Application Notes

Monitoring pH and Dissolved Oxygen in Aquaponics

AN #: 17_003_14_001
Subcategory: Aquaponics
Market: Aquaculture/Hydroponics
Product: HI2020 & HI764080

Description:

Within the past few years locally sourced foods have increased in popularity. Locally grown food is more environmentally friendly and in many cases, more fresh than food available in grocery stores that has traveled great distances to reach its final destination. In addition to freshness, customers are also concerned about the origins of the food they consume and how that specific food product was grown and maintained (i.e. with or without pesticides and hormones, etc.). More and more farmer's markets (venues where local farmers sell various products grown and/or produced on their land) are emerging in every city and people who do not farm for a living are taking it upon themselves to grow a small portion of their own food in their back yard. A specific industry that is benefiting from this environmental movement is aquaponics, a self-sustaining operation that combines aquaculture (fish farming) and hydroponics (vegetable, fruit, and/or plant production grown in nutrient solutions instead of soil). This natural, symbiotic relationship utilizes the microbial breakdown of fish waste to plant fertilizer to sustain the aquaponics system, and operates with only a few necessary inputs: fish, fish food, water, and energy to run a pump and aeration system. Aquaponic farms yield various products including fish, vegetables, fruits, and decorative plants, making it a feasible and profitable practice. During this process, pH, dissolved oxygen, ammonia, nitrite and nitrate need to be actively monitored to ensure process efficiency and guarantee sufficient product yield. Since the process involves fish and fish require oxygen, dissolved oxygen levels are critical. Based upon the species of fish the farmer chooses to use, the optimum dissolved oxygen range will change. Like fish, the plants also have particular sensitivities. The pH of the nutrient solution where the plants are situated affect the overall nutrient availability and therefore, the plant's ability to grow. The nutrients required for plant growth are derived from the breakdown of the ammonia-containing fish waste by the microbes present in the system. Once the microbes "eat" the waste, the ammonia is converted to nitrite and then to nitrate. As the plant roots filter the nutrient solution and utilize the nitrate and other nutrients present, finished nutrient-free water is returned to the fish tank to restart the process. A self-sustaining aquaponics system will consist of negligible concentrations of ammonia and nitrite, adequate levels of nitrate for plant growth, and optimal pH and dissolved oxygen levels based upon the type of fish and plants used.

Application:

A plant farmer new to aquaponics reached out to Hanna Instruments for an easy and inexpensive means of monitoring his operation. They already owned a colorimeter from their conventional greenhouse operations that would allow them to test for ammonia, nitrite, and nitrate, but now needed a way to monitor pH and dissolved oxygen. Hanna's **HI2020** edge® pH kit supplied with the **HI11310** pH electrode and the additional **HI764080** dissolved oxygen sensor was a perfect fit for this customer. The customer could utilize one handheld meter with both the dissolved oxygen and pH sensors. New to electrode based measurements, the customer appreciated the features of edge® that assisted in ease of use and accurate readings. The Cal-Check feature ensured that the pH electrode was in proper working condition, alerting the user to potential problems, including when to clean the electrode or when a pH buffer might be contaminated. The customer also valued the pH electrode condition displayed on the main screen indicating the overall status after calibration. It was then unnecessary for the customer to remember acceptable offset and slope values or the calculations; the user only had to ensure there were bars present in the electrode status. Since two different measurements were going to be performed, the customer was grateful that the calibration information is stored in the sensor rather than the handheld device. This removed the need for calibrating every time the probes are changed, and since aquaponics was a new undertaking for the customer, pH and dissolved oxygen would be monitored more frequently at first until he became more familiar with the process. Furthermore, edge® is the ideal meter for a customer on a limited budget, since the overall cost of ownership was less than buying individual pH and dissolved oxygen meters.