Copper reduction using Limestone

Peter Hopper Lake Case Study & Test

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CASE STUDY

PETER HOPPER LAKE JAR TEST

- The aim of these jar tests is to evaluate the effectiveness of limestone in reducing copper levels detected in Peter Hopper Lake
- Limestone with low silica & low magnesium content will be added in varying concentrations (using stock solutions) to jar samples obtained from Peter Hopper Lake
- These samples will then be compared with a control and each other to evaluate the optimum concentration of limestone required

JAR TESTING METHOD

Control	**Sample 1**	**Sample 2**	**Sample 3**
-	50ppm $CaCO_3$	100ppm $CaCO_3$	200ppm $CaCO_3$
<u>Tests:</u>	<u>Tests:</u>	<u>Tests:</u>	<u>Tests:</u>
pH	*pH*	*pH*	*pH*
Total Hardness	*Total Hardness*	*Total Hardness*	*Total Hardness*
Total Copper	*Total Copper*	*Total Copper*	*Total Copper*
Organic Copper	*Organic Copper*	*Organic Copper*	*Organic Copper*

PREPARING STOCK SOLUTIONS

To prepare the stock solutions 5g, 10g, and 20g of $CaCO_3$ will be added to 1L of water. Once prepared, 10mL of the stock solutions will be added to 1L of sample water and mixed

- 50 ppm limestone: Dissolve 5g of CaCO3 in 1L of water to make a 5,000 ppm stock solution. Add 10 mL of this stock solution to 1L of sample water to achieve a 50 ppm concentration.
- 100 ppm limestone: Dissolve 10g of CaCO3 in 1L of water to make a 10,000 ppm stock solution. Add 10 mL of this stock solution to 1L of sample water to achieve a 100 ppm concentration.
- 200 ppm limestone: Dissolve 20g of CaCO3 in 1L of water to make a 20,000 ppm stock solution. Add 10 mL of this stock solution to 1L of sample water to achieve a 200 ppm concentration.

The sample water will be tested for copper content after 48 hours.

We are also testing the effect of Activated Carbon on copper content of water, as a comparison.

5g of Activated Carbon will be added to 1L of sample water (Sample 4). The samples will then be tested for heavy metals scan and major cations/anions to determine the composition of the solution.

RESULTS

		Control	Sample 1: 50ppm	Sample 2: 100ppm
Chloride - Chloride, as Cl	mg/L	28	27	27
SO4 DA - Sulphate, as SO4	mg/L	10	10	11
Alkalinity - Bicarbonate Alkalinity as CaCO3	mg CaCO3 / L	65	73	75
Alkalinity - Carbonate Alkalinity as CaCO3	mg CaCO3 / L	<2	<2	<2
Alkalinity - Hydroxide Alkalinity as CaCO3	mg CaCO3 / L	<2	<2	<2
Alkalinity - Total Alkalinity as CaCO3	mg CaCO3 / L	65	73	75
MS Total Metals - Copper	mg/L	0.031	0.031	0.029
OES Scan - Calcium	mg/L	12	16	16
OES Scan - Magnesium	mg/L	5.9	5.3	5.7
OES Scan - Potassium	mg/L	4.6	4.1	4.3
OES Scan - Sodium	mg/L	21	22	20

		Sample 3: 200ppm	Sample 4: A.Carbon
Chloride - Chloride, as Cl	mg/L	27	23
SO4 DA - Sulphate, as SO4	mg/L	11	10
Alkalinity - Bicarbonate Alkalinity as CaCO3	mg CaCO3 / L	75	61
Alkalinity - Carbonate Alkalinity as CaCO3	mg CaCO3 / L	<2	12
Alkalinity - Hydroxide Alkalinity as CaCO3	mg CaCO3 / L	<2	<2
Alkalinity - Total Alkalinity as CaCO3	mg CaCO3 / L	75	73
MS Total Metals - Copper	mg/L	0.029	0.024
OES Scan - Calcium	mg/L	17	12
OES Scan - Magnesium	mg/L	5.7	6.0
OES Scan - Potassium	mg/L	4.5	6.8
OES Scan - Sodium	mg/L	20	21

DISCUSSION

The results show that the control sample recorded a free copper value of 0.031 mg/L.

Sample 2, treated with 50 ppm of CaCO3 (limestone) recorded no change in total free copper, whilst sample 3 and 4, treated with 100ppm and 200ppm respectively of CaCO3, both reduced the quantity of free copper to 0.029 mg/L.

Sample 4, treated with Activated Carbon, reduced the free copper value further (0.024mg/L). However, this method would not be practical on a large scale because the water has to go through an activated carbon medium filter. This filter would require regular changing and can be costly and labour intensive.

For large scale copper sequestration at Peter Hopper Lake, limestone/$CaCO_3$ with low silica & low Mg at the rate of 200ppm would be the most effective in terms of cost, efficiency and environmental impact. This equates to a dose of 200kg limestone per 1 Million Litres of water.