45

WATER QUALITY PARAMETERS IN AQUATIC ANIMAL HEALTH

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Aquatic Environment

The aquatic environment is classified into micro environment and macro environment.

The microenvironment of fish is described as the environment directly surrounding it, the primary enclosures such as the tank, raceway, or pond. It contains many factors, including water quality, illumination, noise, humidity, and temperature. The physical environment of the secondary enclosure, such as a room, constitutes the macro environment.

Water Quality

Water quality plays a vital role in the well being of experimental animals. It varies for different fish and also will differ between fish variety, age, weight and animal's use. The system's effectiveness and efficacy depends on its capacity to adapt the experimental environment to the organisms' evolutionary biology.

The important water quality parameters include pH, alkalinity, nitrogenous waste products, phosphorus, residual chlorine, redox potential, salinity, hardness, DO, total atmospheric pressure, minerals, and the microorganisms present in the environment. Regular monitoring of environmental parameters is necessary for proper health management. Aquatic animal health lab analysts should be aware of measuring and managing different water quality parameters that affects fish health.

Dissolved oxygen: The recommended dissolved oxygen (DO) content of pond waters is in the range of 5 ppm saturation level. Aeration of pond water will increase DO availability. The use of paddle wheel aerators or air diffusers will help to improve the DO content of the pond water.

Temperature: Temperature sets the pace for metabolism and biochemical reaction rates. Operation of aerator helps in breaking thermal stratification while planting of trees gives shades.

Turbidity: Several factors like suspended soil particle, planktonic organisms and organic matter contributes to turbidity. Optimum turbidity visibility ranges from 40-60 cm. Turbidity can be measured by using Sechii Disc. Turbidity can be maintained by application of organic manure at 500-1000 kg/ha, gypsum @ 250-500 kg/ha or alum @25-50 kg/ha.

Ammonia: Fish are very sensitive to unionized ammonia (NH_3) and optimum range is 0.001-0.01 ppm in the pond water. The same is reduced in the case of high DO and high CO_2.

Aeration, healthy phytoplankton population removes ammonia from water. Addition of salt @ 1200-1800 kg/ha reduces toxicity. Formalin is also use in certain cases. Biological filter may be used to treat water for converting ammonia to nitrate and then to harmless nitrate through nitrification process.

Hydrogen sulphide: Culture pond should be free from H_2S because at concentration of 0.01 ppm fish lose their equilibrium. Frequent exchange and increase of pH through liming can reduces its toxicity.

pH: Water pH affects fish metabolism, physiological process, toxicity of ammonia, hydrogen sulphides and solubility of nutrient thereby well-being and fertility. pH at the range of 7-9 is best for fish growth and can be increase by application of lime. Agriculture gypsum may be applied to correct alkaline pH.

Total Alkalinity: Ideal range from 60-200 ppm as $CaCO_3$ and it can be treated with lime. Lower levels leads to fluctuation and more than 200 ppm may become unproductive due to limitation of carbon dioxide availability.

Total hardness: It should be greater than 40 ppm because it helps to protect fish against harmful effect of pH and metal ions. Lime application can increase hardness.

Carbon dioxide: Pond water should contain low concentration of free CO_2

Temperature, Humidity, and Ventilation

Fishes are poikilotherms, which depend, for the most part, on the temperature of their environment to maintain normal physiological activities. The temperature of the water may be controlled from the source by using proper biological filters and other treatment units. The relative humidity can be influenced by the amount of the water present in the room. The stability of the macro ambient temperature can also be affected by the thermal load generated by heating systems. Centralized air facilities have to be configured to help make up for these temperature and moisture difference.

Illumination

Fish are prone to environmental stress. Rapid changes in light intensity may cause stress and result in trauma. Hence proper illumination is mandatory to facilitate adequate physiological function.

Noise and Vibration

Fish are subjected to sound and vibration, which are readily transmitted through water. They can be minimized by using insulation pads under aquarium tanks. Life supporting facilities such as biological filters, pumps can be placed away from the animal room to reduce sound and vibration.

Animal tank

The appropriate animal enclosure should,

- Facilitate normal physiological functions of the research animal.

- Support the fish spatial requirements.
- Provide an ambient environment for health monitoring
- Enable access to feed and removing nitrogenous products.
- Prevent injury or unintentional capture of fish or their body parts.
- Not cause injury to animals.
- Enable handling of fish with minimum stress.
- Be constructed of non toxic materials
- Not possess any electrical issues.

Aquatic Environment Management

Behavioural management

External evaluations are typically used for monitoring the health of the experimental animals. Fish should be handled in a way to keep minimum stress. Fish handling types of equipment should be thoroughly disinfected before use and it should be restricted to use in a particular experimental setup to avoid cross-contamination.

Husbandry

Food: Food should be preserved adequately to prevent the nutritional loss, avoiding contamination, and preventing infestation of pests. Live food should be supplied in a healthy and disease-free condition. Experimental animals should be fed with a balanced diet to avoid nutritional deficiency diseases.

Sanitation: The cleanliness in the experimental area can be achieved through a properly built and well constructed supporting system, periodic waste removal, and regular water exchange.

De-contamination: It is usually accomplished through the treatment of water using biological filters, ozone, and ultraviolet light. The use of chlorine as a disinfectant in the aquatic system may be inappropriate because residual chlorine is toxic to fish. Hence complete withdrawal of chorine is ensured if it is used as a disinfectant in the aquatic environment. The entire experimental area including fish tanks, supporting areas, storage facilities, washing rooms should be periodically disinfected with approved disinfectants. Care should be taken to avoid secondary contamination. Cleaning material should be made of corrosion-resistant materials.

Waste disposal. Wastes including biomedical waste should be disposed off, according to the institute's biosafety management committee recommendations.

Emergency, Weekend, and Holiday Care: Experimental animals need regular care and maintenance from lab assistants, hence adequate emergency preparedness plans should be created to resolve major technical glitches.

Experimental animal record keeping: Proper recordkeeping is necessary for experiment system management. Details that may be regularly recorded include length, weight, age, sex, feeding, tank number, signs and symptoms of the disease, feeding regime, mortality, etc. Also, detailed recording of water quality testing is important for maintaining optimum water quality.

Duties and responsibilities of aquatic animal health lab assistants

The duties of aquatic animal health lab assistant typically include,

- Cleaning and disinfecting fish tanks
- Regular water exchange
- Monitoring fish behaviour
- Feeding the fish with artificial or live feed
- Recording each fish length, weight and feeding behaviour
- Maintaining records
- Collection and analysis of data
- Sterilization of equipments
- Taking inventory of supplies
- Report writing
- Submitting sample for analysis
- Also assisting researchers in the handling of aquatic animals.

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