The traditional approach to process monitoring involves sending a production sample to the lab for testing and then waiting for the results. Unfortunately, the results often come back after it is too late to address the problems. Ideally, analytical results should be available while there is time to correct the underlying causes. In this study, we demonstrate how some minor modifications to a benchtop GC can result in an automated, online instrument. Fermenter off-gas was monitored in near real-time by adding a gas sampling valve to a benchtop GC and connecting the sampling valve to the off-gas port of the fermenter. This configuration allowed the operator to monitor the progress of the fermentation as it was happening by simply pressing the GC start button. A custom chromatographic method was developed and optimized to provide results in less than 3 minutes. The system was further automated by employing a sequence table to control the sampling valve. This additional automation provides data every 4 minutes, without having to manually request it. The method also provided early warning of microbial contamination by measuring indicators like acetic acid.

**Experimental Conditions**

- **GC:** Agilent 6850 GC with a gas sampling valve
- **Column:** J&W DB-ALC1 (modified length) 6 m x 0.32 mm x 1.80 µm
- **Temperature:** Isothermal at 40°C
- **Flow Mode:** Constant Flow
- **Linear Velocity:** 32 cm/sec
- **Carrier Gas:** Hydrogen
- **Injection Mode:** Sampling Valve
- **Split Ratio:** 10:1
- **Injection Volume:** 0.50 mL
- **Valve Temperature:** 150°C
- **Detector Temp:** 250°C

**Materials**

- **Fermentation:** Dry ale yeast (Safale US-05), dextrose and DI Water
- **Standards (v/v):** absolute ethanol in DI water 0.1%, 1.0%, 5.0%, and 10.0%

**Materials and Methods**

- A generic heating pad was used to prevent sample condensation in the transfer line.

**Calibration of Ethanol Standards**

- **Ethanol Standards:** 0.1%, 1.0%, 5.0%, and 10.0%

**Conclusions**

1. Acetaldehyde
2. Ethanol
3. Acetic Acid

We would like to thank:
- Agilent Technologies for providing the GC and column
- Parker Hannifin for supplying the gas generators
- Axion Analytical Labs for providing the facilities and direction

**Acknowledgements**