AQUASOL

Analyzing Waters... Anytime... Anywhere...

- EASY TO FOLLOW PROCEDURES
- COMPACT
- PORTABLE
- BASED ON PROVEN METHODS
- ACCURATE
- BACKED BY SOUND CHEMICAL RESEARCH
- ECONOMICAL
- RAPID
- RELIABLE

AE 108F
AQUA CULTURE - FRESH WATER

An ISO 9001:2015 Company

RAKIRO BIOTECH SYSTEMS PVT LTD

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pH :

pH is the measure of the hydrogen ion concentration in water. It denotes if the water is acidic (<7) or alkaline (>7). When pH is 7, it is said to be neutral. Natural water range between pH 5.0 and pH 10.0 while sea water is near pH 8.3.

Why test pH? A suitable environment pH is an essential factor for growth of any living species. Therefore, monitoring the pH of the water in a closed water body viz. aquarium, breeding pond etc. becomes important for the growth and well being of fish. For most freshwater species, a pH range between 6.5- 9.0 is ideal, but most marine animals typically cannot tolerate a wide range pH as freshwater animals, thus the optimum pH is usually between pH7.5 and 8.5(Boyd, 1998). Below pH 6.5, some species experience slow growth (Lloyd,1992). At lower pH, the organism's ability to maintain its salt balance is affected (Lloyd, 1992) and reproduction ceases. At approximately pH 4.0 or below and pH 11 or above, most species die (Lawson, 1995), following table shows the effect of different pH levels to warm water pond fish.

pH tolerance levels and its effect on aquaculture

pH levels	Effect on warm water pond fish
<4.0	Acid death point
4.0 – 5.0	No production
6.5 – 9.0	Desirable range for fish production
9.0 – 11.0	Slow growth
>11.0	Alkaline death point

Source: Lawson 1995, Tarazona and Munoz 1995

pH

The pH of pond water increases daily as phytoplankton consume carbon dioxide during photosynthesis (reaching a maximum value near 6 PM) and decreases at night as they release carbon dioxide during respiration (reaching a minimum value near 6 AM). Indirectly, changes in pH can also affect aquatic organisms. In fishpond, the low pH levels can accelerate the release of metals from rocks and sediments. These metals can affect the metabolism of the fish and its ability to take up water through the gills. Moreover, low pH can reduce the amount of dissolved inorganic phosphorous and carbon dioxide available for phytoplankton during photosynthesis. Ponds with low pH values (< 5) receiving acid rain, mine acid drainage or acidic swamp water can be improved by liming. On the other hand, high pH levels can make the toxic form of ammonia become more prevalent, and the phosphate, which is commonly added as a fertilizer, can rapidly precipitate (Boyd, 1990).

pH :

Country wise acceptable pH level for fish production

Country	Freshwater	Marine water	Reference
Australia	5.0 – 9.0	6.0 – 9.0	ANZECC, 2000
Brunei Darussalam	6.9		PWD
Canada	6.5 – 9.0		CCME, 1999
Hong Kong		6.5 – 8.5	EPD, 1999
India		6.5 – 8.5	
Kenya	5.0 – 9.0		EMCR, 2006
Malasiya	6.5 – 9.0	6.5 – 9.0	
New Zealand	5.0 – 9.0	6.0 – 9.0	ANZECC, 2000
Philippines	6.5 – 8.5	6.5 – 8.5	DAO 1990-34

pH

Minimum pH level required for growth of different Fish species.

Fish Species	pH levels
Perch	4.5 (Chonak)
Pike	5.0 (Badvi)
Trout	5.0 (Trout)
Bass	5.5 (Jitada)
Angelfish	5.0 (Angelfish)
Salmon	6.0 (Ravas)
Crayfish	5.5
Clownfish	7.8
Carp	5.0 (Rohu, Catla)
Tench	5.0 (Dahapat)
Grayling	6.0 (Dhoosan)

A weekly monitoring pattern should be established, as the water gets contaminated by organic waste e.g. Fishfaeces, uneaten food particles, etc.

Ammonia

Ammonia accumulated in fish bearing waters is not only highly toxic to fish but is lethal. It can also cause severe stress suppressing their immune systems thereby causing disease, affecting growth and multiplication.

Fish itself contaminate water with ammonia, produced through their waste and excrete it through their gills. Therefore monitoring the waters for ammonia is absolutely mandatory. A rise in ammonia is always accompanied by a rise in pH, ammonia can cause damage to fish gills, the red blood cells affect osmoregulation and reduce the Oxygen barring capacity of blood at a very low level (0.25 ppm).

A weekly testing programme is essential.

Ammonia tolerance levels of some aquaculture species

Species	**AMMONIA (mg/l of NH_3)**	**Comment**	**Reference**
Different Shrimp species	<0.1 to 0.1 0.4	Safe concentration 50% growth reduction	Boyd 1990
Fresh water fish	<0. 05	Safe concentration	Lawson 1995
Marine fish	<0.02	Safe concentration	Huguenin and Colt 1989
General guidelines	<0.01 to 0.1	Permissible level	Meade 1989

Complied by : Zweig, Morton and stewart, NACA

Regular monitoring is the answer to control, and it is the first step to protection of the fish.

Nitrites

Nitrite is harmful to fish. Nitrite is a byproduct of oxidizing NH3 or NH4+, an intermediary in the conversion of NH3 or NH4+ into NO3. This process is completed through nitrification which is done by the highly aerobic, gram negative, chemoautotrophic bacteria found naturally in the system. The conversion is quick, thus high nitrite concentrations are not commonly found.

The ammonia which is released by the fish is converted to nitrite by bacteria in the water body. Nitrite poisoning causes brown blood disease, wherein the gills of the fish turn to a dark brown color from bright red. Even low concentrations like 0.5 ppm can cause long term damage to fish by considerably reducing their ability to fight off infections. The nitrite damages the nervous system, liver, spleen; kidney of fish & other aquatic flora, killing fish quickly even within a week.

Nitrites bind the oxygen carrier hemoglobin in blood cells and thereby starve them of oxygen, condition known as hypoxia. Therefore, periodical testing of nitrite is extremely essential. A monitoring program needs to be established.

Nitrite :

Optimal nitrite levels for some aquaculture species

Species	Concentration	Optimum	Reference
Fresh water fish	<0.5	Hatcheries	Swann 1993
Blackish water shrimp	<4.5		Boyd1990
Penacide shrimp species	<0.1	Optimum	Clifford 1994
Salmonid species (Salmon, Trout, Chars, Grayling etc.)	<0.01 <0.1	Soft Water Fresh Water	Pillay 1990

Nitrates

Nitrates are far less toxic to fish than ammonia or nitrite. However high nitrate levels can still kill fish. Nitrate shock or poisoning can be lethal.

Nitrifying bacteria in the water converts ammonia to nitrite and finally to nitrate.

Nitrate levels below or 40ppm are generally safe for fish. So, presence of nitrate is actually good as both ammonia and nitrite are highly toxic.

However, nitrate levels above 80ppm can be toxic to fish. Another problem is algal blooms can take place if nitrates are high, which is again detrimental to the fish. Also, bacterial and fungal infections can take place as the buildup of nitrates causes the fish to lose immunity as well as their ability to reproduce and growth is greatly reduced.

Species	Concentration (mg/l)	Comment	Reference
Carp	<80	Optimum	Svobodova et at 1993
Trout	<20	Optimum	Svobodova et at 1993
Shrimp	0.4 – 0.8	Optimum	Clifford 1994
Fresh water	<3	Optimum	Piper et al 1982
General guidelines	<3 <100	Permissible	Meade 1989 Pillay 1992

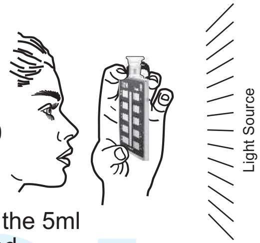
pH

Range : Low Level
6.0, 6.4, 6.6, 6.8, 7.0 ,7.2, 7.6

Procedure :

1) Add 5 drops of **LRP1** in the 5ml comparator tube provided.
2) Then add sample in the comparator tube up to the mark, close the tube with rubber plug & invert the tube several times to mix solution.
3) Place the tube in the comparator slot.
4) Read the low level pH as follows.
   a) Hold the comparator vertically against the light at eye level.
   b) Match the colour to the colour shade on the comparator.
   c) Read the pH value corresponding to colour.

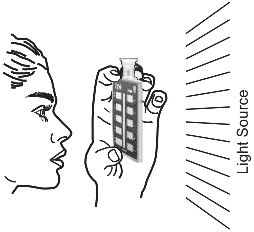
Range :
7.4, 7.8, 8.0, 8.2, 8.4, 8.8, 9.0



Procedure :

1) Add 5 drops of **HRP1** in the 5ml comparator tube provided.
2) Then add sample in the comparator tube up to the mark, close the tube with rubber plug & invert the tube several times to mix solution.
3) Place the tube in the comparator slot.
4) Read the pH as follows.
   a) Hold the comparator vertically against the light at eye level.
   b) Match the colour to the colour shade on the comparator.
   c) Read the pH value corresponding to colour.

Ammonia

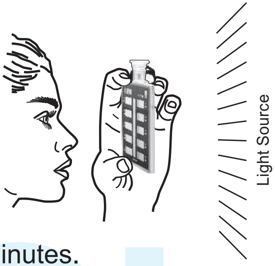


Range : 0.25, 0.5, 1.0, 2.0, 4.0, 8.0 ppm as Ammonia

Procedure :

1) Add 10 drops of **NH1** in the 5ml comparator tube.
2) Then add sample in the comparator tube up to the mark, close the tube with rubber plug & invert the tube several times to mix solution, Wait for 10 minutes.
3) Place the tube in the comparator slot, after vigorously shaking.
4) Read the AMMONIA (as Ammonia) as follows.
   a) Hold the comparator vertically against the light at eye level.
   b) Match the colour to the colour shade on the comparator.
   c) Read the AMMONIA value corresponding to colour.

Nitrite

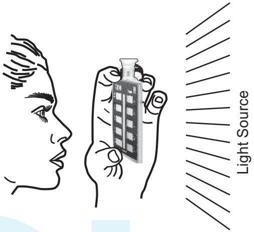


Range : 0.25, 0.5, 1.0, 2.0, 5.0 as NO_2

Procedure :

1) Take 10 ml sample in the glass test jar.
2) Now add 3 drops of **HNT2**, mix. Keep standing for 3 minutes.
3) Now add 1 spoonful of **HNT3**, mix and wait for 5 minutes.
4) Transfer the content in the comparator tube.
5) Place the comparator tube in the comparator slot.
6) Read the Nitrite (as NO_2) as follows.
   a) Hold the comparator vertically against the light at eye level.
   b) Match the colour to the colour shade on the comparator.
   c) Read the Nitrite value corresponding to the colour.

Nitrate



Range : 5, 10, 20, 40, 80,160 ppm as No_3

Procedure :

1) Take 5 ml sample in the comparator tube& transfer it to 10 ml test jar for testing .
2) Add 1 spoonful of **HNT1** powder to it, mix. Keep standing for 10 minutes, while shaking intermittently.
3) To this solution, now add 3 drops of **HNT2**, mix. Keep standing for 3 minutes, while shaking intermittently.
4) Now add 1 spoonful of **HNT3**, mix. Wait for 5 minutes. Dilute to 10 ml mark with demineralised or nitrate free water.
5) Transfer the content in comparator tube.
6) Place the comparator tube in the comparator slot.
7) Read the ppm Nitrate (as NO_3) as follows.
   a) Hold the comparator vertically against the light at eye level.
   b) Match the colour to the colour shade on the comparator.
   c) Read the Nitrate value corresponding to the colour.

AQUASOL Systems are available for
almost all water parameters in individual packs as well as
combination packs depending on the specific requirements of
different industries, such as, 'Boiler Water', 'Cooling Water',
'Construction Industry', 'Swimming Pools', 'R.O. Water', etc.
Also for any specific requirements,
Custom Made AQUASOL Systems can be devised
both as Individual or Combination Kits.

Aquasol Combi Kits : Application in Different Water Systems

Water Systems	Industries	Applications	Parameters
Boiler	Pulp & Paper, Textile, Steel, Chemical Manufacturing Units, Fertilizers, Refineries, Sugar, Thermal Power, Feed Water,	Raw Water, Softener, Blowdown Water,	Total Hardness, Calcium Hardness, Alkalinity, pH, Silica, Phosphate, Tannin, Iron, Chloride, Sulphite,
Cooling Systems	Pulp & Paper, Textile, Steel, , Chemical Manufacturing Units, Fertilizers, Sugar, Refineries, Thermal Power Stations, Engineering Units	Make-up Water, Recirculating Water, Basin Water	Total Hardness, pH, Chloride, Alkalinity, Calcium Hardness, Silica, Free Chlorine, Nitrite, Phosphate/Phosphonate, Zinc, Molybdate
RO Water	Industries having Reverse Osmosis (RO) Plants	Feed Water and Permeate Water	pH, Total Hardness, Calcium Hardness Silica, Sulphate, Iron (Low Level), Nitrate, Nitrite (Low Level)
Swimming Pool	Hotels & Resorts, Houses	Monitoring of Pool Water	pH, Free Chlorine
Metal Working Fluid	Engineering Units	Process / D. M. Water	Total Hardness, Chloride, pH
Potable Water	Universal	Drinking Water	Total Hardness, Alkalinity, Chloride, Fluoride, Sulphate, Calcium Hardness, Nitrite, Nitrate, Free Chlorine, pH
Purified Water	Pharmaceuticals	Purified Water	Acidity, Alkalinity (pH), Calcium, Chloride Magnesium, Ammonium, Sulphate, Heavy Metal as Pb,
Aqua Culture	Fishery	Ponds	pH, Ammonia, Nitrite, Nitrate