ANTONY PUBLIC SENIOR SECONDARY SCHOOL – CBSE

DEDICATE DEVOTE DETEMINE

CHEMISTRY INVESTIGATORY PROJECT SESSION-2023 -2024

Checking the bacterial contamination in drinking water by testing sulphide ion

DONE BY:

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CLASS XI

ACKNOWLEDGEMENT

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ANTONY PUBLIC SENIOR SECONDARY SCHOOL-CBSE

INVESTIGATORY PROJECT WORK

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Submitted for the practical examination held on _____

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Internal examiner **external examiner**

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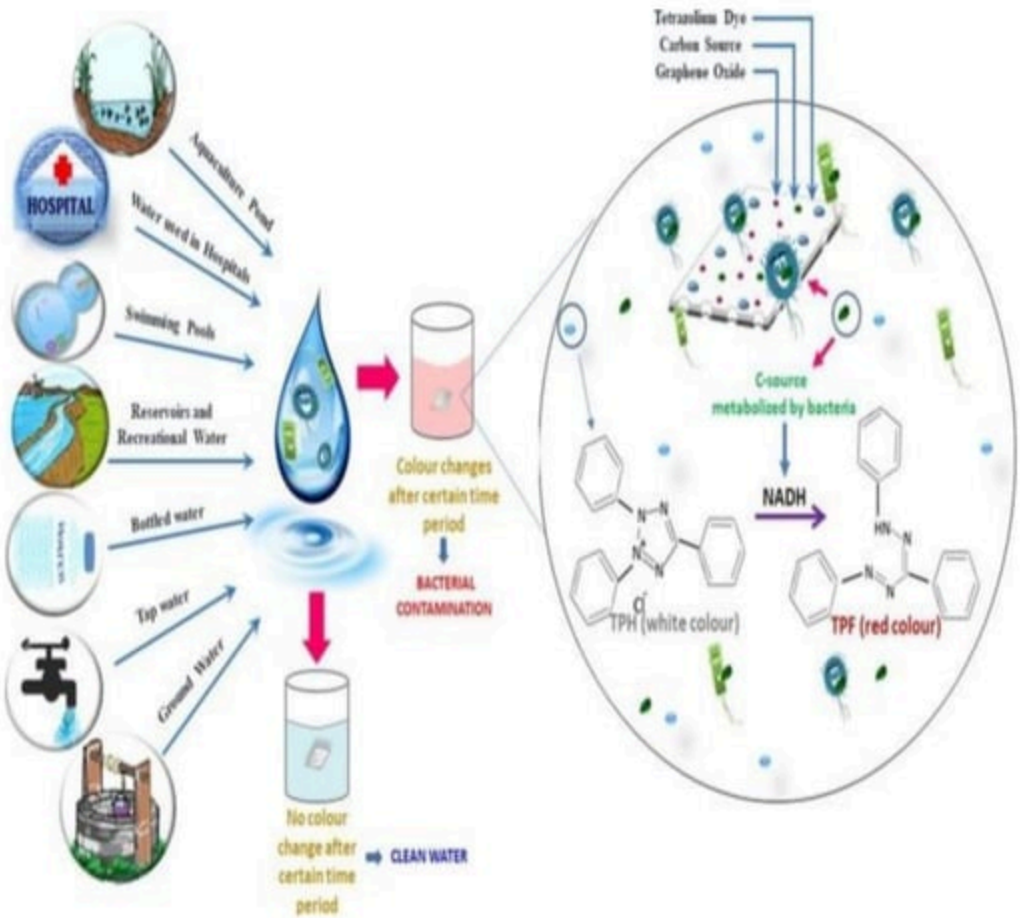
INTRODUCTION

The sulphide ion test for bacterial contamination is good. In surface waters, hydrogen sulphide is formed under oxygen deficient conditions. Hydrogen sulphide is also produced from the decomposition of sulphur containing organic compounds. The concentration of sulphide ion becomes significant only at pH 10 or above .Under acidic conditions, the concentration of hydrogen sulphide predominates. Hydrogen sulphide is a weak acid, which ionizes to yield hydrosulphide (HS^-) and sulphide (S_2) ions. Hydrogen sulphide is highly toxic to fish. Concentrations of total sulphide as low as 0.01.

Hydrogen sulphide also reduces the aesthetic value of the water body due to foul colour. The bacterial contamination can be tested using

H_2S strip. Presence of pathogenic bacteria in water can be detected by testing the sulphide content of water.



The presence of sulphide ions in water is an indicator of:

i) High pH above 10.

ii) Sulphide producing bacteria

ii) Diminished oxygen concentrations

Conducting the sulphide ion test:-

The sulphide ion test is conducted using an Hydrogen sulphide strip (H_2S). - The H_2S strip is dipped into the water to be tested for 14 to 16 hours. - The H_2S strip turns black if sulphide ions are present in the water. The black colour is due to the ionization of the H_2S.

INDICATION OF HYDROGEN SULFIDE AND SULFATE IN DRINKING WATER

Hydrogen sulfide gas produces an offensive “rotten egg” or “sulfur water” odor and taste in the water. Most people can detect hydrogen sulfide in water at concentrations as low as 0.5 milligrams per liter. Concentrations less than 1 milligram per liter give water a "musty" or "swampy" odor. A concentration of 1 – 2 milligrams per liter gives water the “rotten egg” smell and makes it very corrosive to household plumbing. Heat forces the hydrogen sulfide gas into the air, which may cause the odor to be particularly offensive in the shower. Hydrogen sulfide is corrosive to metals such as iron, steel, copper, and brass. It can tarnish silverware and discolor copper and brass utensils. It can also cause yellow or black stains on kitchen and bathroom fixtures. Coffee, tea, and other beverages made with hydrogen sulfide contaminated water may be discolored and the appearance and taste of cooked foods can be affected.

High concentrations of dissolved hydrogen sulfide can foul the resin bed of an ion exchange water softener. When hydrogen sulfide odor occurs in treated water, yet was not originally detected in the pre-treated water, this usually indicates the presence of sulfate reducing bacteria in the treatment system. Ion exchange units provide a convenient environment for these bacteria to grow Sulfates can cause a scale buildup in water pipes as do other minerals, and may also be associated with a bitter taste in the water.

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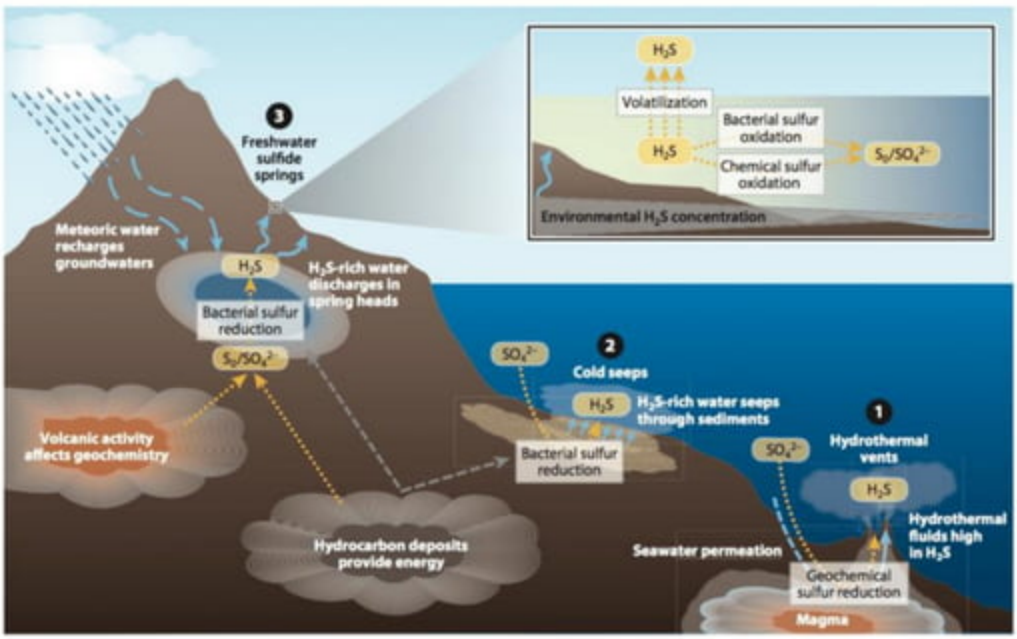
SOURCES OF HYDROGEN SULFIDE AND SULFATE IN DRINKING WATER

Hydrogen sulfide gas occurs naturally in groundwater and can result from a number of sources.Decomposing underground deposits of organic matter such as decaying plant material can produce hydrogen sulfide.

Wells drilled in shale, sandstone, or near coal or peat deposits may also be sources of hydrogen sulfide.



Sulfur-reducing bacteria feed on the naturally occurring sulfates in water, producing hydrogen sulfide gas as a by-product.

Water heaters may also be a potential source of hydrogen sulfide gas. If a magnesium rod is in the tank to prevent water heater corrosion, the rod can chemically reduce naturally occurring sulfates to hydrogen sulfide.

TESTING FOR HYDROGEN SULFIDE AND SULFATE IN PRIVATE DRINKING WATER WELLS

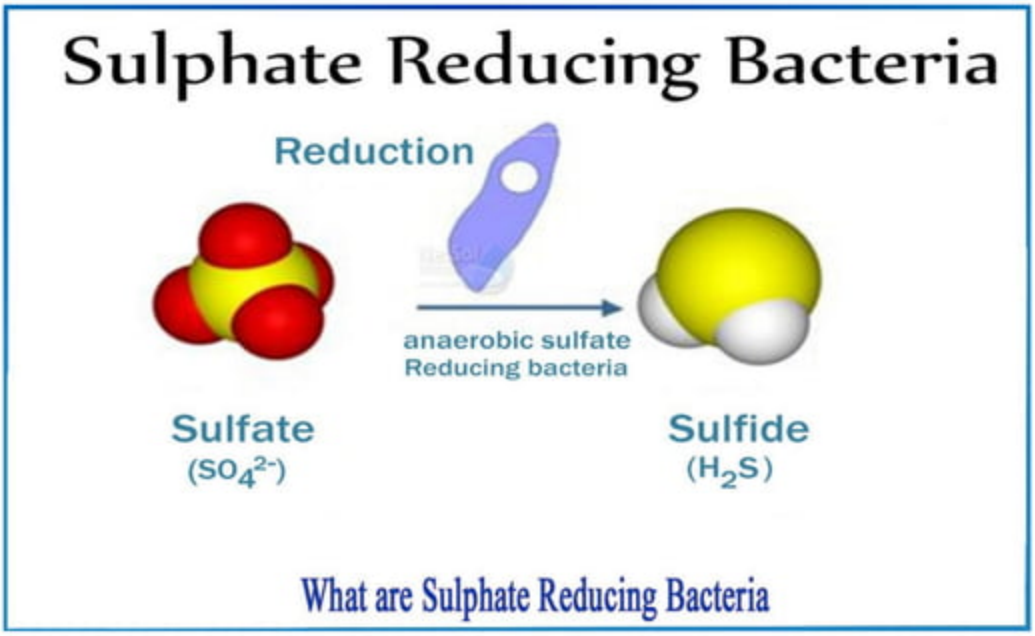
Since hydrogen sulfide is detectable by taste and smell, a laboratory test is not needed to detect its presence, however, a test is necessary to determine the amount of hydrogen sulfide in water. To determine the level, arrange to test your drinking water at a state certified laboratory. Carefully follow laboratory instructions to avoid contamination and to obtain a representative sample. The amount present in water determines which treatment method will be most effective. Because hydrogen sulfide is a gas dissolved in water that can easily escape or be lost from the sample, a

water sample must be chemically stabilized immediately after collection in order for the laboratory to accurately measure its concentration. Be sure to contact the laboratory for the proper sample bottle, chemical preservative and instructions. If wastewater pollution is the suspected source of contamination, collect a separate sample to test for bacteria.
Most state certified laboratories have a standard test for detecting sulfate levels in water.

REDUCING HYDROGEN SULFIDE IN OUR DRINKING WATER

Recommended treatment varies with the amount and form in which hydrogen sulfide and/or sulfate are detected in the water, and whether you need whole house treatment (point-of-entry), or point-of-use treatment for drinking and cooking. At elevated levels, whole house treatment is usually recommended. Other options include buying bottled water—especially if the main problem occurs with food and beverage preparation, or installing a new

well.



Depending on the source of the problem, a new well may need to be installed that is either deeper or more shallow than the existing well, or be located within a different area on your property to avoid the sulfur source. If the hydrogen sulfide is a result of sulfur bacteria in the pipes, chlorinating your well can kill the bacteria. However, this is not a permanent solution and the bacteria can re-occur. For more information on shock chlorination procedures, refer to the fact sheet: Bacteria in Drinking Water Wells.

AIM

To test the contamination of drinking water by bacteria be checking the sulphide ion concentration and find out the cause of contamination.

REQUIREMENTS

1. Apparatus Required

- Hydrogen Sulphide (H_2S strip)
- Beaker
- Drinking water
- Thermometer

2. CHEMICALS REQUIRED

- Hydrogen Sulphide (H_2S)

PROCEDURE

This experiment is to be done in an incubator

- ✓ *Add about 250ml of water in a beaker.*
- ✓ *Dip the H_2S strip in the beaker with water.*
- ✓ *Heat the beaker for about 35 degree centigrade*
- ✓ *Check the temperature (temperature should be at 35 degree centigrade)*
- ✓ *Keep it in incubator for 14-16 hours of time.*
- ✓ *Check the result if the water turns black then it is unfit for drinking / highly contaminated for drinking or for human use.*
- ✓ *The sulphide ion test for bacterial contamination is good.*

In surface waters, hydrogen sulphide is formed under oxygen-deficient conditions. Hydrogen sulphide is also produced from the decomposition of sulphur containing organic compounds. The concentration of sulphide ion becomes significant only at pH 10 or above .

✓ Collection of Samples

Sulphides are readily oxidised, therefore care should be taken at the time of sampling to exclude air by flushing it with nitrogen or carbon dioxide. But the best way is to 'fix' the sample immediately after collection. This can be done by adding small volume of cadmium-zinc acetate solution. For this take 80 mL of water and add cadmium-zinc acetate solution 20 mL to obtain a total volume of about 100 mL. To make Cd-Zn acetate solution dissolve 50 g cadmium acetate and 50 g zinc acetate in 1.0 L of water. If collected sample is acidic in nature, then first neutralize it with little excess of alkali.

✓ Titration of Fixed Solution

Take 100 mL fixed solution in a titration flask, add 20 mL 0.025 M iodine solution and immediately add 15 mL, (1:1) HCl and mix. Titrate the excess iodine against 0.05 M Na2 S2O3 , adding starch solution as indicateor towards the end point. Calculate the amount of sulphide ions in the original samples from the amount of iodine used in the reaction with H2 S. Subtract the values of blank titration if available from the calculated values.

OBSERVATION

Source of Water	***Result***
Water from the tap of house at madanrting	*Water is fit for drinking.*
Water from the tap of happy valley houses	*Water is unfit for drinking*
Spring water	*Water is fit for Drinking*
River water	*Water is not fit for drinking*

PRECAUTION

i) The handling precautions should be numerous and multi-level. They also need to be adapted to the volume of H2S that you will have inside the lab and the extent of the research effort that you plan that involves H2S. It is one thing to run a couple of experiments with small volumes of H2S and it is another to use large numbers of moles of H2S for extended periods of time

CONCLUSION

- Water is mostly unfit for drinking from river.
- Water is also unfit for drinking at some of the water that come to houses.
- Therefore we should purify the water before drinking. And we should not drink water from random places.

RESULT

By the experiment done the result says that at some place water is fit for drinking at some places whereas it is unfit for drinking at some places.

Especially water is unfit for drinking from river bodies

THANKING YOU...