

# Real-time HPLC data in ethanol fermentation from FTIR spectroscopy



## KEY WORDS

- Ethanol fermentation
- Bacterial contamination
- FTIR
- HPLC
- Sugar profile
- Spectroscopy
- Process monitoring
- Real-time measurement
- NIR

## Introduction

Ethanol fermentation is a biological process where complex sugars and carbohydrates are broken down by enzymes, providing food for yeast to ferment into ethanol. HPLC is commonly used to monitor and control the process, but samples are only taken every 8 hours, take 30 minutes to run through the HPLC instrument, and give sporadic, disjointed information about the fermentation. Spectrometers allow continuous and detailed measurement of chemical concentrations in real time. The majority of process spectrometers are based on near infrared light, which is fundamentally less informative than mid infrared light. Conventional mid infrared spectrometers (which often use a Fourier transform and are referred to as “FTIR spectrometers”) have sensitive moving parts and fragile fibre probes – making them unsuitable for production environments such as ethanol refineries. The IRmadillo is a process analyzer built using FTIR spectroscopy, but with static optics, dramatically improving stability, reliability, and ruggedness.

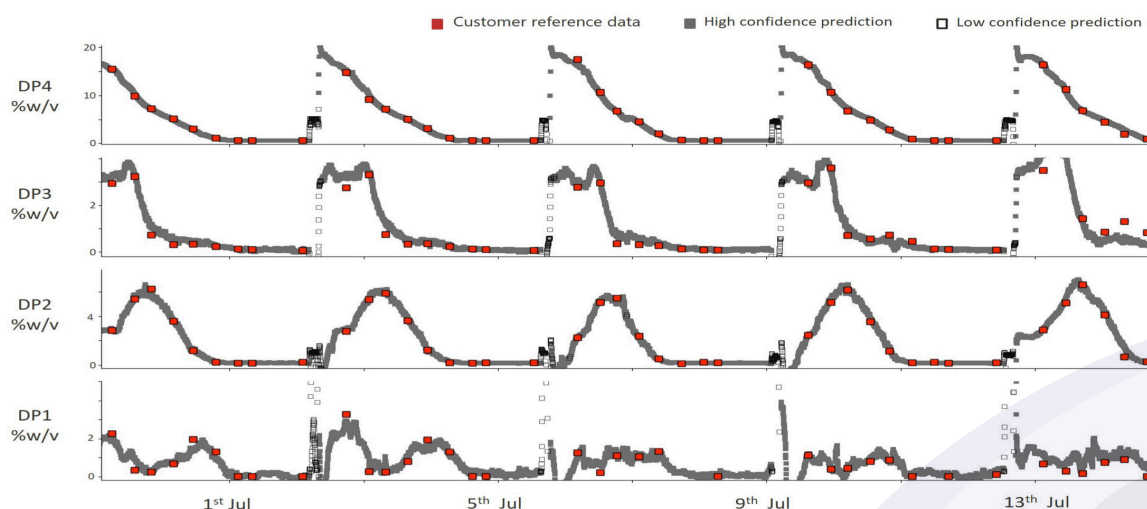
## Example use case

This application note presents data collected from a recirculation line in the fermenter at an ethanol plant in Iowa, measuring the chemicals typically monitored using HPLC – DP4, DP3, DP2, DP1, acetic and lactic acids, glycerol and ethanol. By measuring all of these in real-time, the customer was able to spot problems early (such as bacterial contamination or inactive enzyme), as well as get much more usable data for process and production improvements in the facility.

## Results

Individual models were built for each chemical:

| Species | Range (%w/v) | Accuracy (%w/v) |
|---------|--------------|-----------------|
| 798     | 78           | 09              |
| 765     | 9876         | 9097            |
| 900     | 665          | 3344            |
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**Figure:** Measurements of ethanol, PAN and FAN in real-time for a month long experiment, with associated laboratory reference data provided by Foundation Laboratories [www.keit.co.uk](http://www.keit.co.uk)