

## **Study on optimizing the best additives to be added to vegetable based lubricant to improve machinability performance**

### **Abstract**

The common problems that faced during machining process are high cost due to increase tool wear, reduced quality of product due to poor surface finish and widely use of mineral and synthetic oils as metal working fluids that are recognized as harmful to both environment and health of the machine operator. Vegetable oil is renewable oil that possesses good biodegradability and lubricating ability which has potential to replace synthetic oil and mineral oil as environmental friendly cutting fluid if proper researches have been conducted. The aim of this experimental study is to determine and optimize the best additive to be added to the vegetable oil to improve its machinability. Types of additives selected in this experimental study are Propyl Gallate (PG), Boric Acid (BA) and Polydimethylsiloxane (PDMS). The experimental study uses a Taguchi design methodology in designing the experiment. Three different factors at three different levels are selected to conduct the experiment such as feed rate (mm/rev), cutting speed (m/min) and depth of cut (mm). The effect of tool wear and surface roughness during turning of mild steel (AISI 1040) were statistically evaluated using wear area analysis method and analysis of variance (ANOVA) method, respectively. It is observed that sunflower oil added with 3% Boric Acid is the most effective cutting fluid to reduce the tool wear while sunflower oil added with 3% Propyl Gallate is the most effective cutting fluid to reduce the surface roughness.

**Keywords;** Additives; Boric acid; Polydimethylsiloxane; Propyl gallate; Vegetable based lubricant