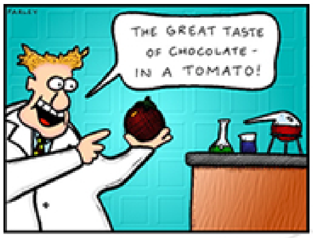

Black Earth Creek & Limnology Minifacts & Analysis

Sheet 5

Chloride Amounts in Water

Information on Salinity (Chloride) Amounts & Water Quality

Introduction

The total dissolved solids in water consist of salts and dissolved materials. In natural waters, salts are chemical compounds made of carbonates, chlorides, sulfates, and nitrates (primarily in ground water), and potassium (K), magnesium (Mg), calcium (Ca), and sodium (Na). In most natural conditions, these salts are present in amounts that create a balanced solution. If there is a large rain with a lot of runoff, this balance is changed and most likely has a negative effect on the aquatic system.

The natural amounts of salts are largely determined by the geologic bedrock underlying the area. Low salinity is expected in non-faulted areas like Wisconsin, which has igneous rock formations. High levels of runoff often happen in areas underlain by ancient marine sediments. As time passes, the salts are removed from the sedimentary rocks by wind and water erosion. These elements remain dissolved in surface waters. Additionally, if an area is heavily faulted, marine sediments buried deep within the earth may contact ground water and form very salty water (brine). The fault may serve as a channel for the brine, which may be introduced to surface water systems via springs.

Salt concentrations are expected to be high in arid or semi-arid areas where evaporation usually exceeds precipitation. As water evaporates from existing water bodies, salt concentrations increase like in the Salt Lake area of Utah. Because precipitation itself contains small traces of salts, evaporation after a rain leaves salts in the soil. These salts may be carried in runoff during the infrequent rains.

What Your Data is Telling You	
Use of Water	**Limits (mg / L)**
Human Consumption	**250** chloride
Irrigation	**500 – 1,000** mg / L chloride
Industry *	
Brewing	**500 – 1,000** mg / L chloride
Pulp and paper	
Fine paper	**200** mg / L chloride
Groundwood paper	**500** mg / L chloride
Boiler feed water	**50 – 3,000** mg / L chloride
Canning / Freezing	**850** mg / L chloride
Aquatic Life	Varies, depending on natural conditions

Health Effects:
Sodium sulfate and magnesium sulfate levels above 250 mg/L in drinking water may produce a laxative effect. Excess sodium may affect those restricted to low sodium diets and pregnant women. High levels of total dissolved solids may impart an objectionable taste to drinking water. Chloride, in particular, has a low taste threshold.

Industrial Effects:
Dissolved salts may either encrust or corrode metallic surfaces. Salt in intake water may interfere with chemical processes within the plant.

Environmental Effects:
Some freshwater organisms are able to tolerate low dissolved solids levels. If a total dissolved solids increase in the water body, a shift to more salinity-tolerant species can be expected. Salt-tolerant plants include greasewood, alkalai sacaton, fourwing saltbush, shadscales, saltgrass, tamarisk (salt cedar), galleta, western wheatgrass, mat saltbrush, reed canarygrass, and rabbitbrush.

High salinity may interfere with the growth of aquatic vegetation. Salt may decrease the osmotic pressure, causing water to flow out of the plant to achieve equilibrium. Less water can be absorbed by the plant, causing stunted growth and reduced yields. High salt concentrations may cause leaf tip and marginal leaf burn, bleaching, or defoliation.

Estuarine aquatic life is generally tolerant of fluctuating salinity levels. Under natural conditions, estuarine water may fluctuate between fresh and brackish, depending on the flow rate of the river discharging into the estuary. Aquatic biota inhabit zones in the estuary according to preferred salinity levels. Thus, if the volume of fresh water entering the estuary fluctuates sufficiently to cause a change in the isohaline (areas of similar salinity) patterns, species may be displaced and the ecosystem disrupted. Urban runoff containing high salt concentrations (e.g., from de-icing) may create saline layers in receiving lakes. Salt water has a higher density than freshwater and tends to sink and form a dense layer in the bottom of the lake. This saline layer does not mix with remainder of the lake water, leading to decreased dissolved oxygen levels in the bottom regions.

Irrigation Effects:
Inadequate drainage or excessive evaporation from agricultural fields may lead to an accumulation of salts in the soil. The arid southwestern U.S. is especially vulnerable to this phenomenon because this area experiences intense evaporation and the upper layer of the soil is often baked to an impermeable crust-like state that prohibits the infiltration of water. Hence, the water ponds and then evaporates, leaving salts behind.

Salt in the soil may harm crops. Certain salt constituents alone can prove toxic to some plant varieties. Also, high salt concentrations in the soil around plant roots may cause plant dehydration by reversing osmotic conditions (water will flow out of the plant in an attempt to achieve equilibrium). In some cases, rather than destroying a crop, elevated salt levels may simply reduce crop yields and leave the plants prone to disease.

Sources:

1. Nonpoint source:

- **Natural:** Natural sources include poorly drained soil, salty ground water (brine), erosion from geologic formations of marine origin, and wind-borne sea spray.

- **Agriculture:** High salinity levels are often found in irrigation return flows and runoff from agricultural fields, especially in arid areas where intensive evaporation causes salt accumulation in soil.

- **Residential and Urban:** The primary contributor of salts in residential and urban areas is runoff from urban areas, where salt is used to de-ice roadways and walkways.

2. Point source: Inorganic chemical industry may release dissolved salts in discharge waters.