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# Influence of molybdenum disulfide particles' concentration on waste cooking oil nano fluid coolant in cutting force reduction on machining SAE 1144 steel

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## Abstract

Utilization of waste cooking oil to develop a Nanofluid with Molybdenum disulfide Nanoparticles for a metal machining application is focused in this research. Based on the nature of lubricating, non-corrosive and biodegradable properties the waste cooking oil and nano Molybdenum disulfide combination is preferred in this research. Molybdenum disulfide Nano-particles enriched waste cooking oil in minimizing cutting forces. This investigation involved 2 group of samples the group-I is control group in which the samples machined (turning) in heavy duty lathe by green machining method. The sample of intervention group machined Nanofluids with variable concentration of Molybdenum disulfide between 0.1 and 0.25 wt%. The sample size estimated with G-Power 80% and was 12 per group but 16 samples group considered to conducting experiments and optimizing the process parameters by means of Taguchi analysis. The results of cutting forces encountered were measured under various combinations of similar input conditions for both green machining and Molybdenum disulfide Nano-particles enriched waste cooking oil based wet machining method for lathe machining of AE 1144 shaft. The statistical test reveals that Molybdenum disulfide Nano-particles enriched waste cooking oil based wet machining method averagely reduced the cutting force 27.53% than green machining method. The significant value is 0.001 ($p<0.05$). It was ensured that the results did not violate the statistical assumption.

## Introduction

Under CNC machining is utilized for mass production of SAE 1144 steel shaft [1], [2]. Discussed service load test on cyclic loading circumstances on SAE 1144 steel shaft. Also investigated to estimate fatigue endurance at room temperature [3], [4], [5]. Investigated the lubrication and wear properties of SAE 1144 steel. From these it is understood that importance of machining SAE 104 steel shaft initiate clean technology of utilization of used food containers in to useful aluminium with nanoparticle reinforcement [6], [7], [8], [9] utilized Nano fluid $Al_2O_3$ and CuO Nano fluids to reduce cutting energy that is reduce the cutting zone temperature in surface grinding on EN 31 steel shaft [10], [11], [12], [13], [14] utilized low concentration of Nano particles in the heat transfer fluid to increase the heat transfer in double tube heat exchanger and there by the new design will more compact in the same capacity. Excellent tribological properties of Molybdenum disulphide ($MoS_2$) in reduction of friction as well as wear, attracts its application in production of dry lubricant [15], [16], [17], [18]. In this research utilize it in wet lubrication application for machining

the motor shafts. They usually dissolved in lubricating oils is important property in preparation of used (waste) cooking oil-based coolant for machining the shafts in the CNC lathe. $MoS_2$ also employed in nano- composite coating [19], [20], [21], [22], [23]. Ultra-fine thin coating provided to reduce friction with help of $MoS_2$ Nanoparticles [24], [25], [26]. In this research the Molybdenum disulfide Nanofluid prepared with waste (used) cooking oil for liquid lubricant to reduce cutting force in SAE 1144 steel shaft manufacturing.

## Section snippets

## Materials and methods

This inhouse research facility of CNC turning centre at Saveetha School Engineering, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai. The facility offers high degree of accuracy in machining.

The round rods of SAE 1144 work piece material purchased from Pujara Steels Pvt. Ltd in Chennai and cut it to 60mm long.

Because the test condition must match for shaft manufacturing. The waste cooking oil obtained from Saravana Bhavan high class vegetarian Hotel, …

## Results and discussion

The experiments were conducted as planned for both control group and experimental group samples. The observations recorded and presented in Tables 2 and 3 for the Control group (dry machining) and experimental group (wet machining with proposed Nanofluids) respectively. The observations are validated statistically using independent samples test. Table 3 shows the independent samples test (T-Test) output of group statistics.

In which the Group 1 (control group) green machining and Group 2…

## Conclusion

The utility of Waste cooking oil is focused in this research. It investigated clean machining possibilities with use of Novel Nano fluid, which prepared from waste cooking oil and enriched with Nano platelets. The proposal tested in machining SAE 1144 shaft under flood cooling condition. The statistical test reveals that Molybdenum disulfide Nano-particles enriched waste cooking oil based wet machining method averagely reduced the cutting force 27.53% than green machining method. The…

## 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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