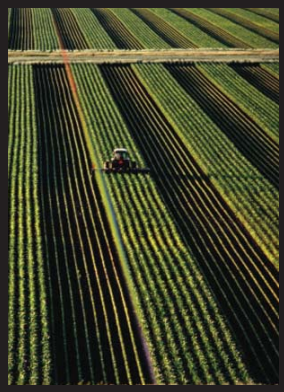
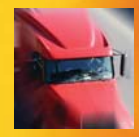


Biodiesel - Market Issues and Solutions

innospec
fuel specialties



A natural solution

Innospec is currently working on the cutting edge of fuel additive technology to ensure Biodiesel can become a truly viable and practical alternative. We understand fuel and the need to develop renewable energy sources.

With our global resources and expertise we are able to work with customers to create innovative solutions for this rapidly expanding renewable fuel market.

In a national effort to rely less on foreign sources of energy more attention is being focused on alternative sources of fuel. Biodiesel is gaining in popularity as a renewable source of energy because it can be manufactured from vegetable oils, animal fats or even recycled greases. Common crops include rapeseed, soy, palm, tallow, corn and sunflowers just to mention a few.

Biodegradable and non-toxic, Biodiesel (B100) produces about 60% less net carbon dioxide emissions than petroleum based diesel. Typical practice is to blend this fuel with petroleum based diesel. Blends of 2, 5, 10 and 20 percent Biodiesel are very common and can generally be used in unmodified diesel engines. These Biodiesel blends are usually referred to as B2, B5, B10 and B20 depending on the blend percentage.

However, as with the introduction of any new product into the market, there still remains concern regarding the quality, such as cold temperature handling, operability and stability of these fuels. This is where Innospec can help.

Our Fuel Specialties business has a proven track record in developing products to improve cold weather operability, fuel efficiency, boost engine performance in extreme operating conditions and reduce harmful emissions.

Today we have an enviable reputation for using advanced chemistries and technical expertise to solve fuel problems, whether for on-road, off-road, home heating, marine, rail or power generation applications.

Innospec is the leading North American supplier of specialty chemicals in the petroleum additives market. Our Fuel Specialties business has been at the forefront of developing innovative fuel additives for 60 years, working closely with fuel suppliers, terminal operators, fuel distributors, vehicle manufacturers and fleet operators.

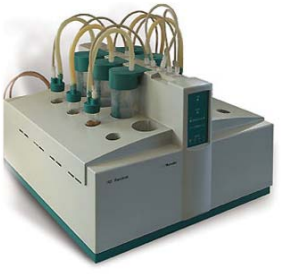
Understanding the chemistry

While Biodiesel provides a natural solution to potential supply issues facing the oil industry today, it is important to understand the drawbacks behind the fuel if it is to be marketed to its full potential as an alternative fuel or blend stock.

• Our BIOSTABLE™ additives are a combination of stabilizers specially formulated to enhance the stability of Biodiesel (B100) and blends of Biodiesel with petroleum based diesel. They are suitable for all types of on-road, off-road, home heating, marine, rail and power generation applications. They are compatible with petroleum fuels and other petroleum fuel additives.

• BIOSTABLE™ products address the various causes of degradation associated with storing and handling Biodiesel and petroleum based Biodiesel fuel blends. BIOSTABLE™ products maintain the stability of fresh fuel, correct the instability of aged fuel and minimize metal catalyzed instability.

• All components of our BIOSTABLE™ line of biodiesel stabilizers have stood the test of time and have been used in motor fuels for over sixty years.



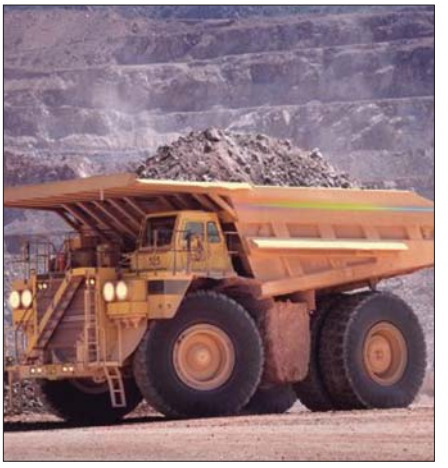
Rancimat Test Procedure EN14112 -Measures formation of volatile acids in B100

• BIOSTABLE™ products help maximize Rancimat performance

• Biodiesel Rancimat Specifications

• US 3 hour min.

• EU 6 hour min.



Innospec has developed additive technologies that address the three main areas of concern, namely fuel stability, fuel quality, and low temperature operability.

Fuel Stability

Bio derived fuels are unstable. Both oxygen and water cause Biodiesel to degrade over time.

To maintain the stability of these fuels and their subsequent blends with petroleum fuels, you need to understand the chemical composition of the biodiesel being used. Compared to petroleum based fuels bio derived fuels contain an abundance of olefinic (unsaturated) materials that contribute to oxidative instability. Different oils contain different levels of olefinic materials.

Storage and handling also affects Biodiesel stability. Exposure to high water content, sunlight or metal at different stages in the manufacturing process all have an impact on fuel stability, as does the presence or absence of natural preservatives.

The composition of the petroleum fuel used in Biodiesel blends is also a factor imparting oxidation stability. The hydrotreating process used to remove sulfur in petroleum based fuels also reduces the materials that help protect Biodiesel blends against oxidative degradation.

Fortunately stabilizers can be added to Biodiesel to guard against product degradation and in some instances even correct oxidative instability that has already occurred.

Fuel Quality

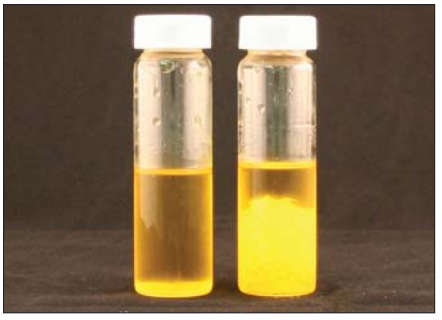
Whether you are a fuel supplier, terminal operator, fuel distributor, vehicle manufacturer or fleet operator, fuel quality is critical. For Biodiesel to gain widespread market acceptance its quality must be consistently reliable.

This means ensuring the fuel meets the required specification and does not greatly deviate from these specifications during normal storage and use.

One of the main problems affecting all bio fuels is the formation of small particles caused by polymerization and exposure to extreme temperatures, this problem is exacerbated when the fuel is stored for extended periods of time. Unlike waxes found in petroleum diesel, these particulates do not re-dissolve when the engine is warm starving the engine of fuel caused by blocked fuel filters.

Our BIOSTABLE™ and BIO WINTERFLOW™ additives offer an excellent remedy for dealing with the formation of particulates while a fuel is being stored. Protection from the formation of various particulate types that could block filters is built into all of Innospec's Bio range of products.

• Our BIO WINTERFLOW™ Cold Flow Improver (CFI) additives offer an effective solution to improving the low temperature handling and operability of biodiesel blends with petroleum distillates. However, to maximize the full benefits of this product and achieve optimum performance, the additive must be designed to deal with the different characteristics present in the customer's fuel blend. The composition of the petroleum fuel is an important factor influencing the low temperature handling characteristics of a blended (Bxx) fuel.



Above: B100 sample at @ 37˚F
Left: B100 treated with BIO WINTERFLOW™ PPD
Right: Untreated B100 sample

• Our BIO WINTERFLOW™ Pour Point Depressant (PPD) additives offer an effective solution to improving the low temperature handling in pure Biodiesel (B100) - the main objective being the reduction in the formation of particulates in the fuel and the lowering of the pour point where these deficiencies are even more pronounced. This is important because although Biodiesel is generally not used as a neat fuel there are concerns over the B100 during low temperature storage and handling. With BIO WINTERFLOW™ PPD the pumpability of B100 is improved dramatically.

Operation in Low Temperatures

As with all diesel fuels, ensuring Biodiesel can flow at low temperatures is essential to engine performance.

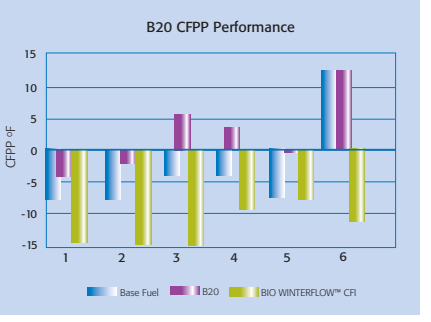
Low temperature handling and operability characteristics of a Biodiesel will vary significantly depending on the specific feed stock used to produce it.

There are a number of tests that can be carried out on a fuel to assess how it responds when the temperature falls.

- Cloud Point (CP) of a fuel is the point at which visible crystals are first detected in the fuel
- Pour Point (PP) is a standardized term for the temperature at which fuel stops flowing upon cooling
- Cold Filter Plugging Point (CFPP) indicates when engine operability will deteriorate because of blocked fuel filters

Tests conducted using BIO WINTERFLOW™ PPD demonstrate the effectiveness the product has at retarding particulate formation over time. The product also maintained fuel liquidity at temperatures below the pour point of the base Biodiesel.

It is well known that bio-derived fuels are inherently more sensitive to cold weather operations than typical petroleum derived fuels. This sensitivity can be attributed to the high levels of paraffins and saturates in these alternative fuels.



BIO WINTERFLOW™ CFI provides an effective solution to the problem of blocked fuel filters at low temperatures. Using the additive improves the Cold Filter Plugging Point (CFPP) of Biodiesel and ensures the engine continues to operate efficiently even when the temperature falls. If left untreated, a Biodiesel blend will generally have a diminished CFPP compared to petroleum diesel.

Creating market opportunities

The move towards more renewable energy sources is creating exciting opportunities for manufacturers of Biodiesel. To capitalize on this market, these fuels must perform to the high standards expected by today's consumer.

Our BIOSTABLE™ and BIO WINTERFLOW™ product lines have been developed to address the key issues that can affect the performance of Biodiesel fuels.

They help protect the fuel against degradation during storage and use and also reduce the impact of exposing the fuel to low temperatures.

By providing effective and innovative solutions to these common problems, we are enabling our customers to take advantage of a growing market for alternative fuel. Our role is to ensure that Biodiesel is viable in terms of its performance and practical application.

With our experience and expertise in fuel technology, we can help customers address common storage and handling problems, addition methods, compatibility, treat rates and product packaging issues.

Our technical team is also able to custom match additive chemistry with the individual components present in the fuel. This approach limits potential interaction between the additive chemistries and ensures proper performance in the blended fuel. Due to extreme variability in feedstock (both bio and petroleum), we will only make these recommendations for fuel treatment after carefully evaluating sample blends.

For more information on our exciting range of additives for Biodiesel and Biodiesel fuel blends call (303) 792-5554.

We have developed our biodiesel additives as part of our market leading LEGAL DIESEL™ range of ULSD fuel additives. Our BIOSTABLE™ and BIO WINTERFLOW™ products are enabling our customers to stay one step ahead in a fast-changing world.

For more information on how Innospec's Fuel Specialties team can work with you, please contact our regional sales office.

Our international office network offers unrivalled product support and it has the resources to deliver the required fuel additive treatments to customers anywhere in the world.

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