

Hydroponics

Group B4

Introduction

The purpose of the second prototype was to test the most critical aspect of the project. For a Deep Water Culture System, having oxygenated water is crucial to the speed of growth, and the healthiness of plants. The Air Pump and Air Stones are the two system components that are pivotal to the operation of our system, so it was decided to test these components first.

Furthermore, a Solidworks model of our system was to be developed to aid in our client's understanding of our design, as well as give us a visual reference to help guide the rest of our project.

Testing Plan

Goal: Purchase an Air Pump and Air Stones, then determine whether they will effectively aerate the growing solution.

Process:

1. Research Air Pumps and determine what will be needed for our system
With regards to power consumption, pump strength, and build quality.
2. Research Air Stones to find out what shape, size, and type of Air Stone
Would best match the size of our reservoir, the budget constraints of the Project. Build quality and reliability must also be taken into account.
3. Purchase the selected components.
4. Assemble the Pump and Air Stones in the Reservoir and turn on to ensure all work as expected.

Results

We knew that the solar panels provided for the project have a maximum power output of 250W. We knew that heating for the greenhouse would use up the majority of the power that the panels could supply, so we focused on searching for low power pumps. A 4W pump with 2 tubing connector outlets was found. User reviews demonstrated that the pump had enough power for more than 4 Air Stones. As a bonus, this pump also came with two small disc Air Stones, some tubing, a check valve to prevent flow back into the pump, and a T-connector to connect two Air Stones to one tube. The pump was also inexpensive and small, and appeared to meet our needs best.

Air Stones come in many styles, shapes, and sizes. Our search was narrowed down to two 8 inch Air Stone Cylinders, four 4 inch rectangles, or four 1.6 inch discs. Reviews for the 8 inch Cylinders were mostly positive, with some people stating that they needed a higher power pump than what was specified in order to get any bubbles out of it. Due to the limited power of our chosen pump, smaller Air Stones appeared to be the better option. The 4 inch rectangles were a great value, however some user reviews stated that the stones would leak air at the connection point. Other reviewers said that the stones quickly lost ability to create bubbles after a few months. The 4 pack of 1.6 inch

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had very positive reviews, but their small size left some uncertainty as to whether they could output enough bubbles to properly oxygenate the growing solution. The 4 pack of 1.6 inch stones were chosen.

After purchasing the Pump and Air Stones, and scavenging a reservoir and extra tubing from a past group's project, we began to assemble our system. The reservoir was partially filled with water, and the Air Stones were submerged for about an hour before use. The tubing was cut to size and two T-connectors were used to connect four of the Air Stones. The Pump was plugged in, and bubbles emanated from two of the Air Stones. A small hole was found in one of the pieces of tubing, so that piece was swapped out for another. No more leaks remained, and all of the Air Stones were deemed functional.



Fig 1: Air Stones resting at bottom of reservoir before first use

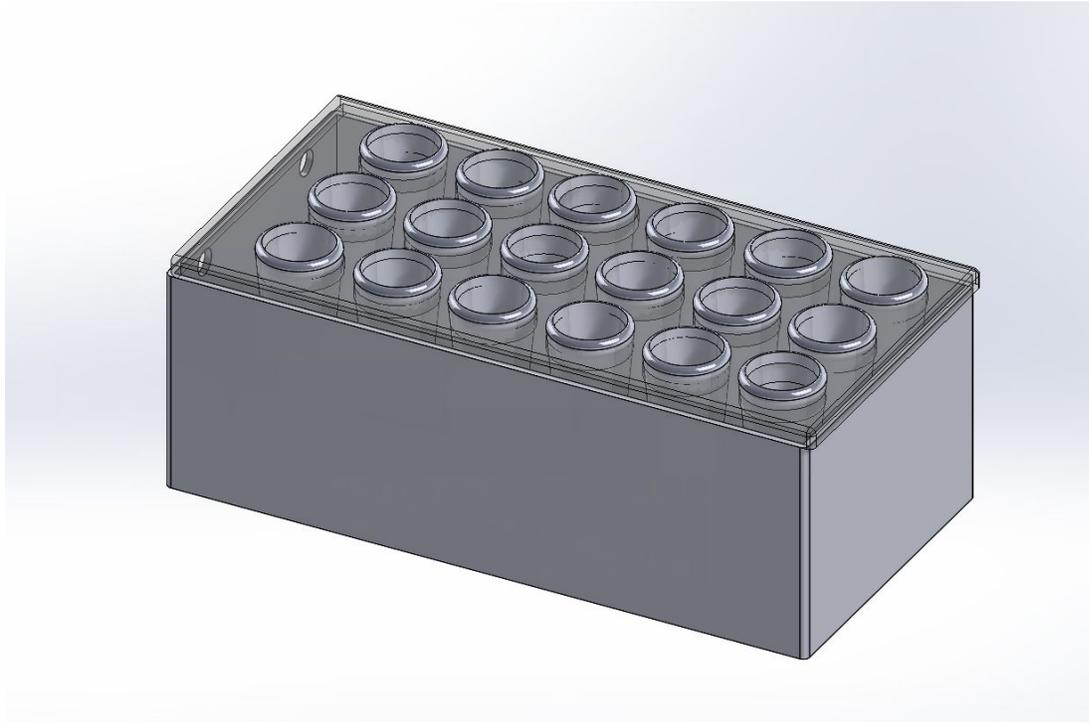
The Air Stones bubbles were not turbulent enough that they would damage the roots of plants, but output enough small bubbles to oxygenate the water around each plant.

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Solidworks Model

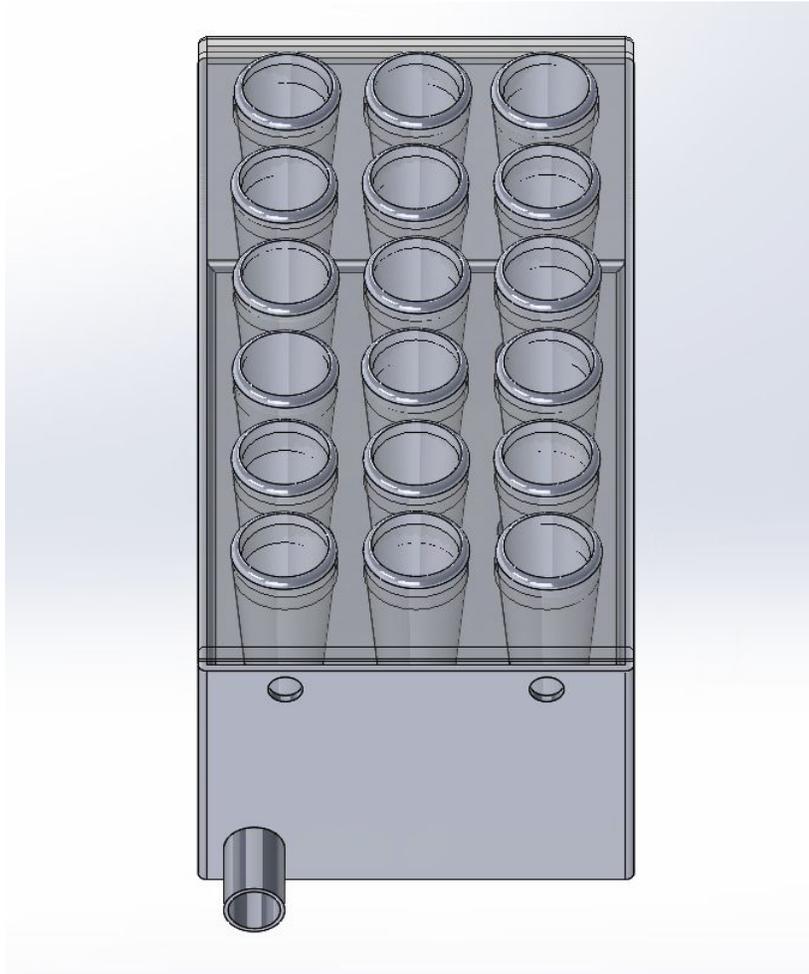
The solidworks model is a basic 3-D model of a visualization of our hydroponics project. It is not a fully defined representation of our final project but it does include our planting pots, drainage system, and airstones.



Top Down View



Front View



Conclusion

By testing the Air Pump and Air Stones first, and developing a 3D model of our project, some of the uncertainty and risk associated with our project has been nullified. The assembly of the second prototype instilled confidence in the Pump and Air Stones. The 3D model gave members of the group a clearer understanding of what the final system may look like, and will help guide our next prototype and future progress. By iterating on the progress we have made with our second prototype, we are confident that our design is achievable.