**Dissolved Oxygen Concentration Monitoring System for Smart Fish Pond Management**

1. **Introduction.**

Oxygen is an important factor for the survival of aquatic organisms. Respiration process of the organisms, photosynthesis process, and formation of aquatic food all depend on oxygen availability.

In a such ecosystem, oxygen should be kept within favorable range that will ensure aquatic organisms’ survival without any complications. However, it’s not always guaranteed that the level of oxygen will remain within the required level due to effect from different environmental factors such as temperature, and salinity. Due to such variations, it’s important to monitor the level pf oxygen dissolved in water and make necessary adjustments whenever the range is not within the preferred values.

1. **Major Parameters to be Monitored.**

* Dissolved Oxygen.

1. **Parameters Affecting Dissolved Oxygen in water in a Fish Pond Ecosystem.**
2. Temperature.

* As temperature increases, the rate of evaporation is increased hence water loses more air to the atmosphere. As more air diffuses to the atmosphere inform of vapor, oxygen continue to reduce in pond water. Temperature above 30 degrees Celsius should be regulated.

1. Water pH.

* pH level varies from 0 to 14. pH affects the activities of organisms in a fish pond. It determines the activeness of bacteria in water. Dissolved oxygen is maximal at the extreme pH values. (6.40 – 5) and (5.64 – 9)
* At pH 7 (4.95 - 5), bacteria are more active hence uses high concentration.

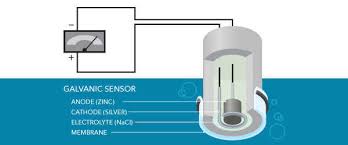
1. Salinity
2. **Methods to Monitor Dissolved Oxygen in a Fish Pond Ecosystem.**

* Galvanic Cell Method
* Optical Dissolved Oxygen Method.

1. **Galvanic Cell Method.**

It entails:

* Two electrodes
* Anode – Active metal (Zinc is used)
* Cathode – Noble metal (Can use active metal such as copper)
* Electrolyte solution (Potassium or Sodium hydroxide)
* Teflon (PTFE) Membrane.
* Glass tube.
* Measuring scale.



Galvanic cell converts chemical energy into electrical energy. Two electrodes are an Anode made up of Zinc and cathode made up of Copper dipped in an electrolyte solution. Two electrodes and the electrolyte are placed in a glass tube which is covered at the rare end with a Teflon membrane. Teflon membrane allows air filtration hence oxygen pass through it however, its hydrophobic. The two electrodes are connected to a measuring scale which is used to indicate the amount of dissolved oxygen in water.

Permeable membrane allows oxygen from the sample fish pond water to diffuse into the sensor, where it is reduced at the cathode. Chemical reaction at the cathode produces electrical signal which flow from cathode to anode then to a dissolved oxygen measuring scale. Consumption of oxygen at the cathode creates a pressure difference across the membrane that varies based on partial pressure of oxygen in sample water.

As oxygen concentration increases, partial pressure and the rate of diffusion increases and hence a proportional increase of current. Electrical signal measured on the measuring scale indicates the amount of dissolved oxygen in the sample water.

|  |  |
| --- | --- |
| **Element** | **Price** |
| Zinc Anode | $ 0.18 – $0.25 |
| Platinum | $ 46 |
| Teflon (PTFE) membrane | $ 17.99 |
| Potassium hydroxide | $ 15 |
|  |  |

1. **Optical Dissolved Oxygen Method.**

It has a replaceable cap with sensing element: - a special dye that will luminesce (glow red) when exposed to light of a particular wavelength.

Dye is covered by an oxygen permeable paint layer which allows oxygen molecules to interact with the dye while offering protection to the system. Sensor emits light and measures the resultant luminesce with a photodiode. Reading is compared to a reference reading using light of different wavelength.

Measurement and reference values are compared to calculate dissolved oxygen in the sample.

1. **Conclusion.**

It’s important to determine the concentration of dissolved oxygen in water since it has a higher impact on the life of aquatic organisms. Its concentration should be kept in a favorable range that enables all the organisms to survive. A suitable method should be used to get the correct concentration, galvanic cell method is the preferred method since its affodable and it can be easily implemented.