

# How IRmadillo™ can increase ethanol yields



**Real-time analysis for  
total process control**





## What is IRmadillo?

IRmadillo™ is the powerful real-time analysis tool that provides continuous, precise data for all your yield improvement projects.

## Why it's perfect for fuel ethanol plants

### BUILT TOUGH

It's built for the rigors of industrial production. With no moving parts, it stands up to vibrations and impacts and can be installed directly into manufacturing lines.

### LABORATORY-GRADE ACCURACY

Despite its rugged nature, it delivers continuous accurate measurements, giving you precise concentrations for a huge range of chemical substances.

### REAL-TIME MONITORING

Constant, reliable data allows you to optimize every step of your production process, leading to higher yields and better overall efficiency.

## What our users say

“The **IRmadillo** online analyzers, installed on fermentation vessels, have multiple benefits for an ethanol plant: because of their easy integration into the plant DCS system, they can work as an early warning system for plant operators to detect potentially faulty fermentation processes at a moment that correction is often still possible. Further, the continuous measurement allows identification small deviations from your standard fermentation curve that otherwise remain unnoticed. This knowledge helps to run fermentations more stable, and as close as possible to ‘golden batch’ conditions, which in turn increases plant stability and productivity. Besides troubleshooting and increase of productivity, the system is also an ideal tool for process engineers when testing new fermentation recipes, like new yeast strains, new enzymes, or other chemicals, and different process settings.”

Technical Director | Biofuels plant in Western Europe

“The **IRmadillo** is the most robust instrument that we have seen in the market for real-time monitoring of ethanol fermentation. It gives us better control of the fermentation process by providing real-time information on how fermentation kinetics are progressing, in other words, how the sugars are being consumed and converted into ethanol”

Julian Parra | Engineering and Technology Manager | Pannonia Bio

“We're excited to fully implement the **IRmadillo** with our operators and see its true potential, especially given the rapid advancements. I'm really excited to see where the technology will go in regard to fermentation monitoring. The Keit team's impressive engineering and data analytics expertise have made them a pleasure to work with”

Dakin Nolan | Chemical Engineer and Environmental Specialist  
United Wisconsin Grain Producers

## What will I see when I use it?

**IRmadillo** software includes calibration and provides continuous updates on chemical concentrations over the whole process. Readings are normally in %wt but can be adjusted as required.

The graph below shows an example fermentation over 5 weeks to give a representation of the output. These batch trends can then be exported into text files for further analysis by your team for process optimization.

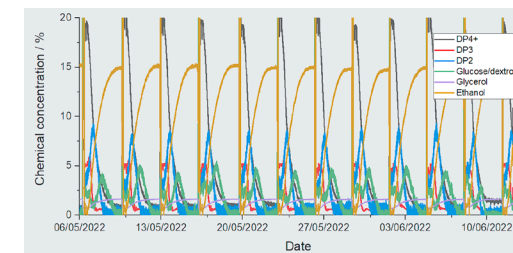


Figure 1: Corn ethanol fermentations over multiple weeks monitored by the IRmadillo - calibrated for DP4+, DP3, DP2, glucose/dextrose, glycerol, and ethanol for real-time, continuous measurement.

The **IRmadillo** can also send concentration data to your DCS, PLC or SCADA in real time. The standard communications protocols are OPC-UA over Ethernet, or Modbus TCP over Ethernet.

## What can IRmadillo measure?

If there is any chemical you'd like to measure in real-time, it's likely that IRmadillo is the tool to do it.

It isn't designed to replace HPLC in terms of error margins or detection limits, but it offers far more frequent data over shorter intervals. This means you get real-time insights that guide you when to take HPLC extracts, helping to deploy staff more efficiently and effectively.

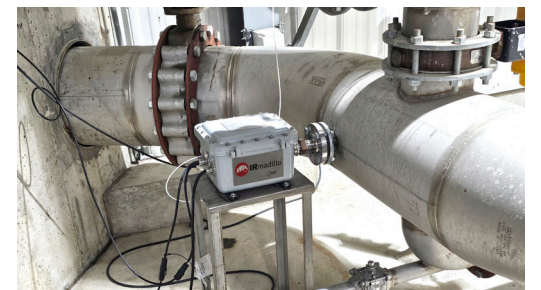
| Chemical    | Measurement error/%wt |
|-------------|-----------------------|
| DP4+        | 0.60                  |
| DP3         | 0.50                  |
| DP2/Maltose | 0.50                  |
| DP1/Glucose | 0.30                  |
| Lactic Acid | 0.005                 |
| Glycerol    | 0.06                  |
| Acetic Acid | 0.005                 |
| Ethanol     | 0.20                  |

## How does IRmadillo fit into my processes?

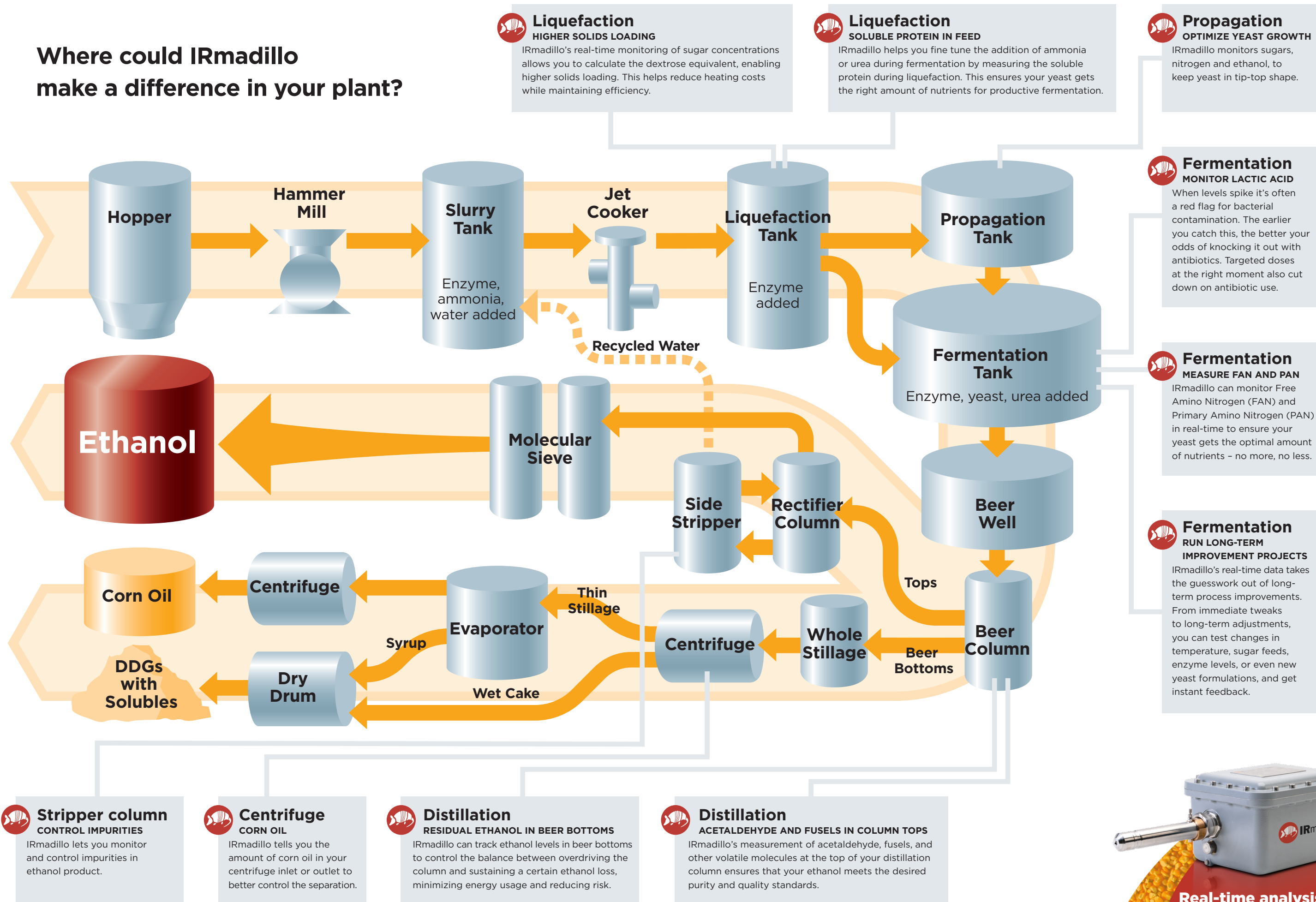
The **IRmadillo's** diamond-tipped probe is built to handle Clean-In-Place (CIP) practices, including caustic washing. Rated for up to 600 psig (40 barg), it can withstand direct exposure to caustic streams. With an operating temperature range up to 430°F (220°C), it's ideal for use in distillation or liquefaction.

## IRmadillo's unique technology

The **IRmadillo** was actually developed for use on Mars, as part of the UK's contribution to the Mars space program. Manufactured by Keit Industrial Analytics, the device has since found a secure and practical commercial niche in many earth-bound industrial processes.



# Where could IRmadillo make a difference in your plant?



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2-85 2-90 2-95 **3-0** **3-0** 2-95 2-90 2-85 2

**Gallons per Bushel**

## Imagine what you could do with an IRmadillo or two

Ethanol and biofuels production involves processes with natural and variable feedstocks, complex biochemical reactions, and potentially vast scale. Couple this with the fast turnaround time of each batch and the need to stick to a production schedule, and the challenge of optimizing these processes to increase yield becomes obvious.

Unlike traditional HPLC, the IRmadillo doesn't just give snapshots; it continuously tracks everything from sugar levels and organic acids to ethanol and glycerol concentrations. It is so robust, you can place it in-line almost anywhere in your

production process. And it catches subtle shifts early on, letting operators jump in with the right response.

Add a little more glucoamylase here, tweak the nitrogen there, and boom — your yeast stays happy, and your conversion from sugar to ethanol stays on track.

Continuous data from the IRmadillo also opens up new opportunities for fine-tuning. When trying new yeast strains or tweaking enzyme doses, you get instant feedback, so there's no more guesswork. Over time, this means more efficient batches, healthier margins and higher yields. Suddenly, getting to three gallons per bushel seems achievable.

### I'm interested. What's next?

Email us at [info@irmadillo.com](mailto:info@irmadillo.com) and a local representative will be in touch to see how **IRmadillo™** could help improve your yields.



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