

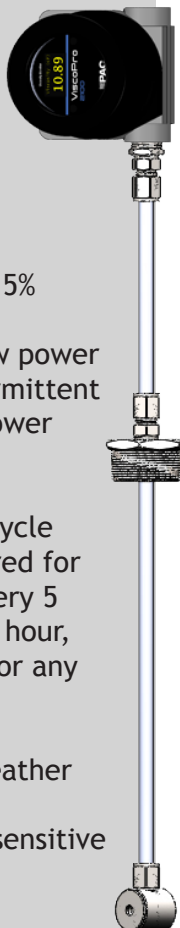
Condition Monitoring of Bulk Fluids using ViscoPro 2100 Viscometer



FEATURES

PAC LP's Cambridge Viscosity ViscoPro 2100 viscometer technology is sensitive to small changes in low-viscosity fluid.

- Factory calibrated
- Self-cleaning and able to run for years without recalibration
- Reliability of 0.5%
- Operates at low power and on an intermittent schedule for power conservation
- Customizable cycle can be configured for continuous, every 5 minutes, every hour, every 6 hours, or any other interval
- Resistant to weather
- Durable and insensitive to vibration



APPLICATION

Monitoring changes in the condition of the material that trigger actionable alarms in hazardous and non-hazardous bulk storage liquids

CHALLENGE

There are several challenges that present themselves in bulk storage applications. These challenges are exacerbated when valuable liquids will be stored for extended periods, used very slowly, transported over large distances, or held in remote locations, such as chemicals used for gas/oil processing or offshore drilling and enhanced oil recovery (EOR) fluids. Probably the most critical challenge is to ensure the fluid stays fresh and meets the manufacturer's specification. Having this assurance through a custody transfer is extremely helpful in preventing a host of issues caused by using an out-of-spec material. Environmental conditions, human interaction, and other factors can cause contamination and degradation. Companies storing fluids over long periods of time need to know if a product undergoes such changes, making it unusable.

Another challenge with bulk monitoring applications stems from the location of the tanks, which tend to be remote and inconvenient to visit. The tanks may also be situated in an area with limited power and no access to utilities.

SOLUTION

Monitoring the viscosity of the fluid is an effective way to determine whether the product has undergone changes during storage, as it will detect:

- Stratification
- Emulsification
- Contamination
- Degradation
- Suspensions falling out of solution
- Evaporation

In order for a viscosity monitor to work well for a bulk storage application, the instrument needs to be able to detect subtle changes within the operating constraints of a remote installation. This means that the system needs to be compact and exceedingly robust. It needs to be highly reliable and impervious to environmental conditions. Devices requiring regular maintenance or calibration cannot even be considered for such a role.

Measuring Viscosity in Bulk Storage Applications

PAC LP's Cambridge Viscosity ViscoPro 2100 with SP series sensor is ideally suited for bulk liquid storage monitoring applications. For over 25 years, the Cambridge Viscosity oscillating piston technology has provided users with the most durable, damage-resistant viscosity sensors in the industry. The patented self-cleaning sensor operation resists coating of critical measurement surfaces. This greatly reduces the need for any external cleaning, calibration shifts, or degradation in sensitivity common to viscosity probes operating on other principles. Likewise, the pumping action of the Cambridge Viscosity piston-based viscometer refreshes samples as it measures, improving response times, especially where external mixing is limited. The analyzers are repeat-use, manufactured of 316L stainless steel, and ATEX and FM rated for use in hazardous locations with volatile materials.

RESULTS

PAC conducted a series of tests to demonstrate the effectiveness of the ViscoPro technology in monitoring changes in a remote tank installation. The low-power ViscoPro 2100 viscometer system was set to monitor tank viscosity over several weeks in a static, fluid-filled tank. Periodic sampling was used to minimize power consumption, as would be needed for a typical remote installation.

The test was devised using a multi-liter vessel filled with water and fitted with a ViscoPro 2100 utilizing an SPL-321 in-tank sensor. The system was calibrated

using NIST traceable viscosity reference standards. Aqueous glycerin was used to manipulate the viscosity of the fluid and simulate changes that could occur with fluids stored in bulk storage facilities (see Illustrations on the following page). The study proved several things:

1. The electronics in the ViscoPro 2100 have the sophistication to be programmable for low-power and intermittent operation. The instrument operates directly from a DC power source and offers multiple data transfer options, including a web interface, analog 4-20 mA, CAN, and Modbus RTU.
2. The ViscoPro 2100 responds very quickly to change in fluid. Even with intermittent measurements, an excellent response is obtained.
3. The ViscoPro 2100 provides stable results over long periods, and remains highly sensitive to small changes in viscosity. The piston motion provides adequate mixing and sample exchange in a non-agitated tank.

CONCLUSION

Regardless of type of transportation or length of storage, the ViscoPro 2100 delivers the assurance that profitable and business-critical fluids are fresh and continue to meet quality expectations. For more information about the ViscoPro 2100, visit us online at www.cambridgeviscosity.com.

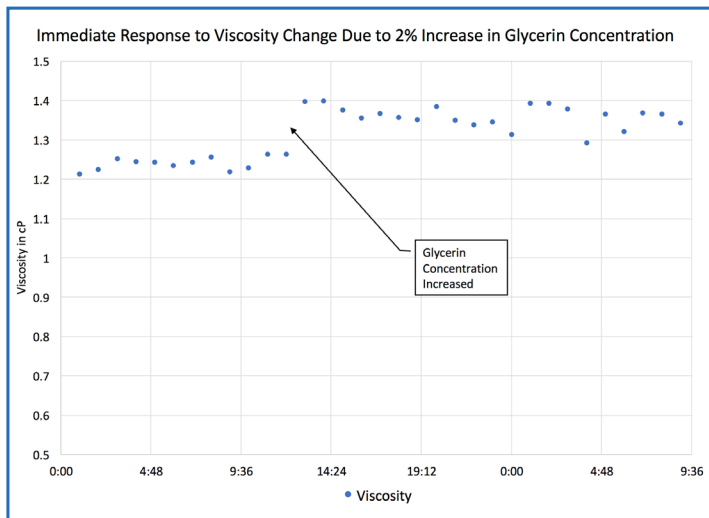


Illustration 1, far left, shows that the ViscoPro 2100 responds very quickly to changes. Even with infrequent measurements of once an hour, good response is obtained.

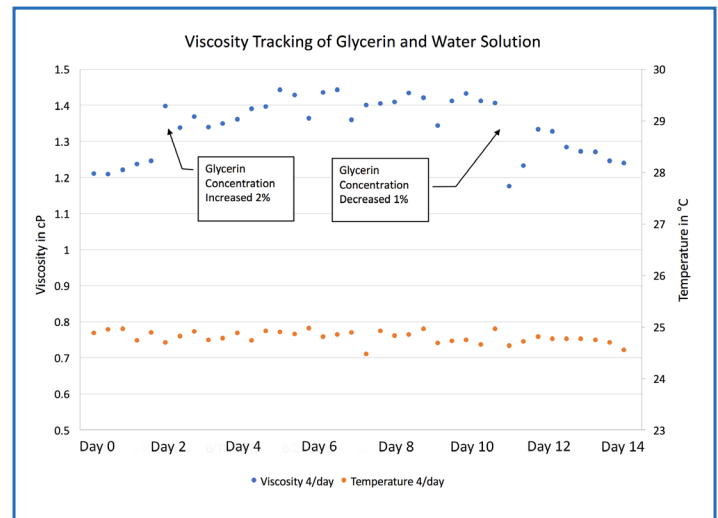


Illustration 2, demonstrates that the ViscoPro 2100 provides stable results over long periods. The viscometer is sensitive to very small changes in viscosity. The piston motion provides adequate mixing and sample exchange in non-agitated tank.