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Biolubricants Synthesis from Oil/Fat Ozonized-derived Products

Bio-based lubricants synthesized from ozonized oils deliver high viscosity index, thermal stability, low-temp liquidity, and oxidation resistance without toxic catalysts.

Researchers at Purdue University have discovered a method to produce biodegradable lubricants from common agricultural byproducts, such as oleic acid (derived from corn and soybean oil), without using toxic materials or expensive catalysts. Currently, almost all lubricants are produced from petroleum, which are not readily biodegradable and often have toxic additives included. As an alternative, oil and fat-based lubricants that are biodegradable have been developed, however they tend to have poor low-temperature performance and are easily oxidized due to the unsaturated carbon-carbon bonds inherent in the molecules.

Purdue researchers have determined a method to produce several bio-based lubricants that have a high viscosity index, indicating that their viscosity does not change with temperature greatly, and are in general capable of maintaining a liquid state at very low and high temperatures. Additionally, because the molecules are saturated with hydrogen, they are not easily oxidized.

Technology Validation:

- Low temperature performance of lubricants was measured with differential scanning calorimetry analysis from -40 to 20 deg C. Of the 6 bio-lubricants studied, three showed excellent low-temperature performance: staying liquid at low temperatures.

- Viscosity and viscosity index of lubricants were measured with Stabinger viscometer at 40 and 100 deg C (following ASTM D 4052 and D 7042). The bio-lubricants showed a wide range of viscosities, indicating that they could be used for a broad range of applications.

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Category
Agriculture, Nutrition, & AgTech/Livestock & Animal Health Solutions
Chemicals & Advanced Materials/Green & Bio-Based Chemistry
Automotive & Mobility Tech/Micromobility & Smart Urban Infrastructure

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- Thermal stability of lubricants was observed with TGA 4000 and measured from 40 to 550 deg C, 15 deg C/min under a nitrogen atmosphere. All bio-lubricants studied showed thermal stability without significant degradation below 200 deg C, and some bio-lubricants were stable up to 400 deg C.

Advantages:

- Readily biodegradable.

- Simple to produce, no toxic materials or expensive catalysts required.

- Wide range of viscosities available; can be used for a range of applications.

- All bio-lubricants studied showed excellent viscosity index.

- Thermally stable up to 200 deg C.

- Select lubricants studied remain liquid at low temperatures (below -40 deg C).

- Oxidization resistant

Applications:

- Low temperature cooling systems

- Motor lubricant

- Industrial lubricant

TRL: 3

Intellectual Property:

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Utility Patent, 2024-08-30, United States

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