# WATER QUALITY IN AQUACULTURE

# HUMIC AND FULVIC ACIDS

- Organic matter arising from living organisms makes an important contribution to the natural quality of surface waters.
- Natural organic compounds are not usually toxic, but exert major controlling effects on the hydrochemical and biochemical processes in a water body.
- Some natural organic compounds significantly affect the quality of water for certain uses, especially those which depend on organoleptic properties (taste and smell).

# HUMIC AND FULVIC ACIDS

- During chlorination for drinking water disinfection, humic and fulvic acids act as precursor substances in the formation of tribalomethanes such as chloroform.
- In addition, substances included in aquatic humus determine the speciation of heavy metals and some other pollutants because of their high complexing ability.
- As a result, humic substances affect the toxicity and mobility of metal complexes. Therefore, measurement of the concentrations of these substances can be important for determining anthropogenic impacts on water bodies.

# OTHER INORGANIC VARIABLES SULPHIDE

- Sulphide enters groundwaters as a result of the decomposition of sulphurous minerals and from volcanic gases.
- Sulphide formation in surface waters is principally through anaerobic, bacterial decay of organic substances in bottom sediments and stratified lakes and reservoirs.
- Under aerobic conditions, the sulphide ion converts rapidly to sulphur and sulphate ions.

# SILICA

- Silica is widespread and always present in surface and groundwaters. It exists in water  in dissolved, suspended and colloidal states.
- Dissolved forms are represented mostly by silicic acid, products of its dissociation and association, and organosilicon compounds.
- Silica may be discharged into water bodies with wastewaters from industries using siliceous compounds in their processes such as potteries, glass works and abrasive manufacture.
- Silica is also an essential element for certain aquatic plants (principally diatoms). It is taken up during cell growth and released during decomposition and decay giving rise to seasonal fluctuations in concentrations, particularly in lakes.

# FLUORIDE

- Fluoride originates from the weathering of fluoride-containing minerals and enters surface waters with run-off and groundwaters through direct contact. Liquid and gas emissions from certain industrial processes can also contribute fluoride ions (F-) to water bodies.
- Fluoride mobility in water depends, to a large extent, on the $Ca_2$+ ion content.
- Fluoride concentrations in natural waters vary from 0.05 to 100 mg l-1, although in most situations they are less than 0.1 mg l-1. Groundwater concentrations are often as high as 10 mg l-1. Very high concentrations of fluoride, far exceeding the WHO guideline value of1.5 mg l-1

# BORON

- Boron is a natural component of freshwaters arising from the weathering of rocks, soil leaching, volcanic action and other natural processes. Industries and municipal wastewaters also contribute boron to surface waters.
- In addition, agricultural run-off may contain boron, particularly in areas where it is used to improve crop yields or as a pesticide. Boric acid, which does not readily dissociate, is the predominant species in freshwaters.
- Higher concentrations of boron (up to 48 mg l-1) are found in some mineral waters which are sometimes used for special health-related bathing, but not as drinking water.

# CYANIDE

- Compounds of cyanide enter freshwaters with wastewaters from industries such as the electroplating industry. Cyanides occur in waters in ionic form or as weakly dissociated hydrocyanic acid.
- In addition, they may occur as complex compounds with metals. The toxicity of cyanides depends on their speciation; some ionic forms and hydrocyanic acid are highly toxic. The toxicity of complex compounds of cyanide depends on their stability.
- Concentrations of cyanides in waters intended for human use, including complex forms (except hexacyanoferrate), are strictly limited because of their high toxicity.
- The WHO recommends a maximum concentration of 0.07 mg $l^{-1}$ cyanide in drinking water, but many countries apply stricter standards of cyanide concentration both for drinking waters and natural water of importance for fisheries.

## Some heavy metal LC 50 levels and confidence limits in aquatic environment

| Metal | 96 hours LC 50 (µg/L) | Confidence limits (µg/L) |
|---|---|---|
| Cadmium | 80-420 | 10 |
| Cromium | 2,000-20,00 | 100 |
| Copper | 300-1,000 | 25 |
| Lead | 1,000-40,000 | 100 |
| Mercury | 10-40 | 0,10 |
| Zinc | 1,000-10,000 | 100 |

## Some confidence limits of pesticides in water ecology

| Pestisit | Confidence limits (ppb) |
|---|---|
| **Aldrin** | 0,03 |
| **BHC** | 4,0 |
| | 0,08 |
| **Klordan** | 0,01 |
| | 0,0043 (freswater) |
| | 0,004 (seawater) |
| **DDT** | 0,001 |
| **Dieldrin** | 0,003 |
| | 0,0019 |
| **Endrin** | 0,004 |
| | 0,0023 |
| **Heptaklor** | 0,001 |