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Investigation of bacterial contamination in different water samples of Sehore district (Madhya Pradesh) by using optical technique

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Bacterial contamination in water is a hazard worldwide and optical technique can detect bacterial contamination in approximately 48 hours. The Beer-Lambert Law, as applied to spectrophotometric turbidity studies, correlates the concentration of organism's growth in a solution to the absorption of visible light. By passing light through a sample of contaminated broth, we directly measure the intensity of the resulting light. We use this to calculate the transmittance and the absorption of light that passes through the solution. However, it is not entirely necessary to transform transmittance into absorption. A plot of transmittance over time tracks the inverse of the bacterial growth curve. The primary objective of this study is to develop a more effective means of investigating bacterial contamination in different water sources of sehore district.

Keyword: Bacterial contamination, Optical technique, Turbidity, Sehore District.

1. Introduction

Water contamination is a serious health concern for human populations around the world. In the developed world, bacterial contamination is detected through traditional laboratory techniques. The standard laboratory test for water contamination involves filtering the water and plating a sample of it in agar. The specimen is incubated in a heat-controlled environment for 24 to 48 hours, and examined for the formation of colonies. These processes are time consuming and therefore costly [1].

A wide variety of analytical techniques and instruments have been used for the determination of the overall chemical quality of waters. These techniques range from simple pH measurements, ion selective electrodes, ion exchange chromatography and other chromatographic procedures such as HPLC, GC, as well as spectrophotometric detection of water. However tests for water safety should ideally be easy, fast, accurate, sensitive, reliable and reproducible. In addition, any method chosen should be able to carry out selective testing of a very wide range of common analytes, spectrophotometry fulfils most of these criteria and is perhaps the simplest technique to use [5].

This experiment uses the principles of the Beer-Lambert Law to model bacterial growth. Monochromatic light is passed through a sample cuvette, and the intensity of transmitted light is measured by a sensor (see Figure 1.1). The initial intensity (immediately after the sample is created) is defined to be 100% transmittance.

As this intensity measurement changes over time, the transmittance changes according to sample, indicates a change in bacterial concentration in the sample.

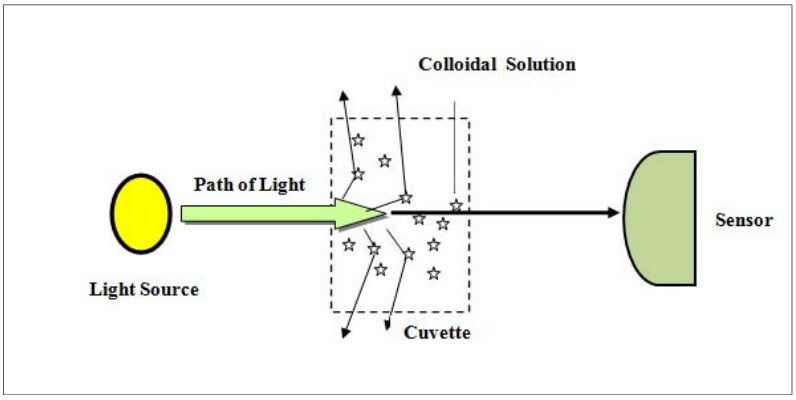

Fig 1: Intensity measurement indicates a change in bacterial concentration in the sample.

2. Method and Material

1. **Collection of samples :** Different water samples were collected from various places of sehore district (Madhya pradesh), water sample were collected from following places-
   a. Bhopal naka, b. Chanakyapuri, c. Housing board, d. Ganga ashram, e. Kotwali, f. Nehru colony, g. Kohlipura, h. Awadhpuri, i.Brahmpuri, j. Englishpura.
2. **Broth Media preparation :** Suspend 8 gms. of medium in 1 litre of distilled water, mix well and dissolve by heating with frequent agitation boil for 1 minute until complete dissolution, dispense into appropriate containers and sterilize in autoclave at 121 °C for 15 minutes, the prepared medium was stored at 2-8 °C
3. **Inoculation of samples:** Different water samples were added at the rate of 200 µl / 2ml of nutrient broth. The experiment has a separate control for measuring maximum contamination [3].
4. **Spectrophotometric detection:** After 48 hours optical density was taken at 620 nm in spectrophotometer. Percentage contamination in different water samples were investigated on the basis of optical density.

Table 1: OD and % Contamination of Bacteria in Different Sources of Sehore District.

S.No.	Places of Sample Collection	Optical Density	% of Contamination
1.	Bhopal naka	0.02	1.96 ± 0.01
2.	Chanakyapuri	0.05	4.90 ± 0.25
3.	Housing board	0.01	0.98 ± 0.11
4.	Ganga ashram	0.04	3.92 ± 0.47
5.	Kotwali	0.09	8.82 ± 1.25
6.	Nehru colony	0.07	6.86 ± 1.36
7.	Kohlipura	0.001	0.09 ± 0.01
8.	Awadhpuri	0.08	7.84 ± 1.02
9.	Brahmpuri	0.07	6.86 ± 1.02
10.	Englishpura	0.01	0.98 ± 1.05

3. Result

This experiment has explored the transmittance properties of light through bacteria, and demonstrated the correlation between % transmittance and the growth of the bacteria in different samples. Each experiment was done five times and the mean values of percentage contamination were presented in table - 1.

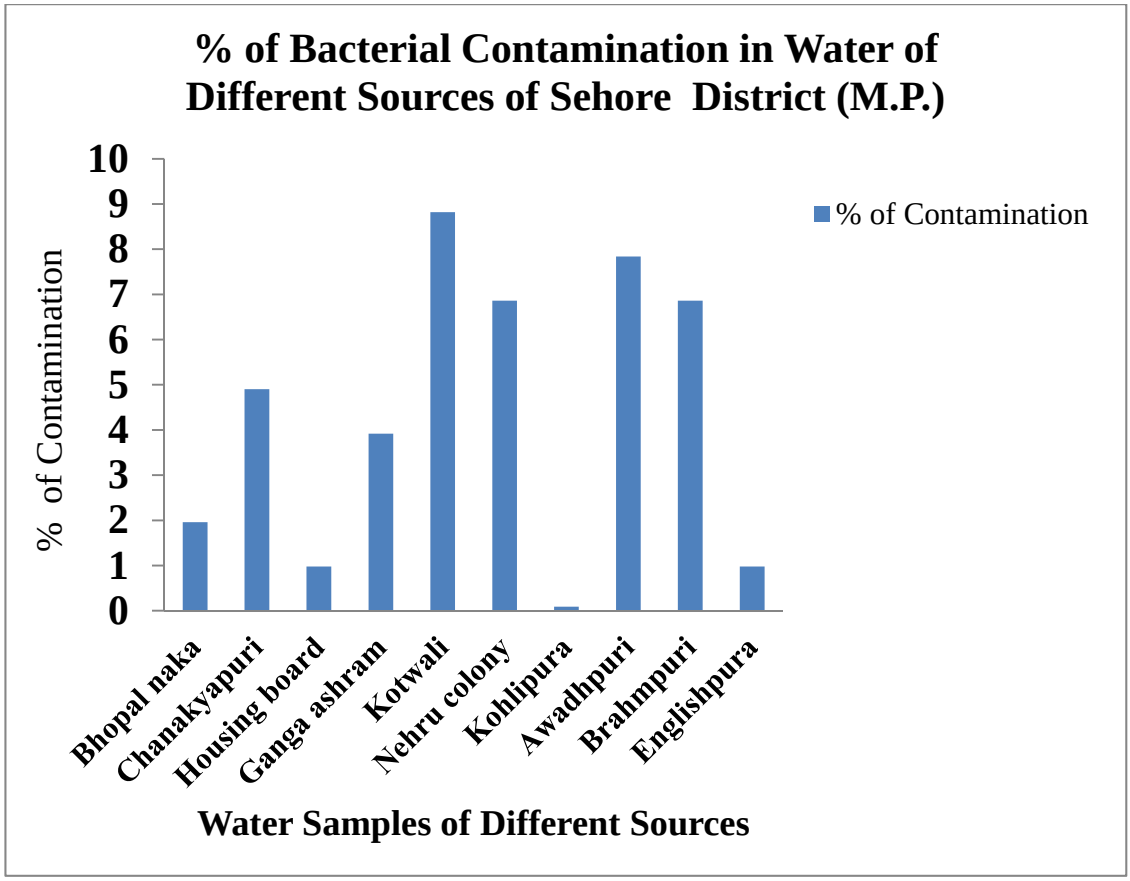

Fig 2: % of Bacterial Contamination in Water of Different Sources of Sehore District (M.P.)

4. Conclusion

The potential applications of this optical technique are numerous, providing a rapid, inexpensive means for detecting the presence of biological contamination. Beyond the interest of scientific advancement is the human interest motivation for this research. The ability to test for the presence of these life forms without advanced laboratory equipment is the next big step in wiping out diseases that have ceased to exist in the developed world. While some strive to provide the under privileged with the means to fight an ailment, this work provides a valuable data about bacterial contamination in water body. With the advancement of this research, the worldwide detection of the presence of more and more pathogens will become possible.

5. References

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