MIXTURE DENSITIES

Common density and specific gravity of mixtures

MIXING AND BLENDING -- We use density as one of the functions to calculate mixer HP on a given mixture. Density of solid particulate which is to be suspended in a liquid dispersion is important to achieve proper solids suspension mixing results. WMProcess carefully considers the tank volume, mixing results desired, sg, viscosity, and solids % as well as other variables in sizing mixers and agitators.

Density (ρ) is defined as mass per unit volume. SI units for density are kg/m^3 and cgs units are g/cm^3. Other common units are kg/L, g/ml, lb/ft^3, oz/in^3, lb/in^3, or lb/gal.

$$\text{Density, } \rho = \frac{m}{V}$$

Specific Gravity (*SG*) is a ratio of a substance density to a reference density at some defined temperature and pressure. The reference for Specific Gravity is usually water which has a density close to 1 g/ml, so SG and densities (g/ml) are often close in value.

$$\text{Specific Gravity, } SG = \frac{\rho_{Sample}}{\rho_{reference}}$$

Solution Density (ρ_s) is the sum of the mass concentrations of all of the components. Mass concentration (ρ_i) is the mass of the component (m_i) divided by the volume of the solution (V).

$$\text{Mass Concentration, } \rho_i = \frac{m_i}{V} \qquad \text{Solution Density, } \rho_s = \sum_i \rho_i$$

Common Conversions for Density

1 g/ml	=	1 g/cm^3
1 kg/L	=	1 g/ml
1 g/ml	=	62.43 lb/cu ft
1 g/cm^3	=	1000 kg/m^3
1 g/ml	=	8.345 lb/gal
1 g/ml	=	0.578 oz/in^3
1 g/ml	=	0.0362 lb/in^3

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Densities of Common Liquids

Substance	Temp (°C)	g/cm^3	lb./ft^3
Acetic Acid	25	1.05	65.6
Acetone	25	0.785	49.0
Alcohol (ethanol)	25	0.785	49.0
Alcohol (methanol)	25	0.787	49.1
Ammonia	25	0.824	51.4
Beer (varies)	10	1.01	63.0
Benzene	25	0.874	54.6
Bromine	25	3.120	194.8
Butane	25	0.599	37.4
Castor Oil	25	0.956	59.7
Citric acid	25	1.660	103.6
Coconut Oil	15	0.924	57.7
Cotton Seed Oil	15	0.926	57.8
Gasoline (Auto)	15	0.74	46
Glycerin	25	1.26	79
Kerosene	15	0.82	51
Mercury	--	13.6	846
Milk	15	1.02-1.05	63-66
Olive Oil	20	0.9	56
Seawater	25	1.03	64
Sulfuric Acid (95%)	20	1.84	115
Sunflower oil	20	0.92	57
Styrene	25	0.90	56
Turpentine	25	0.85	53.1
Water (0°C)		0.99984	62.42
Water (4°C)		0.99997	62.43
Water (20°C)		0.99821	62.32
Water (100°C)		0.95836	59.83

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Densities of Common Aqueous Solutions (20°C unless noted)

Water SG = 1.0 or 62.4lb/cu ft

We often refer to 1 gallon of milk as 8.34lb, so if you put something that had sg=2.0 in a milk container it would weigh 16.68lbs.

Ammonia (NH_3)

Conc. (%)	g/cm^3
20	0.923
30	0.892
50	0.832
80	0.711
100	0.618

Ammonium Chloride (NH_4 Cl)

Conc. (%)	g/cm^3
4	1.011
8	1.023
12	1.034
16	1.046
24	1.067

Hydrogen Chloride (HCl)

Conc. (%)	g/cm^3
10	1.047
20	1.149
30	1.129
40	1.198

Nitric Acid (HNO_3)

Conc. (%)	g/cm^3
20	1.115
30	1.180
50	1.310
80	1.452
100	1.513

Phosphoric Acid (H_3PO_4)

Conc. (%)	g/cm^3
14	1.076
26	1.153
50	1.335
75	1.579
100	1.870

Potassium Chloride (KCl)

Conc. (%)	g/cm^3
8	1.050
12	1.077
16	1.104
20	1.133
24	1.162

Sodium Chloride (NaCl) (25°C)

Conc. (%)	g/cm^3
8	1.054
12	1.084
16	1.114
20	1.145
26	1.194

Sucrose

Conc. (%)	g/cm^3
20	1.081
40	1.176
50	1.230
60	1.286
75	1.379

For info on common viscosities of mixtures visit this link:

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www.wmprocess.com/viscosity-of-common-liquids/

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