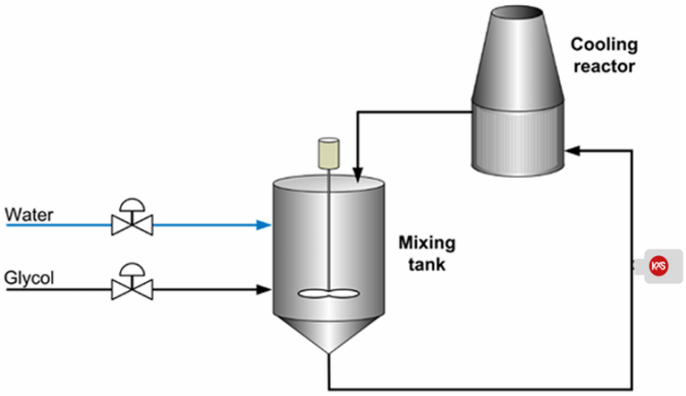
Cooling, heat transfer and dehydration with ethylene glycol

Uses of ethylene glycol in industrial operations | $(CH_2OH)_2$

Benefits of R.I. measurement

- Ensures optimal water-glycol ratios, maximizing heat transfer, preventing corrosion, and avoiding fluid degradation.
- Enables proactive maintenance, helping operators address issues like clogging, cavitation, or corrosion before they escalate. This predictive approach minimizes unexpected system failures and reduces maintenance costs.
- Reduces the frequency of coolant replacement and associated costs.



Overview

Ethylene glycol (EG) is a widely used organic solvent in both household and industrial settings. It is particularly valuable in industries for its role as a precursor to polyester fibers and polyethylene terephthalate (PET) resins, as well as in antifreeze, cooling, heat transfer and dehydration fluids.

However, its effectiveness depends heavily on maintaining precise water-glycol concentrations. Mismanagement can lead to system inefficiencies, increased maintenance costs, and environmental concerns.

Real-time monitoring using refractive index (R.I.) measurement ensures these challenges are mitigated while enhancing system performance and reliability.:

1. System efficiency and performance

Accurate measurement of the water-glycol solution ensures optimal heat transfer, minimizes corrosion, and prevents fluid degradation. Precise control of concentration helps prevent system inefficiencies that could result from incorrect coolant formulations, which could lead to overheating or freezing, especially in extreme temperature conditions.

2. Maintenance and downtime reduction

By monitoring glycol concentration, pH, and contaminants, operators can detect when the coolant solution needs replacement or adjustment, reducing the risk of system clogging, cavitation, or corrosive wear on components. This predictive approach minimizes unexpected downtimes and maintenance costs, ensuring long-term system reliability.

3. Cost efficiency

Regular monitoring and adjustments reduce the frequency of coolant replacement, lower operational costs, and prevent excessive spending on corrective measures. In closed-loop systems, real-time measurement also helps manage fluid top-offs to maintain proper glycol-to-water ratios, limiting waste and unnecessary fluid use.

Refractive index measurement applications

Coolant and heat transfer systems

In industries like automotive, HVAC, and geothermal cooling, ethylene glycol serves as a critical antifreeze and heat transfer agent. When mixed with water, glycol effectively lowers the freezing point and raises the boiling point, enabling safe and efficient operation across a wide range of temperatures.

Maintaining the correct glycol-water ratio is essential, as deviations can lead to serious performance issues. This control is achieved through real-time measurement using inline refractometers, which ensure precise monitoring of glycol concentration during operation.

In particular, the automotive industry has implemented rigorous real-time measurement practices due to lessons learned from costly recalls linked to improper coolant concentrations. Inadequate glycol levels in coolants can lead to engine cooling problems, especially in winter conditions, where low glycol concentration causes coolant freezing. These issues can compromise vehicle reliability, and brand reputation, prompting manufacturers to adopt inline refractometers to continuously monitor and adjust glycol concentration, thus preventing similar failures in the future.

Natural gas processing and dehydration

Ethylene glycol removes water vapor in natural gas processing. It effectively removes water vapor from gas streams, preventing the formation of hydrates that can block pipelines.

Concentration control is critical, as specific glycol-water ratios affect the efficiency of gas dehydration and gas hydrate inhibition. This application underscores the importance of glycol in maintaining the integrity and efficiency of gas transport systems.

Aviation de-icing

Ethylene glycol (EG) and propylene glycol (PG) are critical components in de-icing fluids for aviation, preventing atmospheric ice from accumulating on an aircraft's wings, fuselage, and control surfaces.

De-icing fluids are typically sprayed on aircraft on the ground before takeoff to remove and prevent ice accumulation. Regularly checking the refractive index of the de-icing fluid with a process refractometer ensures glycol concentration remains effective.

Post-application, glycol is recovered, and refractometers monitor the concentration of recycled fluid. They help to separate diluted glycol and guiding of pure water to drainage and concentrated glycol to a sludge tank.

The refractometer also measures final glycol concentration after dehydration, ensuring the fluid meets safety standards before reuse.

Production of resins and fibers

Ethylene glycol is a precursor in the production of PET resin and polyester fibers, requiring precise concentration levels for polymerization processes.

Real-time concentration measurements help maintain the purity of the ethylene glycol feedstock, ensuring product consistency.

Instrumentation and installation considerations

The KxS Process refractometer DCM-20 offers precise and reliable real-time refractive index measurement of the Ethylene glycol. From cooling systems to gas dehydration and de-icing, real-time refractive index measurement optimizes industrial processes, reduces costs, and enhances operational safety.

For instance, **in cooling systems**, refractometer can be installed inline after the water glycol mixing tank or directly at the point of use to provide continuous measurement, reducing the need for sampling and laboratory analyses. This promotes safer processing and increased productivity.

Similarly, **in natural gas dehydration systems,** refractometer can be installed after the stripping column to monitor the concentration of glycol after the regeneration process.

During the dehydration of the gas, the concentration of glycol decreases because of the absorption of water. Another refractometer can monitor the concentration of glycol to ensure an effective process and indicate when regeneration is required.

The refractometer is factory-calibrated for the full refractive index and temperature range, converting measured values directly to concentration units for the process medium. This conversion matches standard chemical curves or can be based on a refractive index set point.

Temperature variations are automatically compensated for in the readings. Thanks to its unique 3-layer calibration method, the refractometer offers free interchangeability between applications or recipes without mechanical adjustments.

Maintenance-free and requiring no recalibration, the DCM-20's precise in-line refractive index measurement is crucial for controlling product quality and optimizing the industrial processes and operations.