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ANALYSIS ON DIFFERENT MACHINING PARAMETERS OF EN31 ALLOY STEEL IN CONVENTIONAL LATHE MACHINE

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Abstract:

Good surface quality is the requirement of customers. In the present work it was seen that the desired surface roughness were not obtained consistently in turning of EN31 steel shaft. These higher values of surface roughness results in rework and increases cost hence the main objective is optimization of surface roughness. The surface quality is influenced by cutting speed feed rate and depth of cut and many other parameter. In the present study attempt has been made to investigate the effect of cutting parameter so surface roughness in the finish turning of EN31 steel. Dry, servo, soluble and palm oil coolants were used in the experimental work the experiments have been conducted on conventional lathe machine. The optimum cutting conditions was determined surface roughness we reevaluated. Thus minimum surface roughness can be obtained by analyzing the operation. It will helps in increasing machine utilization and decrease production cost on automated manufacturing environment.

***Keywords* —** Surface roughness, Coolants **.**

I. Introduction

A large number of engineering components, such as shafts gears bearing, clutches, cams, screw- nuts, etc. need reasonably high dimensional and form accuracy and good surface finish for serving their functional purposes. Performing the casting forging, rolling etc generally cannot provide the desired accuracy and finish. For that, performed objects called blanks need semi finishing and finishing and this is done by machining and grinding. Therefore briefly stated that the engineering components are essentially finished to accuracy and surface and surface finish by machining to enable the product. Machining is an essential finishing process by which jobs of desired dimensions and surface finish are produced by gradually removing the excess material from the performed blanks in the form of chips with the help of cutting tools moved past the work sources. Surface roughness defines the condition of a machined surface. The most important factor in determining the character of a surface is surface roughness. The main reason for surface irregularities is issues that are concerned with machining operations. The magnitude of surface irregularities and range according to the impact of both internal and external factor that affects machining. These irregularities will finally result in performance of the final product in terms of durability, operating noise, air tightness and friction. Errors in machining can also affect the shining appearance if it the product demands that property.

II. Experimental Details:

a) Work Material

For the present study EN31 steel was selected as work material. The materials used as wide range of applications e.g. it is used to manufacture bearings , Shaft , Die, Cams etc. work pieces of length 914 mm and 20mm were used in experimentation. The work piece materials has been shown in table below

Fig. 1 Work Piece

Table.1 Composition of Material EN-31

C	Si	Mn	S	P	Ni	Cr	Mo
1.035	0.2871	0.6964	0.88860	0.8912	0.1619	1.036	0.0404

b). Cutting Fluids (coolants)

The cutting fluid plays an important role in chip formation and its removal, tool life, and hole specification. Water based coolants and their aqueous mixture produced from them such as oil-in-water emulsions or solutions are inferior to the water emulsifable lubricants, especially in their lubricating effects. In turning machine there is a greater demand on the cooling and lubricating properties of the coolants than that in the most common machining properties. Water emulsifiable oils can only be used in exceptional cases as in machining of easy machining under light cutting conditions. In the experiment performed dry, servo, soluble and palm oil are coolants were used.

c). Machine Tools

Machine that holds the work piece between two rigid and strong support, called centre. The chuck is mounted on the projected end of the machine spindle. The cutting tool is rigidly held and supported in the tool post and is fed against the revolving work. There were many types of machine tools were available in the market but the required machine tool, which was used in the present study was made of Sagar Pvt. Ltd.

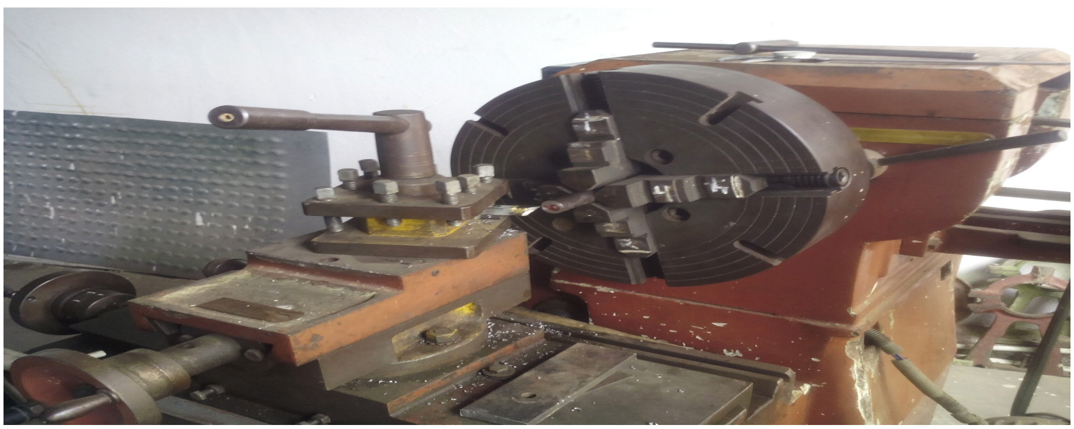

Fig. 2 Experimental set up

d). Surface roughness Tester

The surface roughness Ra and Rz, were measured using Mitutoyo Surftest SJ-301. These values were the average of four values measured from the three different points on the circumference of the machined part.

- Make — Mitutoyo, Japan
- Model — SurfTest SJ-301
- Measurement range — 200 µm to +250 µm
- Stylus material — Diamond
- Tip radius — 2 µm / 5 µm
- Measuring force — 4 mN (0.4 gf)
- Cut-off length — 0.8 mm-2.5 mm

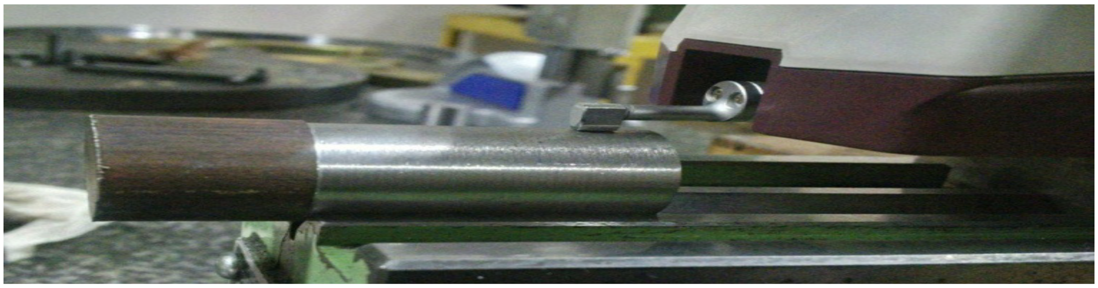

Fig .3 Surface Roughness Tester.

III. Results And Discussion:

Therefore, base upon the different setting of various parameters provided by the design of experiment. The experiments are performed, and the surface roughness is measured. At least three run with the same setting of parameters was taken into consideration and the mean of surface roughness is taken into consideration.

Main effects due to parameters and interactions:

The main effects can be studied by the level average response analysis of raw data of surface roughness with respect to coolants at different rotational speeds. The analysis is done by averaging the raw data of surface roughness at each level of each rotational speed and plotting the values in graphical form.

Table. 2 Output data for surface roughness obtained by experimentation

Experiment	A	B	C
	Speed	Coolant	Ra
1	96	Dry	7.98
2	96	Servo	4.05
3	96	Soluble	5.16
4	96	Palm Oil	4.22
5	210	Dry	10.70
6	210	Servo	2.80
7	210	Soluble	4.79
8	210	Palm Oil	3.40
9	306	Dry	4.40
10	306	Servo	2.44
11	306	Soluble	3.80
12	306	Palm Oil	3.50
13	436	Dry	8.64
14	436	Servo	6.45
15	436	Soluble	6.95
16	436	Palm Oil	7.90

Now with the parameters sited in the above table the output response for surface roughness with different rotational speed and coolant is being plotted and the results are being discussed below

Table No. 3 output data obtained after experimentation at 96 Rpm, Coolants used and Surface roughness

RPM	COOLANT	SURFACE ROUGHNESS
96	DRY	7.98
96	SERVO	4.05

96	SOLUBLE	5.16
96	PALM OIL	4.22

At low speed of 96 RPM the Surface Roughness is Maximum in dry coolant conditions and minimum surface roughness is produced at servo coolant conditions.

At low speed and in dry conditions, the more excessive forces acts upon tool & work piece interface. Hence more rough surface is produced.

At low speed and on servo coolant conditions the Surface Roughness is minimum because servo coolant is more viscous in nature and at high temperature in cutting condition, its viscosity cannot be decreased at minimum. Hence it helps to cool the work tool interference zone & helps to remove the chips from the cutting area.

The Surface Finish at 96 RPM & in presence of soluble & Palm oil lies in between dry & servo Conditions.

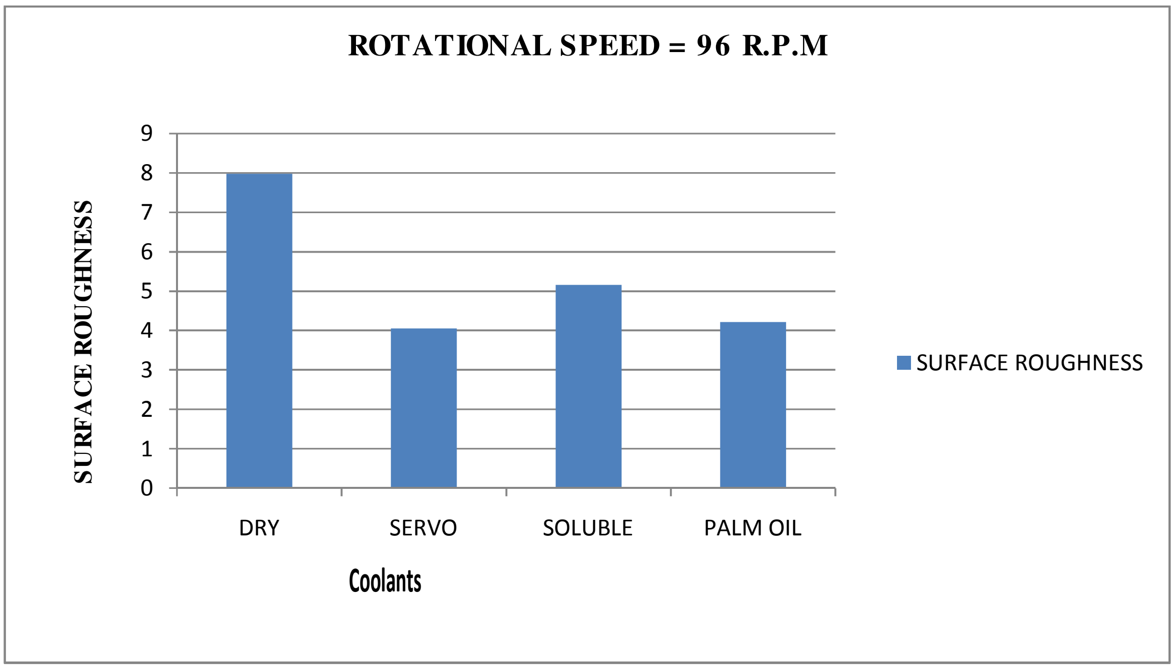

Fig No: 4 Graph plotted between coolant used output data for surface roughness

Table No. 4 output data obtained after experimentation at 210 Rpm, Coolants used and Surface roughness

RPM	COOLANT	SURFACE ROUGHNESS
210	DRY	10.7
210	SERVO	2.8
210	SOLUBLE	4.79

210	PALM OIL	3.4

At low speed of 210 RPM the Surface Roughness is Maximum in dry coolant conditions and minimum surface roughness is produced at servo coolant conditions.

At low speed and in dry conditions, the more excessive forces acts upon tool & work piece interface. Hence rougher surface is produced.

At low speed and on servo coolant conditions the Surface Roughness is minimum because servo coolant is more viscous in nature and at high temperature in cutting condition, its viscosity cannot be decreased at minimum. Hence it helps to cool the work tool interference zone & helps to remove the chips from the cutting area.

The Surface Finish at 210 RPM & in presence of soluble & Palm oil lies in between dry & servo Conditions.

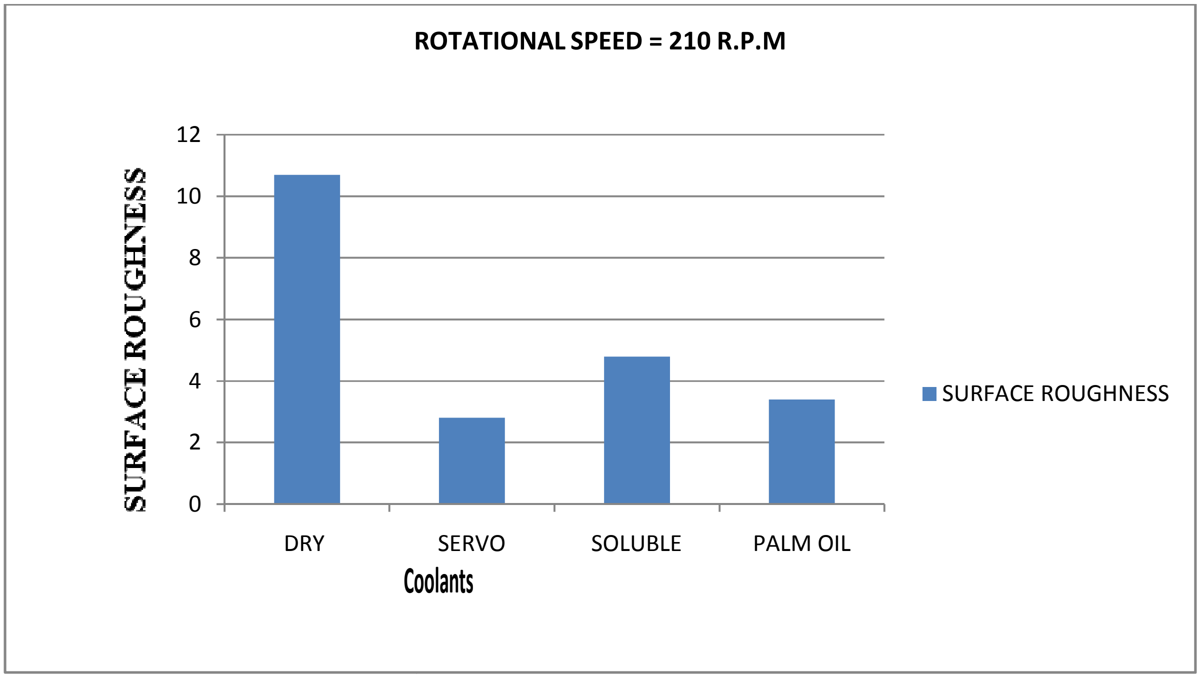

Fig No: 5 Graph plotted between coolant used output data for surface roughness

Table No. 5 output data obtained after experimentation at 306 Rpm, Coolants used and Surface roughness

RPM	COOLANT	SURFACE ROUGHNESS
306	DRY	4.40
306	SERVO	2.44
306	SOLUBLE	3.8
306	PALM OIL	3.55

At low speed of 306 RPM the Surface Roughness is Maximum in dry coolant conditions and minimum surface roughness is produced at servo coolant conditions.

At low speed and in dry conditions, the more excessive forces acts upon tool & work piece interface. Hence rougher surface is produced.

At low speed and on servo coolant conditions the Surface Roughness is minimum because servo coolant is more viscous in nature and at high temperature in cutting condition, its viscosity cannot be decreased at minimum. Hence it helps to cool the work tool interference zone & helps to remove the chips from the cutting area.

The Surface Finish at 306 RPM & in presence of soluble & Palm oil lies in between dry & servo Conditions.

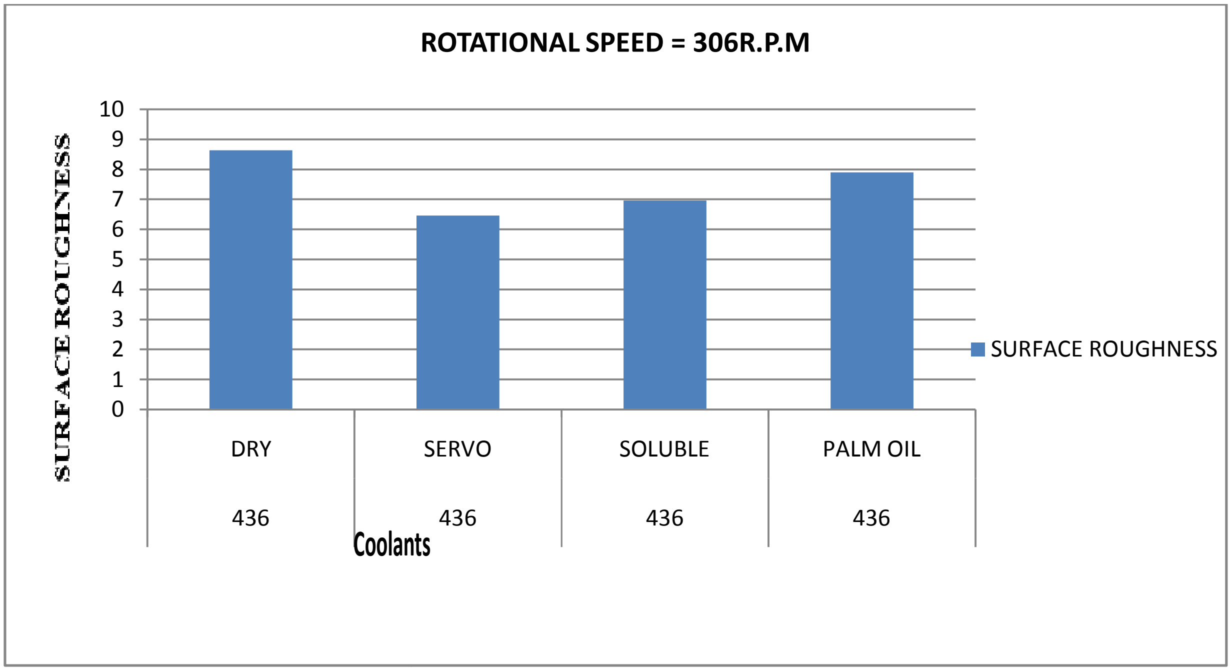

Fig No: 6 Graph plotted between coolant used output data for surface roughness

Table No. 6 output data obtained after experimentation at 436 Rpm, Coolants used and Surface roughness

RPM	COOLANT	SURFACE ROUGHNESS
436	DRY	8.64
436	SERVO	6.45
436	SOLUBLE	6.95
436	PALM OIL	7.90

At low speed of 436 RPM the Surface Roughness is Maximum in dry coolant conditions and minimum surface roughness is produced at servo coolant conditions.

At low speed and in dry conditions, the more excessive forces acts upon tool & work piece interface. Hence rougher surface is produced.

At low speed and on servo coolant conditions the Surface Roughness is minimum because servo coolant is more viscous in nature and at high temperature in cutting condition, its viscosity cannot be decreased at minimum. Hence it helps to cool the work tool interference zone & helps to remove the chips from the cutting area.

The Surface Finish at 436 RPM & in presence of soluble & Palm oil lies in between dry & servo Conditions.

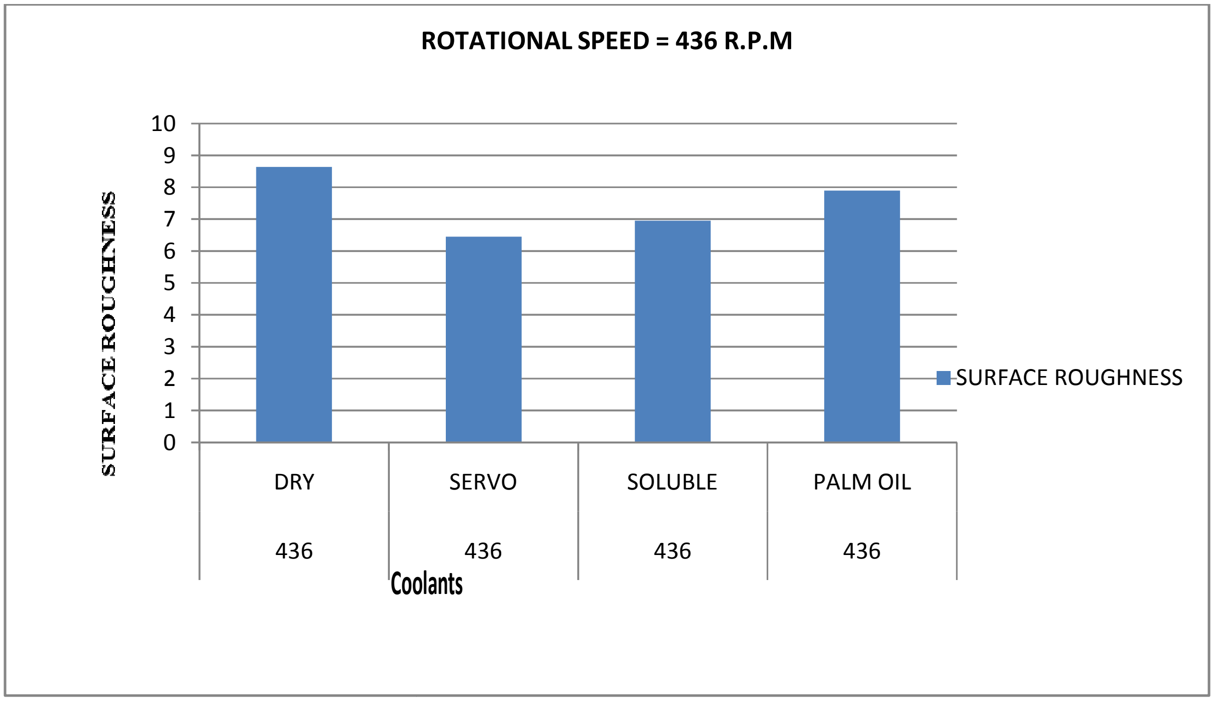

Fig No: 7 Graph plotted between coolant used output data for surface roughness

From the experimentation we have analyzed that the best result can be obtained for surface roughness is by using servo oil as coolant and surface roughness is maximum in dry cutting condition. Servo oil is vicious in nature and generates good surface roughness. As it helps to cool the work tool interface zone and helps to remove the chips from the cutting areas.

IV. Conclusion:

1. At rotational speed of 96 R.P.M: Maximum surface roughness is obtained by using servo oil as coolant.
2. At rotational speed of 210 R.P.M: Maximum surface roughness is obtained by using servo oil as coolant.
3. At rotational speed of 306 R.P.M: Maximum surface roughness is obtained by using servo oil as coolant.
4. At rotational speed of 436 R.P.M: Maximum surface roughness is obtained by using servo oil as coolant.

V. Future Scope:

1. One can use Minitab for the design of experiment.
2. One can use cutting force as an additional factor with addition to cutting speed, feed, and strength of cut.
3. One can go for L27 orthogonal array or more for the experimentation.

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