Modified Tamanu Plant-Based Oil from Pahang Malaysia as biodegradable metalworking fluids

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ABSTRACT

Metalworking fluid (MWF) is a cooling and lubrication agent for the machining process. It is used as a coolant for rapid heat removal and provides a lubrication mechanism at the cutting zone. However, commercial MWFs such as synthetic ester and mineral oil give negative effects on human health and the environment. Therefore, the manufacturing industry should substitute commercial oil with vegetable-based oil. Calophyllum Inophyllum or also known as Tamanu is one of the feasible plant that has abundant oil quantity. In this study, modified Tamanu based oil with Trimethylolpropane ester (MTO) and modified Tamanu based oil with Pentaerythritol ester (MTOP) have been prepared and tested for their physical and tribological properties. Two types of ionic liquids; Phosphonium-based ionic liquid (PIL) and Ammonium-based ionic liquid (AIL) were added to each Tamanu-based oil (MTO and MTOP) to enhance their physical and tribological properties. Physical tests and Fourier Transform Infrared spectrometry (FTIR) were performed on each lubricant samples. The obtained results have shown that there is high viscosity index in MTOP + PIL 1 % and a lower double bond value in MTOP oil. MTOP + PIL 1 % has shown improvement in its tribological properties and can be comparable with commercial oil. Thus, it is suitable to be used as a substitute for commercial metalworking fluid in corresponding to green manufacturing activity.

KEYWORDS

Bio-based lubricant; Green machining; Ionic liquid; Metalworking fluids; Tamanu oil; Viscosity

ACKNOWLEDGEMENTS

The authors would like to express gratitude to Universiti Malaysia Pahang (UMP), the Faculty of Mechanical & Manufacturing Engineering UMP, and the Ministry of Education Malaysia for their supports. This study was funded by the Fundamental Research Grants Scheme FRGS/1/2019/TK03/UMP/02/19 (University reference RDU1901145).