

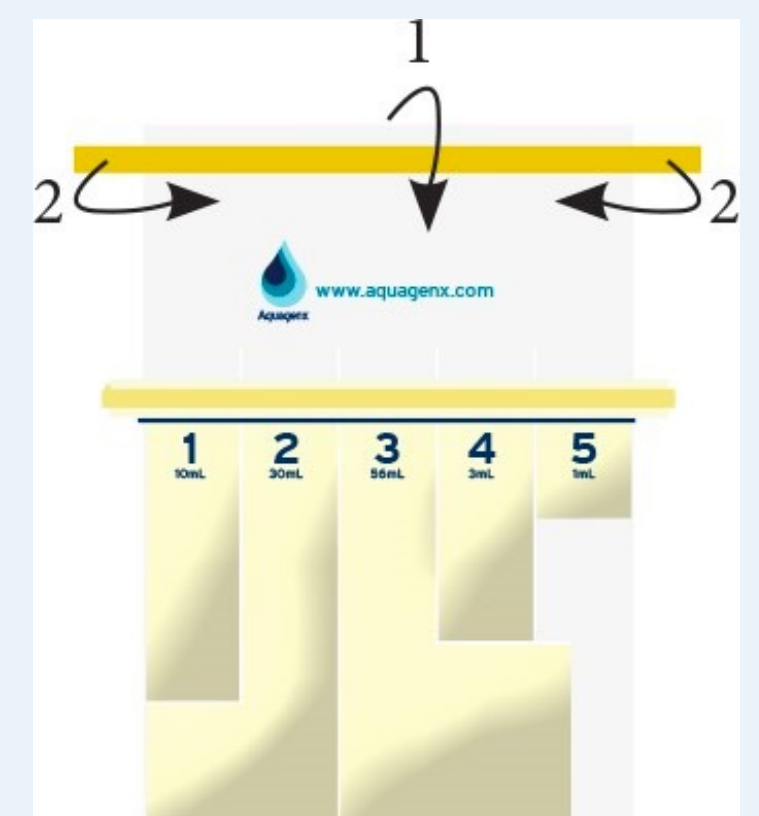
E. coli testing in Water Quality Monitoring

E. Coli is a significant drinking and recreational water contaminant that indicates the likely presence of other harmful microbes that can result in water-borne illness with contact⁵.

Current methods of E. coli testing

E. coli testing typically requires lab incubation that can be costly and time consuming. However alternate methods of E. coli culturing is being explored³.

- The Compartment Bag Test allows for successful E. coli culturing in ambient air temperatures above 25°C (77°F)^{6,7}



Compartment	1	2	3	4	5
1	1	1	1	1	1
2	1	1	1	1	1
3	1	1	1	1	1
4	1	1	1	1	1
5	1	1	1	1	1

Aquagenx.com. 2022. Aquagenx® CBT EC+TC (Compartment Bag Test) Most Probable Number (MPN) Kit Instructions for Use: Drinking Water. [online] Available at: <https://www.aquagenx.com/wp-content/uploads/2021/06/MPN-CBT-ECTC-Instructions-DrinkingWater-June2021.pdf> [Accessed 6 March 2022].

NC Water Quality Monitoring Accessibility

- 33% of the NC population rely on well water that is not regularly tested for contamination⁸.
- Lab incubation testing for E. coli is not always accessible for households relying on private well water.
- A simple incubation system could allow for at home presence/absence E. coli testing and increase accessibility to water quality monitoring in NC.

Literature Review Outcomes

- The optimal temperature for E. coli culturing is body temperature³ : desired incubation temperature is 35 °C (95 °F) and must stay within the general temperature range of 25°C (77°F) to 40°C (104°F)^{2,3}
- Compartment Bag Testing was designed and tested for E. coli culturing in ambient air temperatures above 25°C (77°F) for use in warmer climates^{6,7}
- Incubation system using a cooler and heated water bottles was successful with ambient air above 25°C (77°F)¹

Incubation System

- The system was made with Lifoam cooler with a 10 qt interior, an insulated box and lid (not pictured).
- The system's heat source was heated water held in 2 standard plastic water bottles.
- The interior temperature is monitored with two models of Bluetooth temperature sensor.
- Plastic bags were used to contain the samples inside of the incubation system to mimic Compartment Bag Testing.

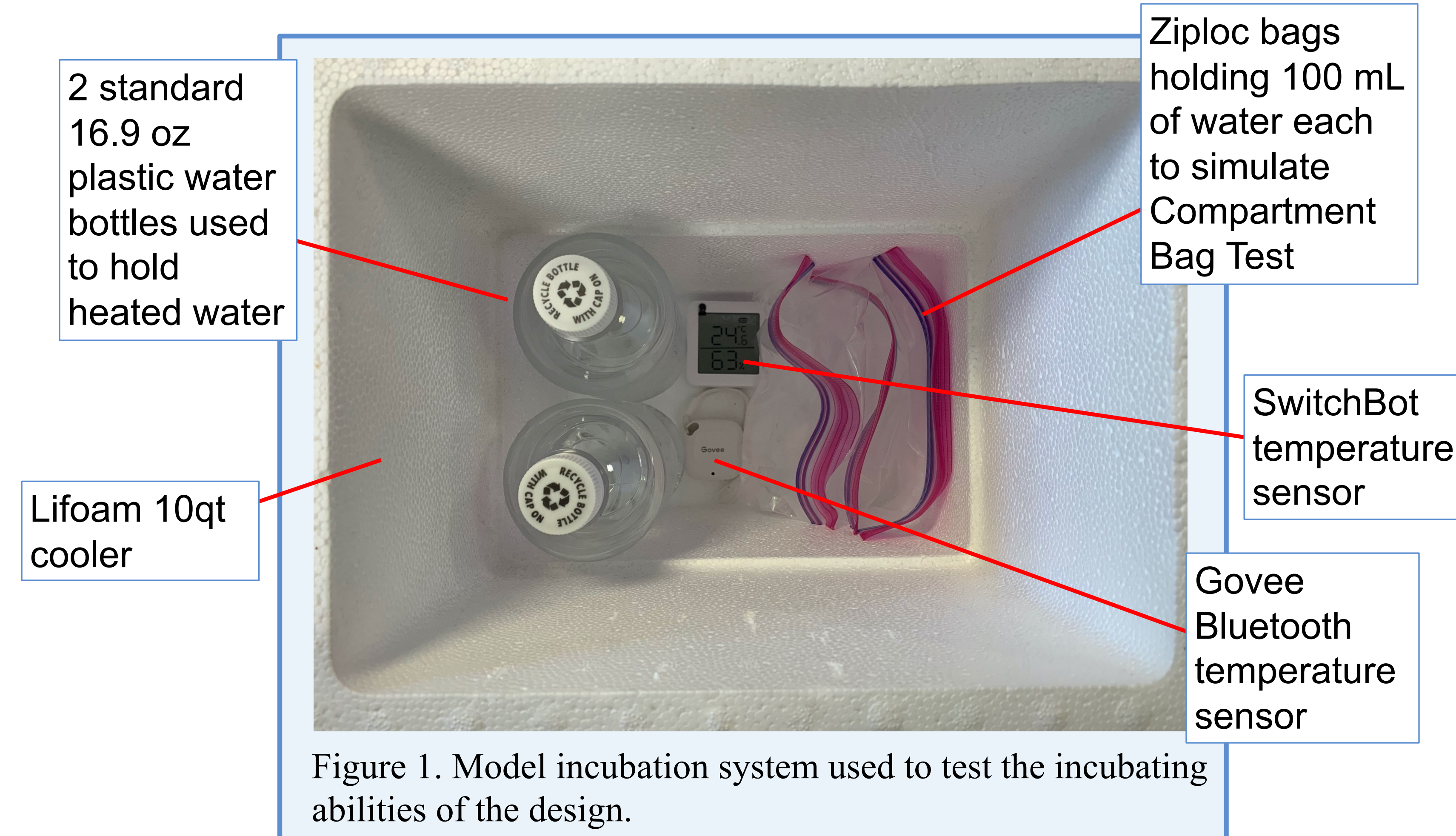


Figure 1. Model incubation system used to test the incubating abilities of the design.

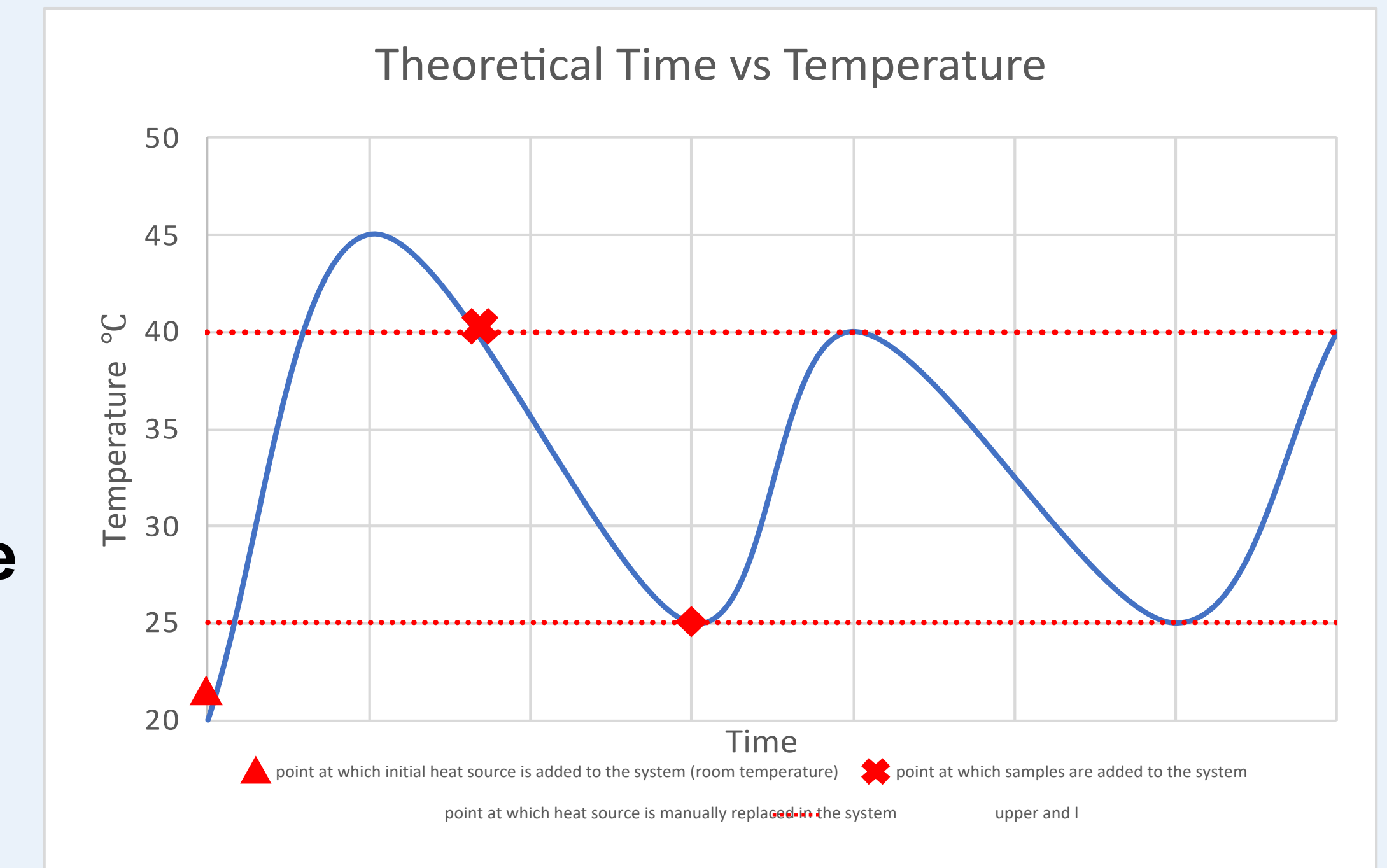
Design Development

- The incubation system designed for this experiment was based on an existing models created for incubation in ambient temperatures over 25°C (77°F)^{1, 4, 6, 7} and modified to maintain successful incubation with lower ambient temperatures.
- The interior temperature will be monitored and adjusted to ensure the temperature remains within the desired range for E. coli culturing³, 25°C (77°F) to 40°C (104°F), to determine the size of the heat source and frequency of heat source replacement

Heat Source Rationale

Goal: average temperature 35 °C (95 °F)

- heat source is added to raise the interior temperature
- heat source is replaced as the temperature reaches the lower bound



- System is design to oscillate within required temperature range to produce the desired average temperature
- Necessary temperature of the heat source was predicted using thermodynamic calculations and will be tested experimentally with the model incubation system

Experimental Design and Next steps

- The necessary temperature of the heat source and frequency of its replacement will be concluded experimentally using the model incubation system
- Further, the accuracy of the incubation system will be determined experimentally, comparing its samples will to lab incubator samples set at 35 °C for 24 hours.

References

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