



PHASE TECHNOLOGY

*Innovations in phase
analysis solutions*

November 27th, 2003

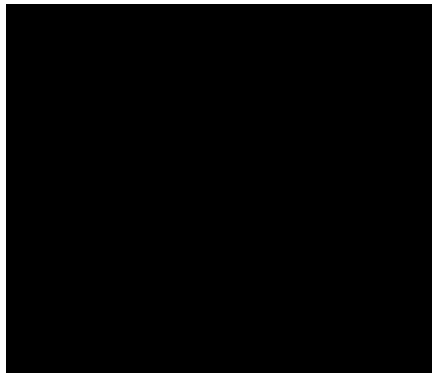
Fuel Gelling Challenges - Technology Solutions

Today's sophisticated real-time planning software provides fleets and independent truck drivers with valuable route and fuel price information resulting in the most cost effective route to their customers. In a *Just in Time* marketplace, fleets and drivers cannot afford late delivery or downtime caused by preventable factors.

One of such factors is diesel fuel gelling in winter months. Fuel gelling, technically referred to as clouding, is a concern to drivers who travel through the cold and diverse climates within North America. Cloud point is defined as the temperature at which waxy solids first appear during the cooling of diesel fuel. It is a quality control test that has been in use by petroleum refineries for well over 50 years. Worldwide, a significant majority of refineries rely on this test for determining diesel fuel operability in cold weather. Cloud point is the preferred test due to its fail-safe nature in predicting operability, quick analysis time and excellent precision. Besides cloud point, other operability test methods are available; however; their reliability is significantly lower and they are impractical for field use.

What does diesel fuel look like at or near its cloud point? The following pictures illustrate the extent of wax formation at various stages of cooling around cloud point. There is no wax crystal at temperatures above cloud point. Once the fuel temperature drops to cloud point, solids appear immediately. Keeping the diesel fuel at cloud point for a longer period of time will result in more extensive solidification; therefore, it is not safe to assume that there is no fuel delivery problem at cloud point. More crystals will also form if the fuel is allowed to cool below cloud point, thus increasing the risk of filter plugging. The amount of solids formed depends on the chemical makeup of diesel, which is different from one batch of fuel to another.

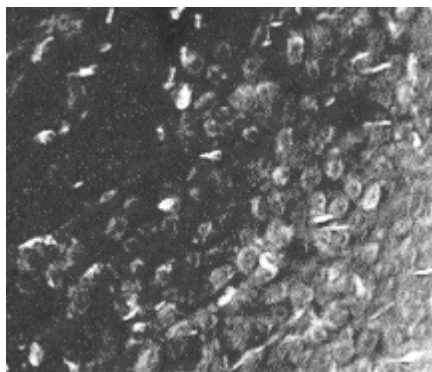
Microscope pictures of a typical diesel fuel



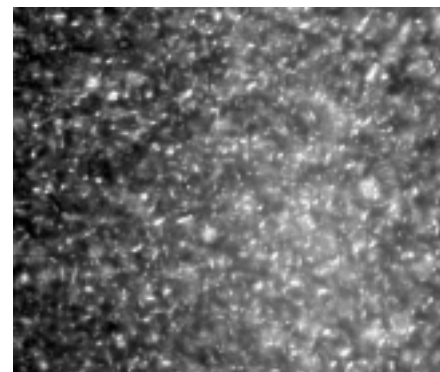
Diesel fuel 1°C above cloud point
No crystals



Diesel fuel at cloud point
A few wax crystals appear
instantaneously



Diesel fuel at cloud point
one hour later
More crystals formed



Diesel fuel at 3°C below cloud point
Immediate and extensive crystal
formation



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Cloud point is an extremely important parameter because it directly impacts truck operability and fuel economy. It is recommended that the fuel cloud point be colder (6°F is often quoted) than the lowest anticipated ambient temperature at which the truck is expected to operate; otherwise, there is a significant risk of filter plugging and downtime.

In wintertime, petroleum refineries supply seasonally adjusted diesel fuels to different regions of North America. Due to the diverse climatic requirements, there are over one hundred temperature zones to satisfy. Even within one state, there could exist multiple zones that are very different in temperature. Compounded with the fact that local cold-snaps are unpredictable, it is not practical for refineries to supply hundreds of winter grades to satisfy the needs of every locale at all times. Furthermore, regional fuel blends may not meet the needs of long haul drivers whose routes begin in a mild climate and traverse into colder regions.

Fortunately, large truck fleets and petroleum marketers such as truckstops and wholesale fuel suppliers are capable of improving the winter quality of diesel by blending a lighter diesel stock, commonly referred to as No. 1 diesel, into the regular No. 2 diesel. They may also achieve positive results with the use of additives. In either case, they can save money and avoid potential down time by knowing the cloud point of the fuel before the blending or additive treatment.

In blending, it is useful to know that No. 1 diesel is a refinery stock that is similar to kerosene and jet fuel. It has excellent winter operability because the cloud point is extremely low, typically in the range of -40°F. However, there are several drawbacks in the use of No. 1 diesel. It has lower energy content, which affects fuel economy and power. In addition, the lubricity is generally poorer than No. 2 diesel, and the price is typically higher. As critical as it is to ensure fuel cloud point below ambient temperature to avoid truck downtime, it is also important that No. 1 diesel is not over-used. To minimize the use of No. 1 diesel, one has to know the cloud point of the fuel before and after blending. A portable cloud point analyzer plays an important role in the optimization process. In many situations, one may find out that the cloud point of the fuel is suitable for their route without blending any No. 1 diesel at all. In the instance of using cold-flow additives, it is also important to ascertain the fuel cloud point so that one knows when or when not to use additives.

In the past, the uncertainty of fuel quality has created several driver tactics that incur additional expenses, productivity loss and unnecessary anxiety. The most common practices that truck drivers use to avoid fuel gelling include frequent refueling in order to purchase seasonally adjusted fuel along their route, the use of fuel heating devices, excessive idling in fear that the truck will not restart and; blindly diluting their fuel with additional No. 1 fuel or chemical additives.

There is an intense need in the transportation industry to reduce costs and avoid downtime. Combined with Promiles software products, Phase Technology's portable cloud point analyzer empowers truck stop operators, fleet and independent drivers with valuable cloud point data to optimize fuel purchasing, fuel blending and additive consumption.



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