

Characterization of Vegetable Oil-Based Lubricants with Halloysite Nanotubes as Lubricant Additives and Their Tribological Performance.

Md Abu Sayeed Biswas, MD Mashfiqur Rahman, and Javier A. Ortega

Department of Mechanical Engineering
The University of Texas Rio Grande Valley
Edinburg, TX 78539, USA

mdabusayeed.biswas01@utrgv.edu, mdmashfiqur.rahman01@utrgv.edu,
javier.ortega@utrgv.edu

Laura Peña-Parás and Demófilo Maldonado-Cortés

Engineering Department
Universidad de Monterrey

San Pedro Garza García, N. L. 66238, México laura.pena@udem.edu,
demofilo.maldonado@udem.edu

Abstract

Vegetable oil-based nano-lubricants are a great alternative to petroleum-based lubricants due to their less adverse impact on the environment. This work evaluated the tribological performance of sunflower, corn, and peanut oils with the addition of Halloysite Nanotubes (HNT) as lubricant additives at different concentrations. Vegetable oils are commercially used as edible oils, but in this current work they were selected as base oils for the nano-lubricants due to their renewability and biodegradability. To analyze the tribology performance of the nano-lubricants, a block-on-ring tribometer was used following the ASTM G-077-05 standard procedure. In addition, tapping torque tests were carried out following the ASTM D5619 standard. Results indicated that sunflower, corn, and peanut oils mixed with HNT at 1.5 wt% provided the best tribological performance. The wear volume loss was lowered by 29%, 78%, and 67% for sunflower, corn, and peanut oil respectively, with the addition of 1.5 wt%, compared to its base oil. Tapping torque test results also provided high tapping torque efficiency that can prolong tool life in machining processes. Based on the experimental results, it can be concluded that the vegetable oils modified with the addition of halloysite nanoclay have the potential to be used as biodegradable lubricants.

Keywords

Vegetable oils, nano-lubricant, Halloysite Nanotubes (HNT), tribology, tapping torque