How to Read Water Analysis

Water analysis can be divided in three categories

1. Water Treatment
2. Wastewater Treatment
3. Zero Liquid Discharge using Thermal Technologies

The analysis is important as it gives us additional information which enable the designer to design an appropriate system for desired application. The parameters required for plant design also depends on -

Source of Water - e.g. Borewell /Well Water, Surface Water, Sea Water, Effluent, RO Reject Water End use. - e.g. Cooling Tower, Boiler, Recycling

Additional Parameters may be required based on the Unit operation opted for the Treatment.

Following are few thumb rules for considering Parameters as per End use of water & Unit operations

Water Treatment	Effluent Treatment	Effluent Recycling
• TSS/Turbidity - high ➡ Settling Unit operation optional, Filtration may be required • TDS – High ➡ TDS Reduction Mandatory • Depending on End use, Main Treatment to be decided • Bacterial Analysis is required in case the End use of water is susceptible to it. Based on End use, Softener/RO/DM plant is required	-	-
-	COD, BOD, Toxic chemicals, TDS are must parameters Toxic Chemical analysis is very important	COD, BOD, Toxic chemicals, TDS contributing ions are must parameters Toxic Chemical analysis is very important

Typical Analysis of Water

Typical Water analysis is divided in three parts,

1. Physical Parameters
2. Chemical Parameters including Organics
3. Bacterial Parameters

Physical Properties					
Parameters	**Units**	**Concentration**	**Parameters**	**Units**	**Concentration**
Colour	Hazen		Density	Kg/m3	
Total Suspended Solids (TSS)	mg/lit		Temperature	Deg C	
Turbidity	NTU				
Viscosity	cP				
Chemical Properties					
pH	-				
Cations			**Anions**		
Parameters	**Units**	**Concentration**	**Parameters**	**Units**	**Concentration**
Calcium as Ca	mg/lit		Bicarbonates as HCO3	mg/lit	
Magnesium as Mg	mg/lit		Carbonates as CO3	mg/lit	
Sodium as Na	mg/lit		Hydroxides as OH	mg/lit	
Potassium as K	mg/lit		Sulfates as SO4	mg/lit	
Ammonium as NH4	mg/lit		Chlorides as Cl	mg/lit	
Iron as Fe	mg/lit		Nitrates as NO3	mg/lit	
Barium as Ba	mg/lit		Nitrites as NO2	mg/lit	
Boron as B	mg/lit		Fluorides as F	mg/lit	
Heavy Metals	mg/lit		Phosphates as PO4	mg/lit	
			Bromides as Br	mg/lit	
TDS*	mg/lit		Reactive Silica as SiO2	mg/lit	
Organics					
COD	mg/lit				
BOD	mg/lit				
Solvents	%				
TOC	mg/lit				
Bacterial Analysis					
Total Bacterial Count (TBC)	Cfu/100ml				
Total Coliforms	Cfu/100ml				
E.Coli	Cfu/100ml				

* - *Addition of all salts in mg/lit as shown above other than Silica*

Physical Properties of the Water will decide the Pretreatment required

Temperature – To be reduced if more which can be detrimental to Suspended solid settling, biological system & MOC of the Pumps & Piping

Total Suspended Solids (TSS) – Need to be removed using Pretreatment based on water application or downstream unit operations, where TSS can create hindrance.

Density & Viscosity – are important to select appropriate Pumps & other equipments.

Colour - Important parameter as the Colour in water can be a result of impurities

Chemical Properties

Alkalinity linked with Hardness – Temporary Hardness, can precipitate

To be reduced/removed based on application

Hardness - Responsible for Scaling, to be removed / reduced based on application

pH plays an important Role in –

- Neutralisation,
- Reduction of CO2

Chemical Properties					
pH	-				
Cations			**Anions**		
	Units	**Concentration**		**Units**	**Concentra**
Calcium as Ca	mg/lit		Bicarbonates as HCO3	mg/lit	
Magnesium as Mg	mg/lit		Carbonates as CO3	mg/lit	
Sodium as Na	mg/lit		Hydroxides as OH	mg/lit	
Potassium as K	mg/lit		Sulfates as SO4	mg/lit	
Ammonium as NH4	mg/lit		Chlorides as Cl	mg/lit	
Iron as Fe	mg/lit		Nitrates as NO3	mg/lit	
Barium as Ba	mg/lit		Nitrites as NO2	mg/lit	
Boron as B	mg/lit		Fluorides as F	mg/lit	
Heavy Metals	mg/lit		Phosphates as PO4	mg/lit	
			Bromides as Br	mg/lit	
TDS*	mg/lit		Reactive Silica as SiO2	mg/lit	

To be removed if in excess

Silica can form hard scale when concentrating, Evaporation

Step 1 - To corelate the pH & alkalinity parameters (i.e., HCO_3, CO_3 & OH) as per pH-Alkalinity scale

Step 2 - To convert all the ions to as $CaCO_3$ and match Cations & Anions. Total cations should match with total Anions. If the same doesn't match, the balancing can be done by increasing either cations or Anions.

Step 3 - To analyse each parameter of Raw Water and then the desired parameter for each application of water. Based on this, a complete Treatment scheme can be suggested.

Dear Readers,

Hope above Topic covers all the related points. Our attempt behind making this topic available to you is to create more awareness about Water & Wastewater Chemistry and respective Case Studies. Please mail us your feedback on this topic or any other topic of your interest which you want us to include in the Library on amit@raditechsolutions.com.