**Investigating physiochemical and tribological Properties of the blends of epoxides of Jatropha, Palm and Castor Oil for Biolubricant Applications**

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**Abstract**

This study compares the potential of castor, palm, and jatropha oils as well as their epoxidized derivatives for use as biolubricants. The applicability, physiochemical and tribological characteristics of the oils, their epoxides, and blends of epoxides in different ratios were methodically examined. To find the most promising option for high-performance biolubricants, parameters including viscosity, pour point, flash point, oxidative stability, and wear resistance were investigated.

Optimizing the epoxidation process improved the oils' oxidative and thermal stability, which is crucial for biolubricant applications. Because of its hydroxyl-rich molecular structure, castor oil demonstrated remarkable lubricity and viscosity retention after epoxidation. Jatropha oil is ideal for colder locations because of its exceptional oxidative stability and low-temperature performance. Despite having excellent tribological qualities, palm oil's oxidative stability was rather constrained in comparison to the other oils.

Synergistic gains in lubrication performance were found in blends of the three oils' epoxides in varying quantities; particular combinations produced improved thermal stability and wear resistance. Because of its exceptional tribological performance and viscosity stability, epoxidized castor oil distinguished out among the oils as the most promising for high-performance biolubricants.

The results highlight the potential for developing sustainable biolubricants using non-edible oils and their chemical derivatives.

**Keywords**: Jatropha oil, Palm oil, Castor oil, Epoxidation, Biolubricants, Tribological performance, non-edible oils