANCE ANALYSIS

Table 4.1, 4.2, 4.3 shows the surface roughness values at different speed, feed, depth of cut and cutting fluid environment.

Table – 3:
Experimental Results at 800 rpm

Sr.No.	Speed(RPM)	Feed(mm/min)	Depth of Cut(mm)	Coolants used	Surface Roughness(µm)
1	800	20	0.2	Boric acid in Soluble oil	1.5
2				Boric acid in vegetable oil	1.1
3				Potassium chloride and boric acid in vegetable oil	1.4

Table – 4:
Experimental Results at 1000 rpm

Sr.No.	Speed(RPM)	Feed(mm/min)	Depth of Cut(mm)	Coolants used	Surface Roughness(µm)
1	1000	25	0.25	Boric acid in Soluble oil	1.9
2				Boric acid in vegetable oil	1.7
3				Potassium chloride and boric acid in vegetable oil	1.5

Table – 5:
Experimental Results at 1200 rpm

Sr.No.	Speed(RPM)	Feed(mm/min)	Depth of Cut(mm)	Coolants used	Surface Roughness(µm)
1	1200	30	0.3	Boric acid in Soluble oil	1.7
2				Boric acid in vegetable oil	1.4
3				Potassium chloride and boric acid in vegetable oil	1.6

V. RESULTS AND DISCUSSIONS

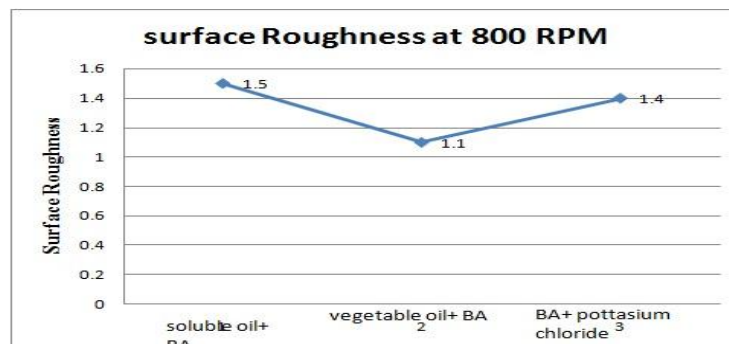


Fig. 4: Surface Roughness at 800 Rpm

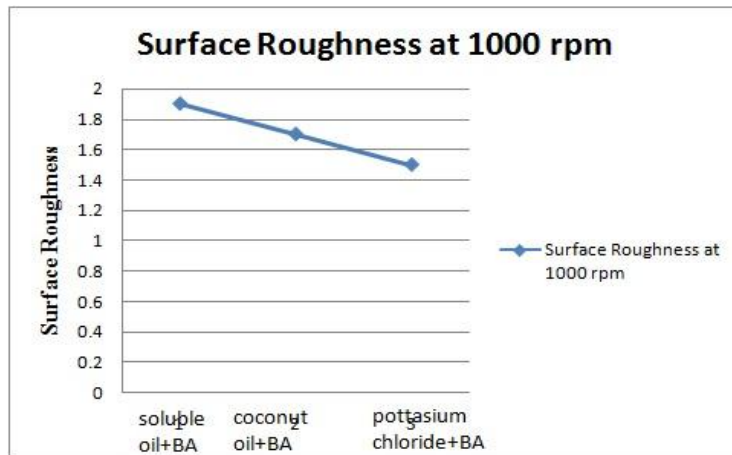


Fig. 5: Surface Roughness at 800 Rpm

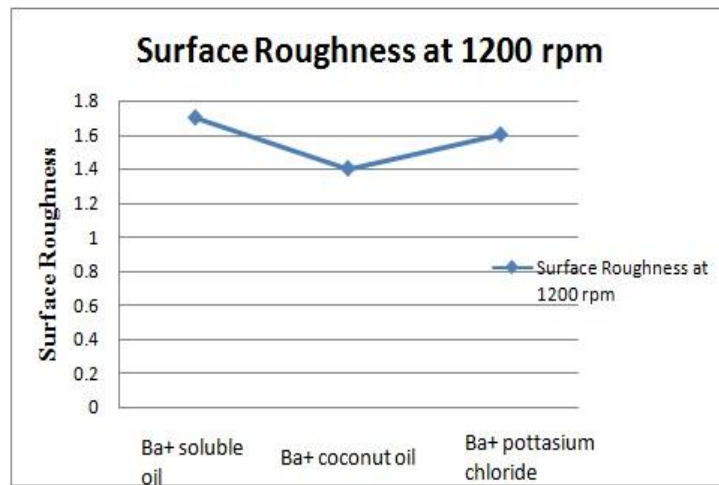


Fig. 6: Surface Roughness at 1000 Rpm

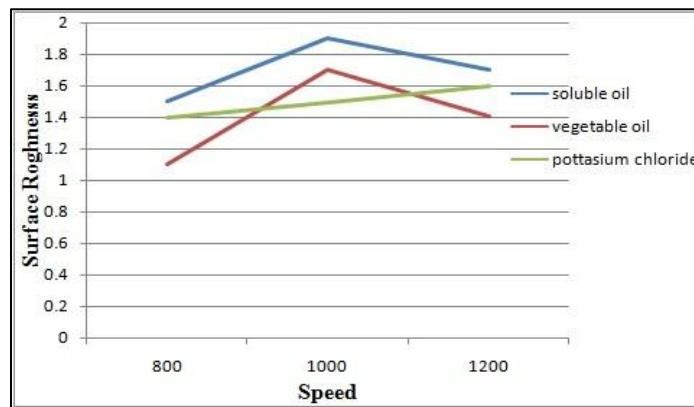


Fig. 7: Comparison at Different Speeds and Different Cutting Oils

VI. CONCLUSION

From the above Experimental results and graphs it can be seen that use of boric acid in vegetable oil as cutting oil in CNC end milling of EN-8 steel reduces the surface roughness values. Fig. 7 shows that at 800 rpm minimum surface Roughness value for boric acid and vegetable oil. If we compare these three oils soluble oil, vegetable oil and boric acid and coconut oil mixture shows better performance. Hence from these we can conclude that vegetable oil and boric acid can be used as lubricants for machining purpose and these cutting fluids can be ecofriendly and helps in reducing environmental risk and hazards.

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