




# Reconnoitering the influence of Nano fluid of Nano boracic acid particles enriched waste coconut oil in Machining SAE 1045 shaft on modification Surface finish

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## Abstract

The surface quality is a prime factor in the failures of shaft by fatigue load. Here used coconut oil or waste coconut oil from Kerala chips shop are used for lubricating purpose for machining the precision shaft. This piece of research work investigating the effect of Nano fluid of Nano boric acid nanoparticles concentrated 'used waste coconut oil' for machining steel in the semiautomated lathe. The motor shafts are machined in dry condition called green machining then used polishing to reduces the surface roughness. This research tried to reduces the cost of manufacturing by using a low cost Nanofluid as coolant and lubricant in the cutting zone. Used coconuts oils are disposed as waste in many sweet and snacks shops. From such waste machine coolant is developed. The same was tested at conventional machining requirements and compared. Taguchi L16 orthogonal array employed as this investigation considered its 3 process variables at 4 levels. The process parameters analyzed and optimized by Taguchi analysis. The results recommended the proposed method as it outperformed.

## Introduction

The steels like SAE 11L17, SAE 1010 SAE1144 and SAE 12L14 were investigated and reported that the constituent elements like Pb, Mn S exhibits self-lubrication [1], [2], [3]. But the experimental results reveal that the more tool wear observed at high-speed machining of them [3]. Hence it is proved that introduction on lubrication and cooling mandatory to achieve high quality machining. Machinability performance for SAE1060 steel was investigated and found that Minimum Liquid Lubrication (MQL) of vegetable oil reduced cutting zone temperature significantly and helped to maintain lubrication on the interface and temperature under control [4]. AISI D2 cold worked steel machining on lathe with physical vapor deposited tool and chemical vapor deposited tool were utilized for investigating the cutting zone temperature effects with and without MQL machining environment and found that MQL method significantly reduced the cutting zone temperature by 25% [5]. AISI 304 Stainless steel machining was investigated with multilayer coated tungsten carbide tools and developed particle swarm optimization algorithm-based optimization and prediction model for cutting zone temperature with use of adaptive neuro-fuzzy inference system [6]. It was found that the developed model based on the experimental values gave good agreement with experimental values [7]. water-jet assisted turning with coated Sandvik Coromant carbide inserts was investigated for machining alloyed steel SS2541-03 and found that 40 to 45% cutting zone temperature reduction. One of the selective

shaft materials is SAE 1045 steel, which is widely utilized in shaft manufacturing [8], [9] experimented the fatigue strength of the SAE 1045 steel and recommended for motor shafts. [10], [11], [12], [13], [14] evaluated its performance at various cyclic loading and for ensuing the strength on fatigue for such steel. Hence many reliable reports reported about the compatibility of SAE 1045 steel. [15], [16], [17], [18] experimented the tribological properties of such steel and found that SAE1045 steel widely preferred the motor shaft. The importance the work preferred was listed in many literatures [19], [20], [21]. Many researchers used the clean technology-based solution for highly commercial use. [22], [23], [24], [25], [26] utilized the waste in to the useful form. The waste food containers were melted and reused with reinforced aluminum alloy for some other application. Like the the used coconut oils are scraped one. Disposing them is waste. [24], [25] preferred the alumina nanoparticles based nanofluids with water as base fluid, similarly copper oxide nanoparticles suspended water based nanofluid as heat transfer fluid for heat exchanger with twisted tube setup. In this research such clean technology is utilized to prepare coolant from the used coconut oil. Nanofluid were used for EN31 steel grinding that is shaft finishing works.

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## Section snippets

### Materials and methods

The possibilities of improving the surface finish with use of a new kind of biodegradable, non-corrosive use of novel Nano fluid for machining supplement is aim of this research. This research facility of high precision heavy duty (5HP) lathe was used. (Refer Fig. 1). The facility can operate 8 different speeds in the range of 32 to 1200rpm as well as 18 variety automated feed. The SAE 1045 employed as work material.

The Boric acid particles is obtained from Chemical laboratory of Saveetha...

### Results and discussion

The Surface Roughness observations at clean and green machining environment presented comparatively in the Table 2. The samples which machined without cooling environment is called as green machining or dry machining. Same experimental input conditions employed for both machining conditions. The observations of surface roughness of the samples from the dry machining and nanofluid based clean machining or wet machining were consolidated in the Table 2 and the same was used. T -test used for...

### Conclusion

Use of Novel Nano fluid experimentally verified, nanofluid successfully synthesized from used coconut oil (Waste) with Boric acid Nanoparticles. The proposed clean manufacturing reduced the Surface Roughness significantly. The proposed method reduces average surface roughness from  $12.3237\mu\text{m}$  to  $8.2844\mu\text{m}$ . Hence the Reduction of average of  $0.03937\mu\text{m}$  surface roughness by use of proposed Nano fluid.

1. The optimized process parameters by Taguchi analysis are: use of 0.3mm nose radius, operate at 190...

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### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper....

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