

Suggested Water-Quality Criteria for Aquaculture

Concentrations are in ppm (mg/l)

(Source: Modification from Wedemeyer, 1977; Piper, etc al. 1982, Meade, 1985, Lawson, 1995)

Chemical	Upper Limits for Continuous Exposure and/or Tolerance Ranges
Alkalinity (as CaCO ₃)	50-300 (Also called Total Hardness)
Aluminum (Al)	0.01
Ammonia (NH ₃)	0.0125 ppm (un-ionized form)
Ammonia (TAN) warm-water fish	3.0
Arsenic (As)	0.05
Barium (Ba)	5
Cadmiuma	0.004 ppm (soft water < 100 ppm alkalinity)
Cadmiumb	0.003 ppm (hard water > 100 ppm alkalinity)
Calcium (Ca)	4.0 to 160 ppm (10.0-160.00 ppm d)
Carbon dioxide (CO ₂)	0 to 10 ppm (0.0-15.0 ppm d), up to 60ppm in tolerant species
Cholorine (Cl)	0.03 ppm
Copperc	0.006 in soft water
Hydrogen Cyanide (HCN)	0.005
Hydrogen sulfide (H ₂ S)	0.002 ppm (Larsen - 0.0 ppm)
Iron (Fe)	0.0 to 0.5 ppm (<i>plants may need up to 2.0ppm</i>)
Lead (Pb)	0.02 ppm
Magnesium (Mg)	15
Manganese (Mn)	0.0 to 0.01 ppm
Mercury (organic of inorganic)	0.002 ppm maximum, 0.00005 ppm average
Nickel (Ni)	0.1
Nitrate (NO ₃)	200 ppm
Nitrite (NO ₂)	0.1 ppm soft water, 0.2 ppm hard water, 0.03 and 0.06 ppm nitrite-nitrogen
Nitrogen (N ₂)	Maximum total gas pressure 110% of saturation
Oxygen (DO)	5.0 ppm to saturation; 7.0 to saturation for eggs or broodstock
Ozone (O ₃)	0.005 ppm
pH	6.5 to 8.0 (6.6-9.0d)
Phosphorus (K)	0.01 to 3.0 ppm

Polychlorinated biphenyls (PCBs)	0.002
Potassium (P)	5
Selenium (Se)	0.01
Silver (Ag)	0.003
Sodium (Na)	75 (<i>while fish like sodium, plants to not, keep below 50pm</i>)
Sulfate (SO ₄)	50
TGP (Total Gas Pressure)	105% species dependent
Sulfur (S)	1
Total Dissolved Solids (TDS)	400
Total suspended and settleable solids	10 to 80.0 ppm
Total Alkalinity (as CaCO ₃)	10.0 to 400 ppm (50.0-400.0 ppmd)
% as phenolphthalein	0.0 to 25 ppm (0.40 ppmd)
% as methyl orange	75 to 100 ppm (60.0-100.0 ppmd)
% as ppm hydroxide	0.0 ppm
% as ppm carbonate	0.0 to 25 ppm (0.0-40.0 ppmd)
% as ppm bicarbonate	75 to 100 ppm
Uranium	0.1
Vandium	0.1
Zinc	0.03-0.05 ppm

Example Water Test

Aquaponic System Water

IRRIGATION WATER ANALYSIS

SOURCE: Denver Municipal

"Routine Package"

"Metals" and "Individual Element" Analysis

	Results	Results		Results	Recommended
		µmhos/cm		mg/L	Limit
				mg/L	mg/L
Conductivity	316			0.16	N/A
pH	6.8			*	0.05 to 0.2
pHc			Phosphorus	1.93	0.3
		meq/L	Aluminum	*	0.05
Calcium	60.4	3.01	Iron	*	1.3
Magnesium	12.0	0.99	Manganese	*	5.0
Sodium	6.52	0.28	Copper	*	0.1
Potassium	3.07	0.08	Zinc	*	N/A
Carbonate	<0.1	<0.1	Nickel	*	0.005
Bicarbonate	75.0	1.23	Molybdenum	*	0.10
Chloride	17.9	0.50	Cadmium	*	2.0
Sulfate	126	2.63	Chromium	*	0.015
Nitrate	<0.1	<0.1	Barium	*	N/A
Nitrate-Nitrogen	<0.1	<0.1	Lead	*	4.0
Boron	0.6		Ammonium	*	0.010
Pounds of Sulfate per acre foot	61		Fluoride	*	0.05
Pounds of Nitrate per acre foot	200		Arsenic	*	0.002
			Selenium	*	
			Mercury	*	
			* Not requested		
Salinity	301				
Hazard	Low	Sodium Hazard	Low		
Total Alkalinity as CaCO ₃	61	400			
Total Hardness as CaCO ₃	200	300	grains per gallon		11.6
Total Dissolved Solids	301	500			

Microbial Water Test Example

Aquaponic System Water

Environmental Quality Laboratory
 154 General Services Building
 Environmental Health Services
 Fort Collins, CO 80523-6021
 (970) 491-4837 or (970) 491-6503



To: **Aquaponics**
 1580 Glen Dee Dr
 Lakewood, Colorado 80215-

Date: Mar 20, 2013

LABORATORY RESULTS REPORT

Project Overview:

Sample(s) were submitted to Environmental Quality Laboratory for analyses on March-14-2013. We performed the following tests: Pseudomonas Count SM: 9213-E, 20th Ed. (Num. of samples 1); Total E.coli Count SM: 9222-D, 9222-G, 20th Ed (Num. of samples 1); Total Fecal Coliform SM: 9222-D, 9222-G, 20th Ed (Num. of samples 1).

Project Sample Results

Project Number: 13-038P

EQL ID	Client ID	Site Name	Samp Type
13-078	treated water	water source	River
Test Performed			Results
Total E.coli Count			1 per 100 mL
Total Fecal Coliform			1 per 100 mL
Pseudomonas Count			3500 per mL

Project QA/QC Report

EQL ID	Collected	Received	BY	Run	BY	Reported	BY	Samp. Cond.	Samp. Pres
13-078	3/13/2013	3/13/2013 11:50:00 AM	AB	3/13/2013 12:07:00 PM	AB		RV	Good	4C

Project Conclusions:

results for Salmonella: Present/100mL

The water sample tested POSITIVE for E. Coli bacteria and is considered NON POTABLE.

The test was run for drinking water and therefore deemed non-potable (which we wouldn't expect aquaponic system water to be considered potable anyway).

A challenge with YES/NO microbial water testing, is that if there is a presence of bacteria in the water or any fecal coliforms, the test will automatically trigger a positive response.

After this test was completed, water was taken to test for 15 pathogenic forms of e.coli all which were negative. Salmonella also tested negative in further lab analysis.

Pseudomonas are heterotrophic bacteria which are commonly found in aquaponic/aquaculture systems.

Make sure that it is understood that aquaponic system water should be tested as irrigation water and not using the drinking/potable water standards.