

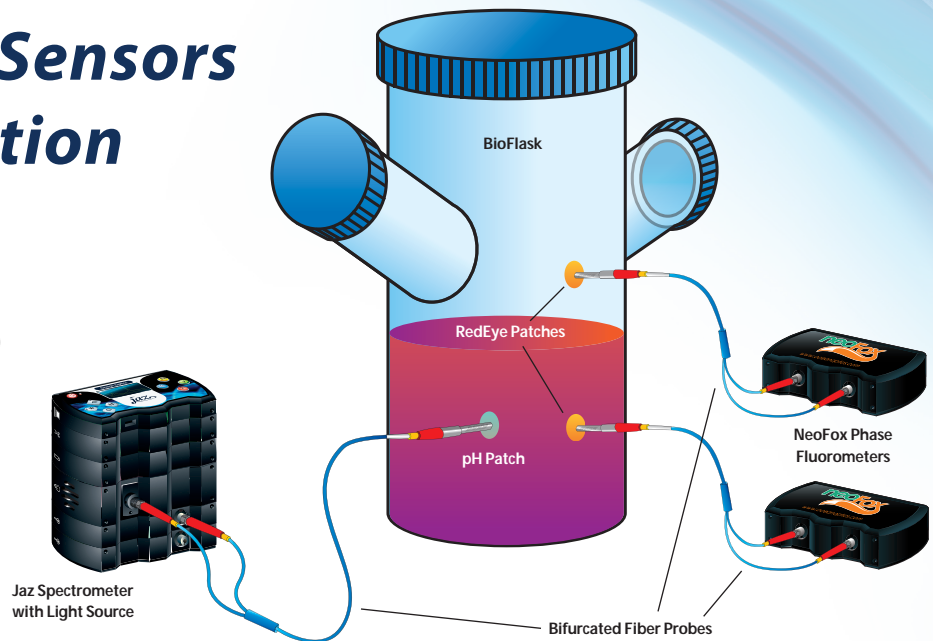
Optical Oxygen Sensors for Biofermentation

Components for Oxygen

- NeoFox Phase Fluorometer
- RedEye® Oxygen Patches (Headspace and In-Solution measurement)
- Bifurcated Fiber Optic probe

Components for pH

- Jaz Spectrometer
- LS-1 Tungsten Light Source
- Bifurcated Fiber Optic Probe
- Reflective pH Patches



Experimental Procedure

- Oxygen Patches were placed inside the Bio-flask to monitor the oxygen in headspace and in solution.
- pH patch was placed in solution to monitor pH changes during the fermentation process.
- Fresh red grapes were mashed and the must was left to sit for 2 days.
- The liquid was placed in bio-flask. Initial measurements were taken. Yeast cells and nutrients were added to begin fermentation.
- This process was observed over a period of 60 hours.

Optical Oxygen Sensing

- Prominent method for luminescence sensing in which the lifetime of the indicator compound changes in response to the analyte sensed (phase measurement).
- A fluorescence method measures the partial pressure of dissolved or gaseous oxygen. The fluorescence is generated at the tip of the optical electrode by a light source.
- When oxygen in the gas or liquid samples diffuses into the thin film coating, it quenches the fluorescence.
- The degree of quenching correlates to the level of oxygen pressure.
- The RedEye Patch is a revolutionary product designed specifically to measure oxygen noninvasively.
- NeoFox is an instrument platform for measurement of fluorescence lifetime and phase for oxygen sensing
- The frequency domain electronics uses a blue LED excitation and an avalanche photodiode for detection.
- A bifurcated optical fiber carries excitation light produced by the blue LED to the thin-film coating of the RedEye Oxygen Sensor
- Fluorescence generated at the surface of the RedEye Patch is collected by the probe and carried by the optical fiber to the detector.

Advantages of Optical Oxygen Sensors:

- Uses fiber optic cable for non-intrusive measurements
- Not contaminated by water or other solutions
- Immune to EMI
- Non-electrical, non-conductive
- Operable in temperature and concentration range of various applications
- Simple calibration
- Works with colored samples without any color or light interference



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