# Sterilization of water

Environment, Water

# Introduction

Water is the major constituent of all living beings. The water is necessary to sustain all types of life. The water used for drinking purpose by human beings should full the following conditions :

1. It should be colourless.

2. It should not possess any smell.

3. It should contain any harmful dissolved salts such as nitrates, mercury salts, lead salts.

4. It should not contain any living organisms such as algae, fungus, bacteria, etc.

## Sterilization of Disinfection of Water

In order to obtain water for drinking purpose, water is first treated with alum whereby clay and other colloidal particles go precipitated the suspended impurities are then removed by filtration, and the clear water obtained is subjected to some suitable treatment to destroy harmful germs and bacteria. These bacteria cause many dangerous diseases such as cholera, thyroid, dysentery, tuberculosis, diphtheria, etc.

The process of killing the harmful bacteria by some suitable treatment of water is called sterilization of the disinfection of water. The common sterilizer agents are chlorine, ozone, bleaching powder, potassium per magnate chloramines. Sterilization of water through bleaching powder gives chlorine and if it is in excess, it is harmful tohealthand causes diseases like

chlorosis, unconsciousness, etc. So here we determine the exact amount of bleaching powder used of required for the sterilization of given samples of water.

## General Methods of Sterilizing Water

There are many methods of sterilizing water but the best is one which gives a sample of water which is totally free from germs. Sometimes potassium per magnate is used to disinfect water but it is not for drinking as it gives red colour and the excess of it is in harmful for health. We use dissolve in water, so it can not be used in large scale. Another method for disinfection is by simply boiling the water for about 15 minutes, but this powder. The chemical action of bleaching powder on germs and bacteria is due to the chlorine which becomes available when it is added to water.

So here in the present context, we shall focus on disinfection of water using bleaching powder.

## Theory

Objective: Our objective of this project is to determine the amount of bleaching powder required for the sterilization of given samples of water. So certain steps are taken in the context as follows :

1. A known mass of the given samples of bleaching powder is dissolved in water to prepare a solution of known concentration. This solution contains dissolved chlorine, liberated by the action of bleaching powder with water. $CaOCl_2 + H_2O$ ----------> $Ca(OH)_2 + Cl_2$
2. The amount of chlorine present in the above solution is determined by treating a known volume of the above solution with an excess of 10%

potassium iodide solution when the equivalent amount of iodine is liberated. The iodine, thus liberated is then estimated by titrating it against a standard solution of sodium thiosulphate using starch solution as indicator. $Cl_2 + 2KI$ ----------> $2KCl + I_2$ $I_2 + 2Na_2S_2O_3$ ----------> $Na_2S_4O_6 + 2NaI$

3. A known volume of one of the given samples of water is treated with a known volume of bleaching powder solution. The amount of residual chlorine is determined by adding excess potassium iodine solution and then titrating against standard sodium thiosulphate solution.
4. From the reading in 2 and 3, the amount of chlorine and hence bleaching powder required for the disinfection of a given volume of the given sample of water can be calculated.

## Requirements for the Experimental Determination

Requirements are as follows :

Apparatus :

1. Burette
2. Titration Flask
3. 500 ml measuring flask
4. 100 ml Graduated Cylinder
5. 250 ml Measuring flask
6. 1lt. Measuring flask
7. Glazed Tile
8. Glass Wool.

Chemicals :

1. Bleaching powder -5gm.
2. Na2SO4----> 12. 4 gm.
3. KI - 25gm.
4. Different Sample of Water
5. Distilled Water
6. Soluble starch - 1gm.
7. Indicator - Starch Solution.

Procedure :

1. Preparation of N/20 Na2SO4 solution: Take 12. 4 gm of sodium thiosulphate hydrated and mix it in about 500ml of water then the mixture is diluted to make the volume 1000ml. or 1lt. Normality = strength/Molecular Mass. = 12. 4 / 248 = 1/20N
2. Preparation of 10%KI solution: Take 25gm. of KI powder and mix it in about 100ml of water then dilute the mixture to make the volume 250 ml and take it in the measuring flask.
3. Preparation of Bleaching Powder solution: Weight 5gm of bleaching powder and mix it in about 200 ml of distilled water in a conical flask. Stopper the flask and shake it vigorously. The suspension thus obtained is filtered through glass wool in measuring flask of 500ml. and dilute the filtrate with water to make the volume 500 ml. The solution of obtained is 1% bleaching powder of solution.
4. Preparation of starch solution: Take about 1gm of soluble starch and 10 ml of distilled water in a test table mix vigorously to obtain a paste. Pour the paste in about 100ml. of hot water contained in a beaker with constant stirring. Boil the contents for 4-5min. and then allow cooling.

5. Take 100ml. of distilled of water and then 20ml of bleaching powder of solution in a stopper conical flask and add it 20ml of 10% KI solution. Shake the mixture, titrate this solution against N/20 Na2S2O3 Solution taken in the burette. When a solution in the conical flask becomes light yellow in colour adds about 2ml of the starch solution as indicator. The solution now becomes blue in colour. The endpoint is the disappearance of blur colour, so continue titrating till the blue colour just disappears. Repeat the titration to get a set of three readings.
6. Take 100ml of water sample in a conical flask and add 20ml of KI solution and stopper the flask. Shake it and titrates against N/20 Na2S2O3 until the solution becomes yellow. Then add 2ml of starch solution and then again titrate till the blue colour disappears. Repeat titration for three readings.
7. Repeat step 6 with other samples of water and records theobservation.

## Observation Table

Titration: I

- Volume of distilled water is taken 100ml
- Volume of bleaching powder sol. taken 20ml
- Volume of KI solution added 20ml

| Burette Reading Sr. No. | Initial | Final | Final Vol. of 0. 2N Na2S2O3 sol. used |
|---|---|---|---|
| 1. | 1. ml | 0. 9ml | 7. 7ml |
| 2. | 0. 9ml | 16. | 7. 7ml |

| | | | |
|---|---|---|---|
| | | 6ml | |
| 3. | 16. 6ml | 24. 0ml | 7. 7ml |

Titration: II

- Volume of water sample I taken 100ml
- Volume of bleaching powder sol. added 20ml
- Volume of KI solution added 20ml

| Burette Reading Sr. No. | Initial | Final | Final Vol. of 0. 2N Na2S2O3 sol. used |
|---|---|---|---|
| 1. | 10. 1 ml. | 16. 2 ml. | 6. 1 ml. |
| 2. | 16. 2 ml. | 22. 3 ml. | 6. 1 ml. |
| 3. | 22. 3 ml. | 28. 4 ml. | 6. 1 ml. |

Titration: III

- Volume of water sample I taken 100ml
- Volume of bleaching powder sol. added 20ml
- Volume of KI solution added 20ml

| Burette Reading Sr. No. | Initial | Final | Final Vol. of 0. 2N Na2S2O3 sol. sed |
|---|---|---|---|
| 1. | 8. 9 ml. | 14. 1 ml. | 5. 2 ml. |
| 2. | 14. 1 ml. | 19. 3 ml. | 5. 2 ml. |
| 3. | 19. 3 ml. | 14. 5 ml. | 5. 2 ml. |

Titration: IV

- Volume of water sample I taken 100ml
- Volume of bleaching powder sol. added 20ml
- Volume of KI solution added 20ml

| Burette Reading Sr. No. | Initial | Final | Final Vol. of 0. 2N Na2S2O3 sol. used |
|---|---|---|---|
| 1. | 16. 1 ml. | 21. 6 ml. | 5. 5 ml. |
| 2. | 21. 1 ml. | 27. 1 ml. | 5. 5 ml. |
| 3. | 27. 1 | 32. 6 | 5. 5 ml. |

| | | | |
|---|---|---|---|
| | ml. | ml. | |

## Calculations

Sample I (TAP WATER) Amount of bleaching powder used to disinfect 100ml of water samples I. = (7. 7 - 6. 1) ml of 0. 2 N of Na2S2O3 solution. 1. 6ml. 1ml of bleaching powder solution contains bleaching powder = 5/500 = 0. 01gm. 20ml of bleaching powder solution = 7. 7ml of 0. 2N of Na2SO4 So 1ml of Na2S2O3 solution = 20/7. 7 ml of bleaching powder solution. Volume of bleaching powder solution used to disinfect 100ml of water = 1. 6 x 20/7. 7ml. 1. 6 x 20/7. 7 ml. of bleaching powder solution = 1. 6 x 20 x 0. 01 gm / 7. 7 = 0. 4156 gm

Sample II (POND WATER) : Amount of bleaching powder used to disinfect 100ml of water. = (7. 7 - 5. 2) ml of 0. 2 N Na2S2O3 solution = 2. 5ml 1ml of bleaching powder solution contains bleaching powder = 0. 1 gm. 7. 7ml. of 0. 2N Na2S2O3 = 20ml of bleaching powder solution So 1ml of Na2S2O3 = 20ml. of bleaching powder solution. Volume of CaoCl2 solution required to disinfect 100ml of water. = 2. 5 x 20/7. 7 ml. 2. 5 x 20/7. 7 ml. of bleaching powder solution. = 2. 5 x 20 x 0. 01 gm / 7. 7 of bleaching powder

Amount of bleaching powder required to disinfect 1 let. of water. = 2. 5 x 20 x 0. 01 x 1000 / 7. 7 x 100 = 25 x 2/7. 7 = 0. 6493 gm.

Sample III (TANK WATER) : Amount of bleaching powder used to disinfect 100ml of water. = (7. 7 - 5. 5 ) = 2. 2ml of 0. 2 N of Na2S2O3 solutions. ml of bleaching powder solution contains bleaching powder. = 5/500 = 0. 01gm 7. 7 ml. of 0. 2 N Na2S2O3 = 20ml of bleaching powder solution.

so 1ml of 0. 2 N Na2S2O3 solution = 20/7. 7 ml volume of bleaching powder solution used to disinfect 100ml of water = 2. 2 x 20/7. 7 ml. 2. 2 x 20/7. 7 ml of bleaching powder solution = 2. 2 x 20 x 0. 01 gm / 7. 7 of bleaching powder

Amount of bleaching powder used to disinfect 1 ltr. of water = 2. 2 x 20 x 0. 01 x 1000 / 7. 7 x 100 = 22 x 2/77 = 0. 5714gm

## Results

Amount of the given samples of bleaching powder required to disinfect one litre of water :

Samples I = 0. 4156

Samples II = 0. 6493

Samples III = 0. 5714

Thus we get the amount required for disinfection and if bleaching powder is taken less than this amount water will remain impure and if it's taken in excess than this will also be harmful as it will contain chlorine. The results show that Samples II is the imputes water as the amount of bleaching powder requires is maximum and Sample I is less impure than others as the bleaching powder used is minimum. The tables also show the difference. Titration III has minimum reading because of impurities and titration I has maximum reading because the sample was distilled water.

## Conclusion

This is a convenient method of sterilizing water. It leaves no impurities and its harmful effect if bleaching powder is taken in the right amount. In this

way, we can calculate the amount of bleaching powder required for any sample of water and then take it in large amount if the water is to be disinfected on a large scale as in waterworks. And thus the only cause of using bleaching powder to disinfect water instead of any other method is this that it kills all germs and bacteria due to its chemical action and provides us with a pure sample of water to use for all-purpose.