InyoProcess

Properties of Liquid Alum

Specific Gravity, (g/mL)	lb/gal	$\%Al_2O_3$	Equivalent % Dry Alum	Dry Alum per Gallon Solution (lb)	Dry Alum per Liter solution (g)
1.0069	8.40	0.19	1.12	0.09	11.277
1.0140	8.46	0.39	2.29	0.19	23.221
1.0211	8.52	0.59	3.47	0.30	35.432
1.0284	8.58	0.80	4.71	0.40	48.438
1.0357	8.64	1.01	5.94	0.51	61.521
1.0432	8.70	1.22	7.18	0.62	74.902
1.0507	8.76	1.43	8.41	0.74	88.364
1.0584	8.83	1.64	9.65	0.85	102.136
1.0662	8.89	1.85	10.88	0.97	116.003
1.0741	8.96	2.07	12.18	1.90	130.825
1.0821	9.02	2.28	13.41	1.21	145.110
1.0902	9.09	2.50	14.71	1.34	160.368
1.0985	9.16	2.72	16.00	1.47	175.760
1.1069	9.23	2.93	17.24	1.59	190.830
1.1154	9.30	3.15	18.53	1.72	206.684
1.1240	9.37	3.38	19.88	1.86	223.451
1.1328	9.45	3.60	21.18	2.00	239.927
1.1417	9.52	3.82	22.47	2.14	256.540
1.1508	9.60	4.04	23.76	2.28	273.430
1.1600	9.67	4.27	25.12	2.43	291.392
1.1694	9.75	4.50	26.47	2.58	309.540
1.1789	9.83	4.73	27.82	2.74	327.970
1.1885	9.91	4.96	29.18	2.89	346.804
1.1983	9.99	5.19	30.53	3.05	385.841
1.2083	10.08	5.43	31.94	3.22	385.931
1.2185	10.16	5.67	33.35	3.39	406.370
1.2288	10.25	5.91	34.76	3.56	427.131
1.2393	10.34	6.16	36.24	3.74	449.122
1.2500	10.43	6.42	37.76	3.93	472.000
1.2609	10.52	6.67	39.24	4.12	494.777
1.2719	10.61	6.91	40.65	4.31	517.027
1.2832	10.70	7.16	42.12	4.51	540.484
1.2946	10.80	7.40	43.53	4.71	563.539
1.3063	10.89	7.66	45.06	4.91	588.619
1.3182	10.99	7.92	46.59	5.12	614.149
1.3303	11.09	8.19	48.18	5.34	640.938
1.3426	11.20	8.46	49.76	5.57	668.078
1.3551	11.30	8.74	51.41	5.81	696.657
1.3679	11.41	9.01	53.00	6.05	724.987

*17% AL_2O_3 in dry alum +0.03% free AL_2O_3

Alum Addition
for Stock Solutions

Solution (%)	Concentration (mg/L)	mg of Alum Added to 1-L Flask
0.1	1,000	1,000
0.2	2,000	2,000
0.5	5,000	5,000
1.0	10,000	10,000
1.5	15,000	15,000
2.0	20,000	20,000

Preparation of an Alum Feed Solution

1. Determine the desired percent solution for feeding the alum (Typically a 10 to 20 percent solution used. for this example, let's assume a 15% solution).

2. Based on the volume of alum solution to be prepared, determine the weight of alum to add to the solution tank.

For an alum solution volume of 1000 gallons, determine the alum weight as follows:

Alum Weight = 1000 gal x 8.34 lb/gal x 0.15 = 1,251 lb

General Comments When Dosing Alum

Alum (aluminum sulfate) is a commonly used coagulant in water treatment.

Adding alum to water creates insoluble precipitates such as aluminum hydroxide $Al(OH)_3$ to form.

The optimum pH range for alum coagulation is 5 to 8.

Alkalinity must be present for the alum reaction to work effectively.
If there is insufficient alkalinity in the raw water, the pH will be lowered to a point where soluble aluminum ion is formed instead of aluminum hydroxide.

If soluble aluminum is present, this can cause problems in the distribution system and clear well from post flocculation.

Typically 1.0 mg/L of commercial grade alum will consume about 0.5 mg/L of alkalinity.

At least 5 to 10 mg/L of alkalinity should remain after the reaction to maintain optimum pH.

1.0 mg/L of alkalinity (in the form of $CaCO_3$), is equivalent to:

0.66 mg/L of 85% quicklime (CaO)

0.78 mg/L 95% hydrated lime ($Ca(OH)_3$)

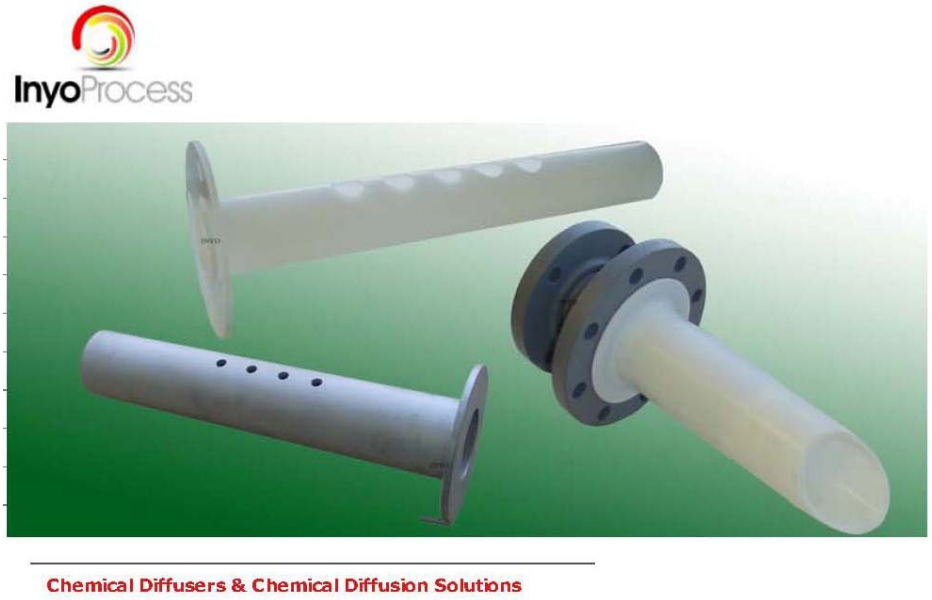
0.80 mg/L caustic soda (NaOH)

1.08 mg/L soda ash ($Na_2(CO)_3$)

1.52 mg/L sodium bicarbonate ($NaHCO_3$)

If additional alkalinity is needed it should be added before adding the coagulant and thoroughly mixed.

When mixing alum with water to make a feed solution, confirm that the pH is below 3.5 to prevent hydrolysis—Hydrolysis will reduce the effectiveness of the alum coagulant. A 10 to 20 percent alum solution by weight will maintain this pH requirement in most applications.



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