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Ratiometric optical dual oxygen and pH sensor with three emission colors

The efficiency of biofuel production depends on the photosynthetic activity of microbes; to maximize their growth it is necessary to continually monitor the environmental conditions. Traditional monitoring methods (such as using electrodes to measure CO₂ consumption and/or O₂ generation) are typically time- and labor-intensive, have low throughput, and often require special devices. It would be desirable to simultaneously measure several parameters with a simple, robust multiplexed high throughput sensor.

Researchers at the Biodesign Institute of Arizona State University have developed a ratiometric optical dual oxygen and pH sensor fabricated by thermal polymerization of pH and oxygen sensing monomers. This sensor also contains an intra-reference probe and has three emission colors. The ratiometric method is based on the measurement of two probes simultaneously, one that is sensitive to the analyte of interest, and a second that is not, and then taking the ratio of the two. The ratiometric method has been known to increase measurement accuracy and to alleviate environmental influences, such as fluctuations in excitation source intensity, variance in probe concentration, and uncontrollable variations in background fluorescence.

The method is amenable to high throughput sensing of the physiology and biochemistry of photosynthetic microbes (as for biofuel production), and also has significant potential for applications in biological, environmental, and food production monitoring.

Potential Applications

- environmental monitoring
 - water and dissolved oxygen measurements in fluvial, lacustrine, and marine environments
- biological applications
 - cellular metabolism, photosynthesis, etc.
- food production
 - monitoring fermentation processes and beverage freshness

Benefits and Advantages

- biocompatible (no observed cytotoxicity)
- no leaching of sensor materials
- many different matrix material choices including hydrogels and silica gels
- probes can be tuned
- sensors can be fabricated on many different substrates and supplied as fibers, films, patches, etc.

For more information about the inventor(s) and their research, please see [Dr. Meldrum's directory webpage](#)[Dr. Meldrum's Biodesign directory webpage](#)

[Dr. Holl's directory webpage](#)