

CDS - how to dilute

Tomas 22 November 2012

<http://g2cforum.org/index.php/list/cds-chlorine-dioxide-solution/16372-math-of-cds?start=14#27093>

It has been postulated by MMS team that:
One Standard DOSE of CDS is 1 ml of 3000 ppm CDS
(equivalent to 3 drops of activated MMS1 = 3 mg ClO₂)

Then simple formula is valid:

$$\text{Volume of CDS [ml] for 1 dose} = 3000 / \text{CDS Concentration [ppm]}$$

Example:

We have 1500 ppm stock solution.

Volume of CDS we need is $3000/1500 = 2$ ml

If we dilute this 2 ml with water to total volume 125 ml we have one dose of CDS with concentration 24 ppm and dose 3 mg ClO₂

Let's start to distinguish between CONCENTRATION and DOSE.

We are accustomed to using ppm for expression the concentration of CDS. It is OK. But when we use the same unit (ppm) for a dose, it is incorrect and might be confusing. ppm - one part per million - denotes one part per 1,000,000 parts.

One kilogram (kg) = 1000 grams (g) = 1,000,000 milligrams (mg).

3000 ppm CDS means that there are 3000 mg (milligrams) of chlorine dioxide in 1,000,000 mg (=1000 g =1 kg) of solution.

At low concentrations and normal temperature we can take that 1 kg = 1 liter and CDS 3000 ppm is then approximately 3000 mg of chlorine dioxide in 1 liter of CDS.

It has been postulated by MMS team that:

One Standard DOSE of CDS (equivalent to 3 drops of activated MMS1) is 1 ml of 3000 ppm CDS, usually diluted in 125 ml (4 fl oz) of water to circa 25 ppm concentration.

From above:

in 1 liter of 3000 ppm CDS is 3000 mg of chlorine dioxide,

in 1 ml of 3000 ppm CDS is 3 mg of chlorine dioxide

One Standard DOSE is 3 mg of chlorine dioxide in 125 ml (4 fl oz) of water.

If we dilute this amount (3 mg) to any volume of water the, concentration is changed, but the dose remains the same. The concentration of 25 ppm (3 mg of ClO₂ in 125 ml of water) was established as the optimal one in regards of the CDS taste.

The dimension of:

- Concentration in our case is [mg/liter] (weight/volume)
- Dose is [mg] (weight)

There are simple relations between Dose, Concentration and Volume:

$$\text{Dose [mg]} = \text{Concentration [ppm]} \times \text{Volume [liter]}$$

$$\text{Concentration [ppm]} = \text{Dose [mg]} / \text{Volume [liter]}$$

$$\text{Volume [liter]} = \text{Dose [mg]} / \text{Concentration [ppm]}$$

or

$$\text{Volume [ml]} = (\text{Dose [mg]} / \text{Concentration [ppm]}) \times 1000$$

$$\underline{1 \text{ Dose} = 3 \text{ mg ClO}_2}$$

So that:

$$\text{Volume [ml]} = 3 \text{ [mg]} / \text{Concentration [ppm]} \times 1000 = 3000 / \text{Concentration [ppm]} - \text{above mentioned formula.}$$

How to dilute CDS

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One Standard DOSE of CDS is 1 ml of 3000 ppm CDS

(equivalent to 3 drops of activated MMS1 = 3 mg ClO₂)

Then simple formula is valid:

$$\text{Volume of CDS [ml] for 1 dose} = \frac{3000}{\text{CDS Concentration [ppm]}}$$

Read the volume of CDS in the table according to your concentration [ppm] at corresponding column A, B or C. Measure the volume of CDS and;

- A dilute it to circa 125 ml of total volume in a glass
- B pour the CDS to 1 liter bottle and add water to the bottle to be full. Every hour use 1/8th of the volume (125 ml)
- C pour the CDS to 1 liter bottle and add water to the bottle to be full. Every hour use 1/10th of the volume (100 ml)

3 drops of MMS1 equivalent			
	A	B	C
	1 dose in 125 ml	8 doses to 1 liter	10 doses to 1 liter
	CDS		
Conc. [ppm]	Volume		
	[ml]	[ml]	[ml]
100	30	240	300
200	15	120	150
300	10	80	100
400	8	60	75
500	6	48	60
600	5	40	50
700	4,29	34,3	43
800	3,75	30,0	38
900	3,33	26,7	33
1000	3,00	24,0	30
1100	2,73	21,8	27,3
1200	2,50	20,0	25,0
1300	2,31	18,5	23,1
1400	2,14	17,1	21,4
1500	2,00	16,0	20,0
1600	1,88	15,0	18,8
1700	1,76	14,1	17,6
1800	1,67	13,3	16,7
1900	1,58	12,6	15,8
2000	1,50	12,0	15,0
2100	1,43	11,4	14,3
2200	1,36	10,9	13,6
2300	1,30	10,4	13,0
2400	1,25	10,0	12,5

3 drops of MMS1 equivalent			
	A	B	C
	1 dose in 125 ml	8 doses to 1 liter	10 doses to 1 liter
	CDS		
Conc.	Volume		
[ppm]	[ml]	[ml]	[ml]
2500	1,20	9,6	12,0
2600	1,15	9,2	11,5
2700	1,11	8,9	11,1
2800	1,07	8,6	10,7
2900	1,03	8,3	10,3
3000	1,00	8,0	10,0
3100	0,97	7,7	9,7
3200	0,94	7,5	9,4
3300	0,91	7,3	9,1
3400	0,88	7,1	8,8
3500	0,86	6,9	8,6
3600	0,83	6,7	8,3
3700	0,81	6,5	8,1
3800	0,79	6,3	7,9
3900	0,77	6,2	7,7
4000	0,75	6,0	7,5
4100	0,73	5,9	7,3
4200	0,71	5,7	7,1
4300	0,70	5,6	7,0
4400	0,68	5,5	6,8
4500	0,67	5,3	6,7
4600	0,65	5,2	6,5
4700	0,64	5,1	6,4
4800	0,63	5,0	6,3
4900	0,61	4,9	6,1
5000	0,60	4,8	6,0
5100	0,59	4,7	5,9
5200	0,58	4,6	5,8
5300	0,57	4,5	5,7
5400	0,56	4,4	5,6
5500	0,55	4,4	5,5
5600	0,54	4,3	5,4
5700	0,53	4,2	5,3
5800	0,52	4,1	5,2
5900	0,51	4,1	5,1
6000	0,50	4,0	5,0
6100	0,49	3,9	4,9
6200	0,48	3,9	4,8
6300	0,48	3,8	4,8
6400	0,47	3,8	4,7
6500	0,46	3,7	4,6
6600	0,45	3,6	4,5
6700	0,45	3,6	4,5
6800	0,44	3,5	4,4
6900	0,43	3,5	4,3
7000	0,43	3,4	4,3

Concentration of all the solutions in the table is 24 ppm