Chemistry Tips for the Water Treatment Tech.

By Kevin Wong

A quick note in chemistry that is, fun and useable immediately. One of the areas we deal with always is TDS. Total Dissolved Solids (or Salts) is also a measure of conductivity. Today we read this off a meter from our box of devices we carry into the home or business to diagnose the water. Usually, TDS will give us a notion of how effective a reverse osmosis will work but it is more important than that.

TDS gives us an idea of how much "salts" are dissolved into the water sample. Subsequent tests for hardness, iron, manganese, and other parameters will split that TDS number into its relevant segments for us, as we start thinking of what equipment needs to go into the job.

But TDS and all that other chemistry is also very important in knowing when to recommend to the customer that you may need to take the sample to the lab outside for further testing.

How do we know this?

Your water analyses report mineral (ionic) parameters in either parts per million (ppm) or as milligrams per liter (mg/L). These are equivalent values and any water parameter reported in mg/L units is equivalent to ppm (1 ppm = 1 mg/L).

Most complete water analyses, report the various parameters such as calcium (Ca), sodium (Na), magnesium (Mg), sulfates (SO4), chlorides (Cl), etc., as the ion. We also report this, in this manner to our customers, as it assists in the sizing of water treatment equipment.

In order to estimate total dissolved solids (TDS) concentration or to make calculations with respect to various treatment technologies, water analyses must be expressed in the "as CaCO3" format.

We often see this on third party lab reports.

TDS is the sum of all of the cations or anions (not both). To confirm that the analyses are accurate, the sum of cations should equal the sum of anions.

The following multipliers should be used to convert water parameters from the "as the ion" to "as CaCO3":

Cations	Symbol	To convert ppm "as the ion" to ppm "as $CaCO_3$" multiply by...
Aluminum	Al^{+++}	5.55
Ammonium	NH_4^+	2.78
Barium	Ba^{++}	0.73
Cadmium	Cd^{++}	1.78
Calcium	Ca^{++}	2.49
Chromium	Cr^{+++}	2.89
Copper	Cu^{++}	1.57
Ferric (Iron)	Fe^{+++}	2.69
Ferrous (Iron)	Fe^{++}	1.79
Hydrogen	H^+	50.0
Lead	Pb^{++}	0.48
Magnesium	Mg^{++}	4.10
Nickel	Ni^{++}	3.16
Potassium	K^+	1.28
Silver	Ag^+	0.93
Sodium	Na^+	2.18
Zinc	Zn^{++}	1.53
Anions		
Bicarbonate	HCO_3^-	0.82
Bisulfite	HSO_3^-	1.25
Carbon Dioxide	CO_2	1.14
Carbonate	CO_3^{--}	1.67
Chloride	Cl^-	1.41
Fluoride	F^-	2.63
Hydroxide	OH^-	2.94
Nitrate	NO_3^-	0.81
Phosphate	PO_4^{---}	1.54
Silica	SiO_2	1.67
Sulfate	SO_4^{--}	1.04

You can use this table to calculate and check your TDS balance.

Analysis	Concentration, ppm: As ion	Concentration, ppm: As $CaCO_3$
Calcium (Ca^{++})	80	199
Magnesium (Mg^{--})	32	131
Sodium (Na^+)	183	399
TDS (Total Dissolved Solids)		729
Chloride (Cl^-)	163	230
Bicarbonate (HCO^-_3)	122	100
Sulfate (SO^-_4)	385	400
TDS (Total Dissolved Solids)		730

If the in-field calculations account for less than 80% of the calculated TDS, then the historical recommendation is to send the water sample off to the lab to check is there is something else in the water that would affect the specifying and sizing of any water treatment equipment.

Here is a simple example of this. First you do your tests and note the ppm values as the "ion" reading. Then you calculate the "As $CaCO_3$" equivalent using the multipliers in the table above. If you add them up and get within 80% of your TDS meter's reading, the odds that anything you recommend will work within anticipated parameters. The reason for this is simple. There are no easy field tests for some parameters such as barium, arsenic, aluminium etc. Some of them are health related and need to be analysed at an accredited lab but can affect the performance of the water treatment system that you recommend to your customer.

These sort of tips and tricks, helps the sales and service team put in the right equipment the first time and can often minimize the number of calls your service techs have to do in order to get the equipment working right.

We need to be trained to be doing the right things, at the right time, in the right place, in front of the right people. Failing that drives doubt into the consumer's mind that we are unsure of what we do.