Removal of Hardness Using Lime

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Abstract- *We all known now a days availability of safe drinking water is very worst it may be due to increase in pollution of water or may due to increasing demand of water. So to avoid the bad effects of polluted or unsafe water we use so many different options to remove pollutants and other unwanted contaminants. Even in non polluted water if concentration of dissolved salt is more than specific limit it is also called as Hard water which may unsafe to human health. In same situation we use R.O. system to reduce hardness of water, but it is not that much economical and common option to use it everywhere so we are trying to find economical option to remove hardness of water.*

Keywords- R.O.,Hardness

I. INTRODUCTION

One of the primary goals of the World Health Organization (WHO) and its Member States is that "all people, whatever their stage of development and their social and economic conditions, have the right to have access to an adequate supply of safe drinking water". A major WHO function to achieve such goals is the responsibility "to propose ... regulations, and to make recommendations with respect to international health matters ...." Today's growing demand on natural resources ,water treatment has become one of the major problems in day to day life and watersupply.

II. HARD WATER

Hard water is water that has high mineral content. Dissolved minerals are nothing but the hardness of water, As we known that the hardness is one of the major impurity in water which should within limit.If it exceed the certain limit it may cause some harmful effects- Dissolved minerals contribute to the taste of drinking-water;hard water can cause increased soap consumption and scale deposition in the water distribution system, as well as in heated water applications where insoluble metal carbonates are formed, coating surfaces and reducing the efficiency of heat exchangers.

Table No.1

Sr. No.	Hardness range *(mg/l)*	Degree of hardness
1	0-60	Soft
2	60-120	Moderately hard
3	120-180	Hard
4	180 and above	Very hard

Theory

Chemical precipitation is one of the more common methods used to soften water. Chemicals normally used are lime (calcium hydroxide, Ca(OH)2) .Lime is used to remove chemicals that cause carbonate hardness.

When water has hardness, only calcium needs to be removed. Only enough lime is added to water to raise pH upto 10.6, and hardness will be removed from thewater.

III. LIME ADDITION

Hardness Lime Precipitate

CO_2. + $Ca(OH)_2 \rightarrow CaCO_3 + H_2O$ $Ca(HCO_3)_2 + Ca(OH)_2 \rightarrow 2CaCO_3 + 2H_20$
$Mg(HCO_3)_2 + Ca(OH)_2 \rightarrow CaCO_3 + MgCO_3 + 2H_20$ $MgCO_3 + Ca(OH)_2 \rightarrow CaCO_3 + Mg(OH)_2$

CO_2 does not contribute to the hardness, but it reacts with the lime, and therefore uses up some lime before the lime can start removing the hardness.

Maximum criteria of for drinking water is 100 mg/l.

Methodology

Here we are doing comparison between hardness of water sample and same sample after adding lime ,in that we are taking three different dosage of lime solutions.After analyzing these samples we will observe that is lime addition really reducing hardness of water sample.If it reduces hardness

of water then we will find the minimum dose of lime for reducing hardness ofwater.

A. Lime solution – It produced by dissolving one gram of lime in one litre distilledwater.

B. Determine hardness of water sample – (threesteps)

1.Tap water sample

25 ml of water sample+100 ml of distilled water+1-2 ml of buffer solution+ few giains of dry indicator it gives red wine colour then titrate it against EDTA solution till sky blue colour appears. It gives us reading –X

2.Standard of EDTA

10 ml of 0.02N CaCO3solution +100 ml of distilled water+1-2 ml of buffer solution+ few giains of dry indicator it gives violet colour then titrate it against EDTA solution till sky blue colour appears. It gives us reading – Y

3.Blank correction

100 ml of distilled water+1-2 ml of buffer solution+ few grains of dry indicator it gives red wine colour then titrate it against EDTA solution till sky blue colour appears. It gives us reading –Z

Hardness of water sample before lime addition Calculations

x- Burette reading for Tap watersample
y- Burette reading for Std. of EDTASolution
z-Burette reading for BlankCorrection
(Table No.-2)

Total Hardness = {(x-y) *N*(50)*1000}/ Vol. of sample (ml) N= 10X Normallity of CaCO3 /(z-y)
So, N = 10*0.02/(11.6-0.6)
= 0.2/11
N = 0.018
And Total Hardness = {(4.8-0.6)*0.018*50*1000}/25
Total Hardness= 151.2mg/lit……..(Trial 1,2,3)

Table No.-2

TrialNo.	pH	Burette reading (*ml*)				Total Hardness *(mg/l)*	Avg. Total Hardness *(mg/l as CaCO3)*	Remark
		Initial	X	Y	Z			
1	8.2	0.0	4.8	0.4	11.6	151.2	151.2	Hard Water
2		0.0	4.8	0.4	11.6	151.2		
3		0.0	4.8	0.4	11.6	151.2		

Table No.-3 Hardness of water sample after lime addition

Sample No.	Amt. of lime solution *(ml/l)*	Trial No.	pH	Burette reading (*ml*)				Total Hardness *(mg/l)*	Avg. Total Hardness	Remark
				Initial	X	Y	Z			
1	30	1	8.5	0.0	4	0.4	11.6	129.6	132	Hard
		2		0.0	4.2	0.4	11.6	136.8		
		3		0.0	4	0.4	11.6	129.6		
2	60	1	9.2	0.0	3.2	0.4	11.6	100.8	98.4	Moderately hard
		2		0.0	3.2	0.4	11.6	100.8		
		3		0.0	3	0.4	11.6	93.6		
3	90	1	10	0.0	2.8	0.4	11.6	86.4	90	Moderately hard
		2		0.0	3	0.4	11.6	93.6		
		3		0.0	2.9	0.4	11.6	90		

An experiment performed by jar test on the water sample which is done by following steps:

C. Jar test

Jar test is a laboratory procedure where varying dosages of alum are tested in a series of glass or plastic jars under identicalconditions Determine the pH of the raw watersample.

1. Place 1 liter's of raw water in each of the three beakers of the laboratory stirrer. Immerse blades and stir the raw water samples at about 100rpm.
2. Add lime solution into each of the beaker to obtain the desired concentrations in the raw watersamples.
3. Let the samples mix at approx. 100 rpm for 1minute, then decrease the speed to approx. 30 rpm. Allow the sample to mix for a period of 10 minutes. Observe any changes in the suspended matter in thesample.
4. At the end of the mixing period, turn off the stirrer, let the flocs settle (at least 20 minutes) and carefully remove the supernatant from each beaker and filter outs amples through What man paper
5. Determine the pH of each treated water sample.
6. Measure the hardness of the samples and find minimumlime dose to remove hardness.

Calculations same as like above)

From the all this testing ,observations and calculations we can say that lime is able to reduce hardness of water .In jar test also we get three different results for different lime concentrations ,in which 60 ml/l and 90 ml/l dose gives us as a moderate hardness of water which is less than 120 mg/lit.So we can say that the optimum dose of lime for given water sample is 60 mg/lit ,Because we find here optimize dose of lime.

IV. CONCLUSION

From above comparative study we observe that the addition of lime is able for reducing hardness of water .60 ml/l dose gives us as a moderate hardness of water which is less than 120 mg /lit.

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