

FOOD-GRADE PALM-BASED LUBRICANT BASE FLUIDS

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Mineral-based or petroleum-based lubricants are detrimental to the environment, as they are not easily biodegradable and are toxic towards aquatic organisms, and based on a non-renewable resource. Due to increasing global environment awareness, a keen search for more environmental-friendly lubricants is being made.

Lubricants comprise 97%-98% base fluids with 2% performance additives. For better environmental-friendliness, the present petroleum-based fluids can be replaced with either synthetic fluids or vegetable oils. As vegetable oils are less expensive than synthetic fluids, they are preferred.

The performance of a lubricant is very much dependent on the quality of the base fluid used. Thermal stability and cold-temperature fluidity are the desirable properties for a good lubricant base fluid. Bio-based fluids from vegetable oils, such as soyabean oil, sunflower oil, canola oil and rapeseed oil, often have superior viscosity indices, flash points, extreme pressure lubricity, good compatibility with additives and lower volatility than their petroleum counterparts. However, many vegetable

oils are inferior in thermal oxidative stability due to their high content of unsaturated fatty acids, and cold-temperature fluidity due to the high melting points of their saturated fatty acids. These drawbacks can be overcome by chemical or genetic modification of the fatty acid composition or by incorporating additives to the oil. Although palm oil contains equal amounts of saturated and unsaturated fatty acids, its moderate thermal oxidative stability and cold-temperature fluidity make it potentially suitable for use as a bio-lubricant.

APPLICATIONS

Biodegradable food-grade palm-derived base fluids (*Figures 1 and 2*) are designed for formulation of a wide range of lubricants for different applications in hydraulic systems, anti-wear hydraulic systems, air compressors, penetrating lubrication systems, reciprocating systems, as general circulating oil, and spindle or telemotor, bar, chain and sprocket oil. The series of palm-based fluids can also be used in general purpose lubricants for motors and bearings (Malaysian patent application No. PI 20055209).



Figure 1. NSF certified food-grade base fluids: NSF registration numbers 136685, 136686, 136687, 136688, 136689.



Figure 2. Other palm-based lubricant base fluids

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For the formulation of all lubricants, the base fluids are easily blended with various additives to enhance their physical properties. The base fluids (*Table 1*) are National Sanitation Foundation (NSF) certified HX-1 ingredients for use in lubricants with incidental food contact (H-1) in and around food-processing areas. They are included in the current NSF White Book Listing of Non-food Compounds in the NSF website (<http://www.nsf.org>).

NOVELTY OF INVENTION

Food-grade palm-based lubricant base fluids are carefully designed and developed to substitute for the unsafe and toxic petroleum-based fluids in lubricant formulations for use with incidental food contact in and around food-processing areas. They are inexpensive, readily available, biodegradable, environmental-friendly and renewable. Besides reducing the dependency on petroleum, they will help maintain the global environment from pollution.

TABLE 1. TYPICAL CHARACTERISTICS OF FOOD-GRADE PALM-BASED LUBRICANT BASE FLUIDS

| Performance characteristics | FG BASE 1 | FG BASE 2 | FG BASE 3 | FG BASE 4 | FG BASE 5 |
|---|-----------|-----------|-----------|-----------|-----------|
| NSF registration number | 136685 | 136686 | 136687 | 136688 | 136689 |
| Specific gravity @ 15°C (g cm ⁻³) | 0.8975 | 0.8946 | 0.8909 | 0.8867 | 0.8817 |
| Viscosity, kinematic @ 40°C, cSt | 41.66 | 32.29 | 25.56 | 19.93 | 15.97 |
| @100°C, cSt | 8.47 | 7.17 | 6.12 | 5.18 | 4.41 |
| ASTM D445 | | | | | |
| Viscosity index ASTM D2270 | 186 | 196 | 202 | 211 | 206 |
| Moisture content (%) ASTM D1744 | 0.085 | 0.084 | 0.097 | 0.081 | 0.087 |
| Air release (min) ASTM D3427 | 1.40 | 1.30 | 1.60 | 1.80 | 1.90 |
| Copper strip corrosion ASTM D130 | 1a | 1a | 1a | 1a | 1a |

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