Constructing an Optical Density Sensor for Measuring Anaerobic Bacteria Growth

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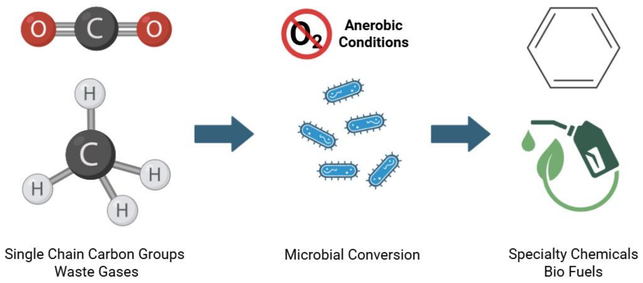
Background



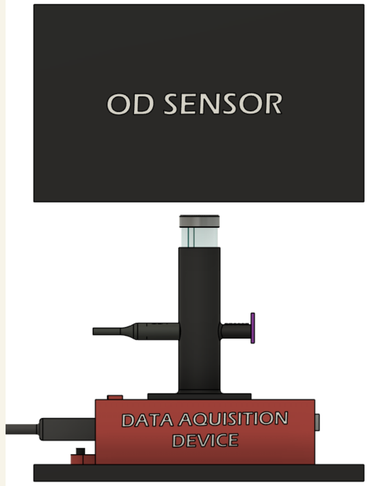
With 3D printed components and simple electronics, a customizable optical density (OD) sensor can be constructed to cheaply measure anerobic bacteria growth rates

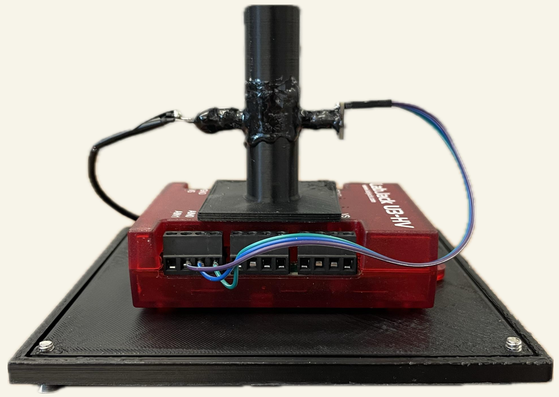
Current State of the Art

Spectrophotometer

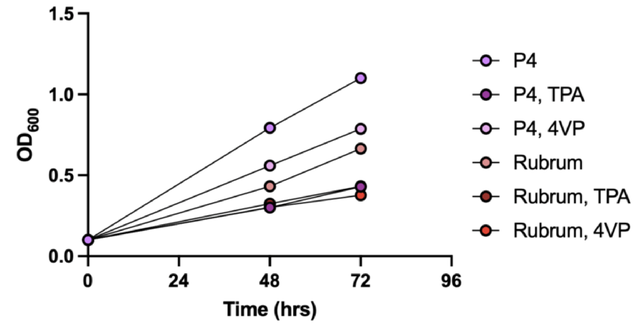
Anerobic growth typically tracked using optical density (OD) in Spectrophotometer

- Requires manual sampling
- Large and bulky
- Fixed use cases
- Expensive ($200 - $400)



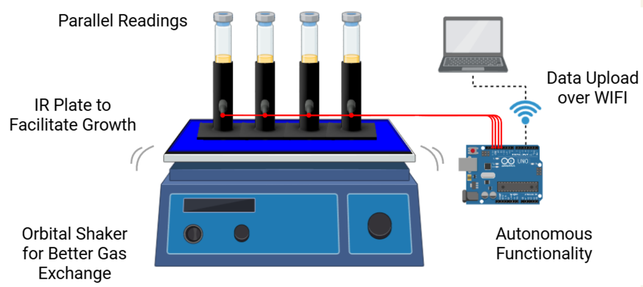


Results

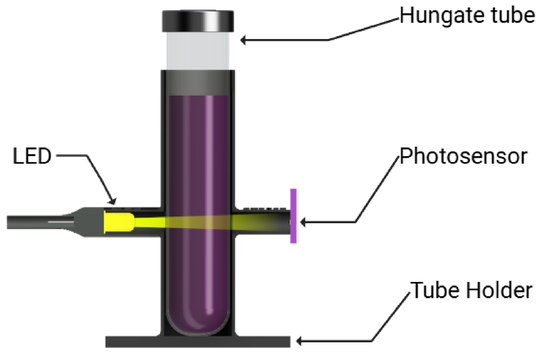


Example growth curves of P4 and Rubrum bacterial strains under different assay conditions (TPA and 4VP) over a multi-day experiment

Future Improvements



Functionality



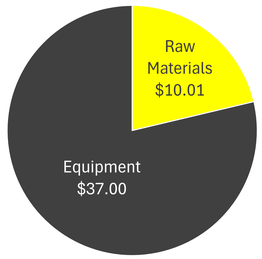
Photosensor produces a voltage value proportional to OD of sample

The sensor design, based on Deutzmann et al. (2022), consists of a 3D-printed sample holder with an LED and a photosensor positioned on opposite sides.

The photosensor generates a voltage, which a Python script processes to calculate optical density values for each bacterial species

Benefits

- Sample directly from sealed containers
- Works for anaerobic and aerobic species
- Easily reproducible from 3D printing and simple electronics
- Open-Source
- Customizable
- Low cost
- Portable



Acknowledgments & References

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Deutzmann et al, “Low-Cost Clamp-On Photometers (ClampOD) and Tube Photometers (TubeOD) for Online Cell Density Determination.” *Frontiers in Microbiology.* (2022).