



BIOSYNTHETIC[®]
TECHNOLOGIES

PCMO

Biosynthetic[®] Technologies manufactures renewable and biodegradable base oils that can be used to formulate high-performance synthetic passenger car motor oil (PCMO). These sustainable base oils are biobased and provide an alternative to petroleum products while meeting the top synthetic performance standards and providing cleaner emissions while protecting vehicle components against wear, and improving fuel efficiency.

To illustrate the superior functionality of the base oils, Biosynthetic Technologies formulated an API certified motor oil that meets industry and OEM requirements while being environmentally friendly as well.

Biosynthetic motor oils deliver superior performance and decrease varnish build up in engines while delivering superior environmental performance. These certified PCMO formulations can function as a starter formulation to jump-start your entry into the market of renewable and biodegradable engine oils. Biosynthetic motor oils provide the performance characteristics that are comparable to, or better than other petroleum derived synthetic engine oils available on the market today and have been used to successfully formulate 0W-20, 0W-30, 5W-20, 5W-30, and 10W-30 SAE motor oils.

Biosynthetic Technologies base oils are compatible with conventional additive packages, allowing for the formulation of superior PCMOs that can perform under extreme pressure and offer superior rust and oxidation characteristics, with excellent biodegradability.

Biosynthetic base oils improves sustainability at each step of the life cycle analysis—production, manufacturing, use, and disposal. It is also compatible with existing recycling and re-refining infrastructure, continuing to reduce petroleum use through responsible collection practices.

Passenger Car Motor Oil Sample Formulation

**USDA Certified Biobased
Superior Oxidative Stability
Excellent Wear Performance
Superior Hydrolytic Stability
Biodegradable and Non-Toxic*
Excellent Performance Characteristics**

These sample formulations have been created to assist our partners in formulating PCMO. However, they are not intended for commercialization.

Formulation Data

For this Biosynthetic Technologies PCMO formulation used the low viscosity Biosynthetic Technologies base oil and commercially available additive package and viscosity modifiers. The finished motor oils are API SN-RC certification on a 5W-20 and 5W-30 motor oils and meet the International Lubricant Specification Advisory Committee (ILSAC) GF-5 performance standard.



Biosynthetic Technologies Base Oil Performance Features

- High Oxidative Stability
- Low Volatility
- Excellent Anti-wear Performance
- High Viscosity Index
- Hydrolytic Stability
- Low Pour Point
- Natural Detergency
- Longer Lasting
- High Shear Stability
- Increased Safety
- Fewer Additives Needed
- Increased Stability
- Less Maintenance

Biosynthetic Technologies Base Oil Environmental Benefits

- High Biodegradability
- Low Bioaccumulation
- Low Toxicity
- High Bio-Content
- Low Environmental Risk
- Reduced Risk to Wildlife
- EcoLabel and VGP
- Renewable Carbon Based

Certifications and Registrations



Formulation

Formulation	Biosynthetic 5W-30	Biosynthetic 5W-20
	mass %	mass %
Viscosity Modifier SV277	3.5	2.0
Estolide	35.0	35.0
Additive 10100A	13.4	13.4
4 cSt Group III	23.0	48.2
6 cSt Group III	25.2	1.5

Because Estolides have higher VIs than most products, they have several advantages over other motor oils. Estolides have a high VI and reduce varnish so the use of Estolides in a formulation allows for reduced treat rates of some additives that may serve the same function.



Field Trial

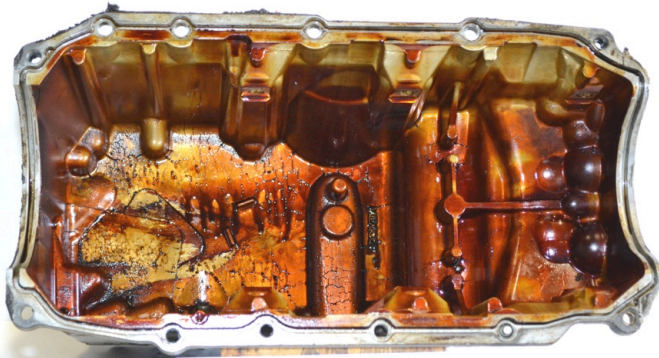
Biosynthetic Technologies conducted a field trial with a taxicab in Las Vegas. Running 150,000 mile (241,402 km) under severe stop and go conditions.

- First 100,000 miles (160,934 km) ≈ 84% Estolide with additives.
- Last 50,000 miles (80,467 km) ≈ 42% Estolides, 42% Group III, and additive package.
- Reference Oil – Minimum Quality GF-5 oil.
- Typical drain interval 2 to 3 times recommended mileage.
- Vehicle – Taxicab, Chevy Impala, 3.5 liter V6.

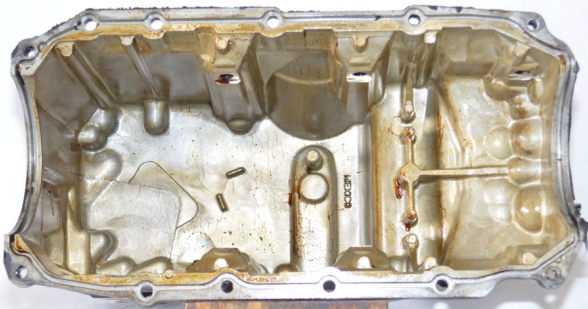
In addition to the Las Vegas field trial, Biosynthetic Technologies demonstrated this fully synthetic bio-based motor oils for use in non-tactical Department of Defense (DoD) and civilian federal agency gasoline powered vehicles. This latter demonstration validated the performance of bio-based oils in engines, facilitated awareness of sustainable alternatives to petroleum-based motor oils, and resulted in the assignment of new National Stock Numbers (NSNs) for these bio-based oils, making them available for DoD and civilian Federal Agency procurement.

Conclusion

Engines run on Estolide-based formulations had far less varnish. Biosynthetic Motor Oils are compliant with Federal directives.



4179
10/2013 Desert Cab



4212
01/2014 Desert Cab

Protect the environment

Biosynthetic Technologies is committed to sustainability and clearly focused on the responsible use of natural resources in our daily business. We understand that health, environmental awareness and traceability play just as large a role for consumers as quality and efficacy. Biosynthetic® Technologies is aware of its responsibility in this business and sustainability. As such, our manufacturing facility is operating with a NEGATIVE carbon footprint! Take used oil and grease to an authorized collection point. Comply with local regulations. Do not discharge into drains, soil or water.

Health & Safety

This product is not likely to present any significant health or safety hazards when properly used in the recommended application and good standards of personal hygiene are maintained. Reference is made to the Safety Data Sheet (SDS).

Storage

We recommend storing all packages under cover. In case outside storage is unavoidable, drums should be laid horizontally to avoid the possible ingress of water and damage to drum markings. Products should never be stored above 60°C, exposed to hot sun or freezing conditions.

Legal disclaimer

Typical properties depicted on this document are average values only and do not constitute a specification. Minor variations that do not affect product performance are to be expected during normal manufacture, and at different blending locations. Product formulations are subject to change without notification.

**Pertains to Biosynthetic base oils and not the formulated product.*

Formulation Assistance

Our lubricant specialists are well versed in our patented sustainable base oils as well as a variety of targeted performance additives engineered to provide ideal lubrication properties in countless applications. Our technical support staff is available to help with your formulation needs and assist you in achieving your target viscosity, biodegradability and renewability levels while remaining within your targeted price point.

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