*Density

Density is defined as the weight of a substance per a unit of its volume. For example, pounds per cubic foot or pounds p
Here are a few key facts about density:
Density is measured in units of lb/ft3, lb/gal, or mg/L. Density of water = 62.4 lb/ft3 = 8.34 lb/gal.

*Specific Gravity

Specific gravity is the ratio of the density of a substance (liquid or solid) to the density water.
It is the ratio of the weight of the substance of a certain volume to the weight of water of the same volume.
Any substance with a density greater than that of water will have a specific gravity greater than 1.0. Any substance wit
Specific gravity examples:
Specific gravity of water = 1.0
Specific gravity of concrete = 2.5 (depending on ingredients)
Specific gravity of alum (liquid @ 60˚F) = 1.33
Specific gravity of hydrogen peroxide (35%) = 1.132
Specific gravity is used in two ways:
To calculate the total weight of a % solution (either as a single gallon or a drum volume).
Total Weight = Drum Vol X SG X 8.34
To calculate the "active ingredient" weight of a single gallon or a drum.

Active Ingredient Weight within Drum = Drum Volume X SG X 8.34 X % solution as a decimal. (i.e., Total Weight X

NOTE: Both ways start with solving for the total weight (Drum Vol X SG X 8.34). When solving for "active ingredient

Types of hypochlorites
Sodium hypochlorite (NaOCl) comes in a liquid form which contains up to 12.5% chlorine
Calcium hypochlorite ($Ca(OCl)_2$), also known as High-test Hypochlorite (HTH), is a solid which is mixed with water to
Hypochlorites decompose in strength over time while in storage. Temperature, light, and physical energy can all break d

*Chlorine dosing terms

Chlorine dose - the amount of chlorine added to the system. It can be determined by adding the desired residual for t
Chlorine Demand - the amount of chlorine consumed by iron, manganese, turbidity, algae, and microorganisms in the
Free chlorine - free chlorine refers to all chlorine present in the water as Cl_2(g), HOCl(aq) and OCl^-(aq).
Combined residual - is the result of combining free chlorine with nitrogen compounds. Combined residuals are also re
Total chlorine residual - is the mathematical combination of free chlorine and combined residuals. Total residual can

Example 1: If a 5 MGD flow is to be dosed with 25 mg/l of a certain chemical, calculate the lbs/day that chemical req

Solution

Polymer is being added at 0.3 mg/l in order to achieve a 92% capture efficiency for a belt press. The feed to the belt pr

lbs polymer required:

$100 * 1440 gal \ \ sludge day * 8.34 lbs \ \ sludge gal \ \ sludge * 0.3 lbs \ \ polymer 1,000,000 lbs \ \ sludge$

$= 0.36 lbs \ \ polymer day$

gallons polymer solution required:

$0.36 lbs \ \ polmyer day \ = \ x gal \ \ polymer \ \ solution day \ * \ 8.34 * 1.1 lbs \ \ polymer \ \ solution \ \ gal \ \ polymer \ \ solution * \ 0.04 l$

$=0.982 gal \ \ polymer \ \ solution day$

Polymer cost:

$\$460 gallon \ \ polymer \ \ soultion * 0.982 gal \ \ polymer \ \ soultion day$

$=\$451.26 day$

Dry tons of solids captured:

$100 * 1440 gal \ \ sludge day * 8.34 * 0.025 \ \ lbs \ \ solids gal \ \ sludge * 0.92 \ \ lbs \ \ solids \ \ captured lbs \ \ solids * ton \ \ solids 2000 lbs \ \ so$

$=13.81 tons \ \ dry \ \ solids day$

Polymer cost per dry ton of solids captured:

$\$451.26 per day 13.81 tons \ \ dry \ \ solids \ \ per \ \ day = \$32.67$

A flow of 5 MGD is being treated with 9.8 mg/l aluminum using liquid alum of 48% strength and SG of 1.32. Alum has

Solution:

lbs aluminum required:

$5 MGD * 8.34 * 9.8 lbs \ \ aluminum day = 408.7 lbs \ \ aluminum day$

Alum needed to meet this dosing need:

$408.7 lbs \ \ aluminum day \ = \ x gal \ \ liquid \ \ alum day \ * \ 8.34 * 1.32 lbs \ \ liquid \ \ alum per \ \ gal \ \ liquid \ \ alum * \ 0.48 lbs \ \ alumi$

$x gal \ \ liquid \ \ alum day \ = \ 408.7 8.34 * 1.32 * 0.48 * 0.19 \ = \ 407 gal \ \ liquid \ \ alum day$

Cost per day=$407 gal \ \ liquid \ \ alum day * \$1.62 gal \ \ liquid \ \ alum = \$659.45$

Prior to sand filtration, a secondary effluent flow of 5 MGD is dosed with 0.75% strength polymer solution to achieve a

a) lbs of dry polymer required (lbs formula)=$5 MGD * 8.34 * 1.5 = 62.55 lbs \ \ polymer day$

b) Flow rate of 0.75% strength polymer = $62.55 lbs \ \ polymer day = x gal min * 1440 min day 1,000,000 gal MG * 8.34 * 750$

$x gal min = 62.55 * 1,000,000 1440 * 8.34 * 7,500 = 0.7 GPM$

If a chemical costs $30 per ton, how much will it cost per year to treat a flow of 15 MGD if the average dose is 18 mg/l

Tons of chemical required per year: (use lbs formula)

$\left[15 \ \ MGD * 18 \ \ mgl \ \ * 8.34\right] lbs day * 365 days year * ton 2000 lbs = \ \ 411 \ \ tons year$

Chemical cost:

$411 \ \ tons year * \$30 ton = \$12,328 \ \ per \ \ year$