

APN1087 Enhancing Plant Safety with Real-Time Ethanol Monitoring in Distillation

Key Words

■ Distillation
■ Whole Stillage

■ Ethanol
■ Explosion

■ Safety
■ Beer Bottoms

Abstract

Accurate measurement of ethanol in beer bottoms is vital for plant safety. Ethanol vapor is highly flammable, and its presence in significant quantities can pose serious fire and explosion risks. By continuously measuring the ethanol content of beer bottoms in real time, plant operators can monitor and react accordingly, reducing the likelihood of dangerous levels of ethanol vapor.

This application note highlights the safety risks associated with inadequate monitoring. It addresses the potential hazards of ethanol vapor migrating downstream of beer bottoms, off-gassing, and venting into various plant areas. The IRmadillo offers a solution to these challenges by providing continuous and real-time monitoring of ethanol in the liquid phase upstream, enhancing safety and efficiency in ethanol production facilities.

Introduction

Ethanol is highly flammable, making its production inherently hazardous. The presence of residual ethanol in beer bottoms can pose significant safety risks if not properly monitored. Current safety measures include interlock systems and flame scanners on Dryers and Thermal Oxidizers (TOs), which are intended to identify and avert dangerous situations. However, while flame scanners operate in real time, they do not provide real-time measurements of ethanol levels at the source, in the beer bottoms. This lack of continuous data at the source is vital for early hazard detection and timely intervention.



Recent incidents at ethanol plants have underscored the importance of vigilant monitoring practices. These events illustrate the dangers of inadequate ethanol measurement and control, emphasizing the importance of accurate and continuous monitoring to reduce such hazards.

Safety Risks

There are two primary safety hazards associated with elevated ethanol levels in beer bottoms:

- 1. Ethanol Vapor Traveling Downstream:** Ethanol in beer bottoms can travel downstream to various process equipment, such as centrifuges, evaporators, dryers, and TO's, where high temperatures and conditions conducive to ignition pose a risk of explosion.
- 2. Off-Gassing from Whole Stillage:** Whole stillage can emit ethanol vapor, which, without proper ventilation or monitoring, can accumulate and create explosive atmospheres, posing environmental and health risks to plant personnel.

Early detection of dangerously high ethanol levels provides operators with the information needed to intervene promptly and reduce risks.

Solution

The IRmadillo offers a robust solution to these detection challenges. By providing real-time, continuous analysis of liquid ethanol concentrations in beer bottoms, operators can act quickly to implement controls.

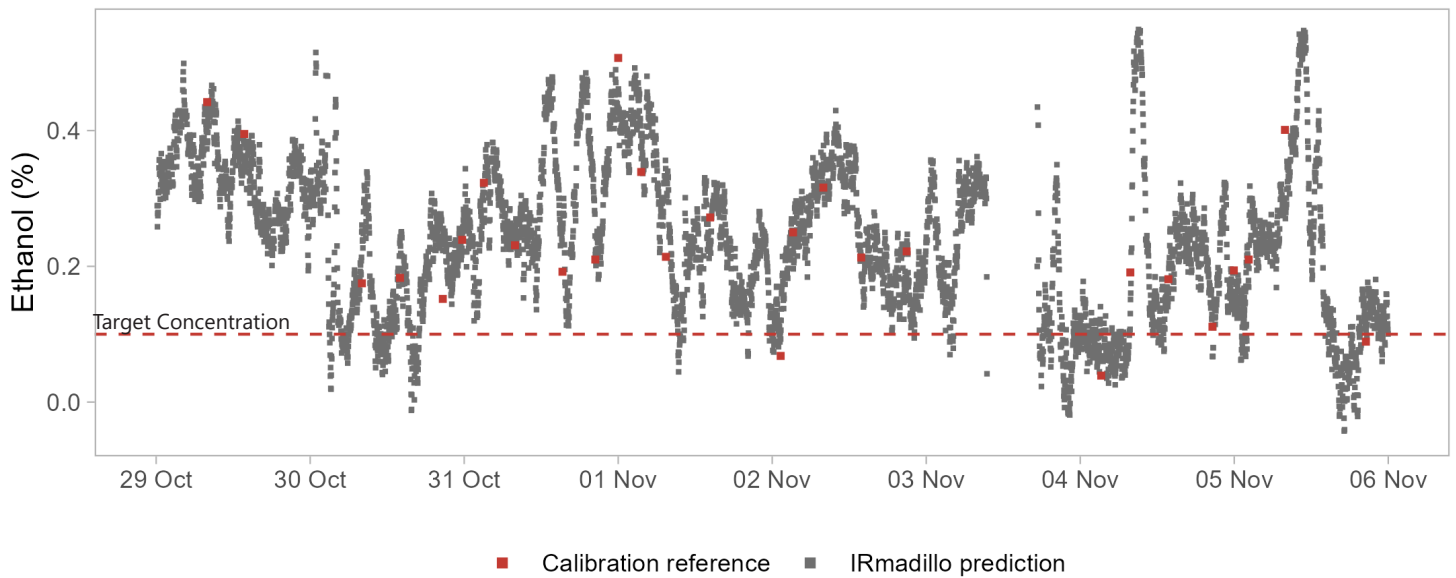


Figure 1: Real time measurement of ethanol in the beer bottoms overlaid with offline HPLC data

For instance, if liquid ethanol levels exceed an upper limit, the beer bottoms can be rerouted back to the Beerwell until the ethanol concentration returns to safe levels. This allows operators to make necessary changes to the column profile as they see ethanol levels beginning to trend up, reducing lost production time. Having real-time ethanol concentration values in the plant control system also allows improved operation of the beer column, potentially leading to lower energy consumption. Current practice involves rerouting back to the Beerwell more often than necessary due to the inability to measure ethanol in beer bottoms in real time. The IRmadillo provides the data needed to make informed decisions on plant interventions. Figure 1 presents an example of monitoring ethanol concentrations in beer bottoms using an IRmadillo.

Conclusion

In summary, real-time monitoring of beer bottoms ethanol helps ensure the safety and efficiency of your ethanol plant. The IRmadillo offers a robust solution to these safety challenges by providing accurate, continuous analysis of ethanol concentrations. This proactive approach can significantly reduce the risk of fire and explosion, safeguarding both your plant and personnel. Don't wait for an incident to occur—enhance your monitoring practices today with the IRmadillo for a safer, more efficient operation.


Don't wait for an incident to occur - enhance your monitoring practices today with the IRmadillo and ensure a safer, more efficient operation!



Keep in Mind

The IRmadillo is more than just a distillation instrument. It can be installed across the plant to measure any liquid, slurry, or emulsion. Certified as C1D2 and ATEX compliant, it provides value across any area of your ethanol plant by measuring multiple chemical species simultaneously and in real-time!

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