Advanced Integrated Multi-Chambered Culture System

Bullseye Designs, Rice University

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Objective

The Advanced Integrated Multi-Chambered (AIM) culture system fills a critical need for hypoxia research by creating a controlled environment in which cells can be grown simultaneously at differing atmospheric conditions while allowing for real-time viewing on a microscope.

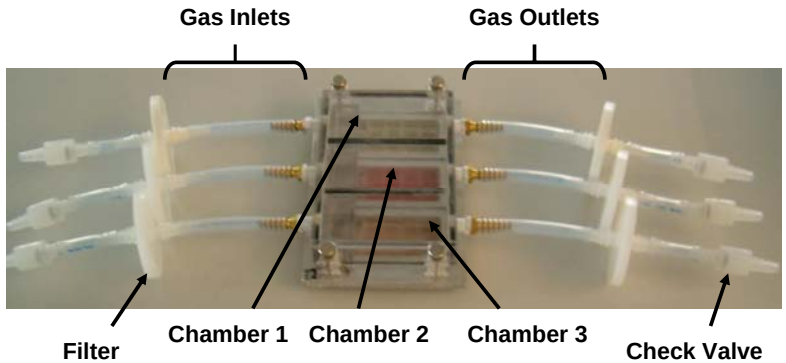
Device Features

Design Objectives
- Fit onto inverted microscope (11x16x4 cm)
- Transparent material for easy visualization
- Maintain sterility for over 1 week
- Air tight (<5% change after 2 hours)
- 3 separate environmental chambers

Culture Unit
- Transparent Lexan chambers fit variety of tissue culture ware
- Filters maintain sterile environment
- Check valves prevent back flow allowing for detachment from gas source during culture to perform treatments on cells

Gas Mixing System
- Computer controlled mixing of 3 different gas sources
- Easy to use computer software
- Run experiments unattended
- Feedback system to monitor experiment

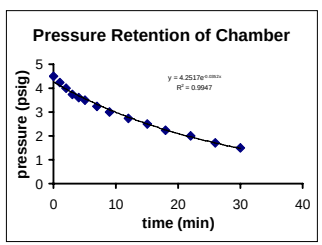
Culture Unit



Test Results

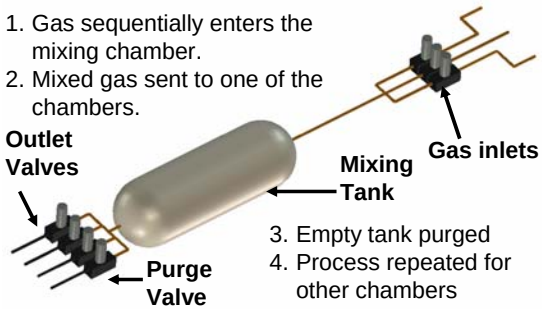
Sterility Test
FBS with antibiotics, FBS without antibiotics, and LB media were placed in the different chambers of the culture unit and monitored for contamination by microscopic visualization for a total of 10 days. **All media remained sterile for the entire period.**

Gas Contamination Test
The chamber was pressurized to 5 psig using an air pump. A cut-off valve then blocked flow while a pressure gauge was used to measure the chamber pressure at several time points. **The chamber lost pressure at a low enough rate to allow for our batch mixing system.** Further tests using gas chromatography will be performed to measure exact leakage rate.



Gas Mixing System

1. Gas sequentially enters the mixing chamber.
2. Mixed gas sent to one of the chambers.
3. Empty tank purged
4. Process repeated for other chambers



Conclusion

- **Need**: System capable of creating a controlled environment for cell culture for hypoxia research
- **Solution**: AIM culture system capable of creating 3 different culture environments while allowing for microscope visualization during incubation
- **Validation**: Preliminary tests show excellent sterility and environmental control properties

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