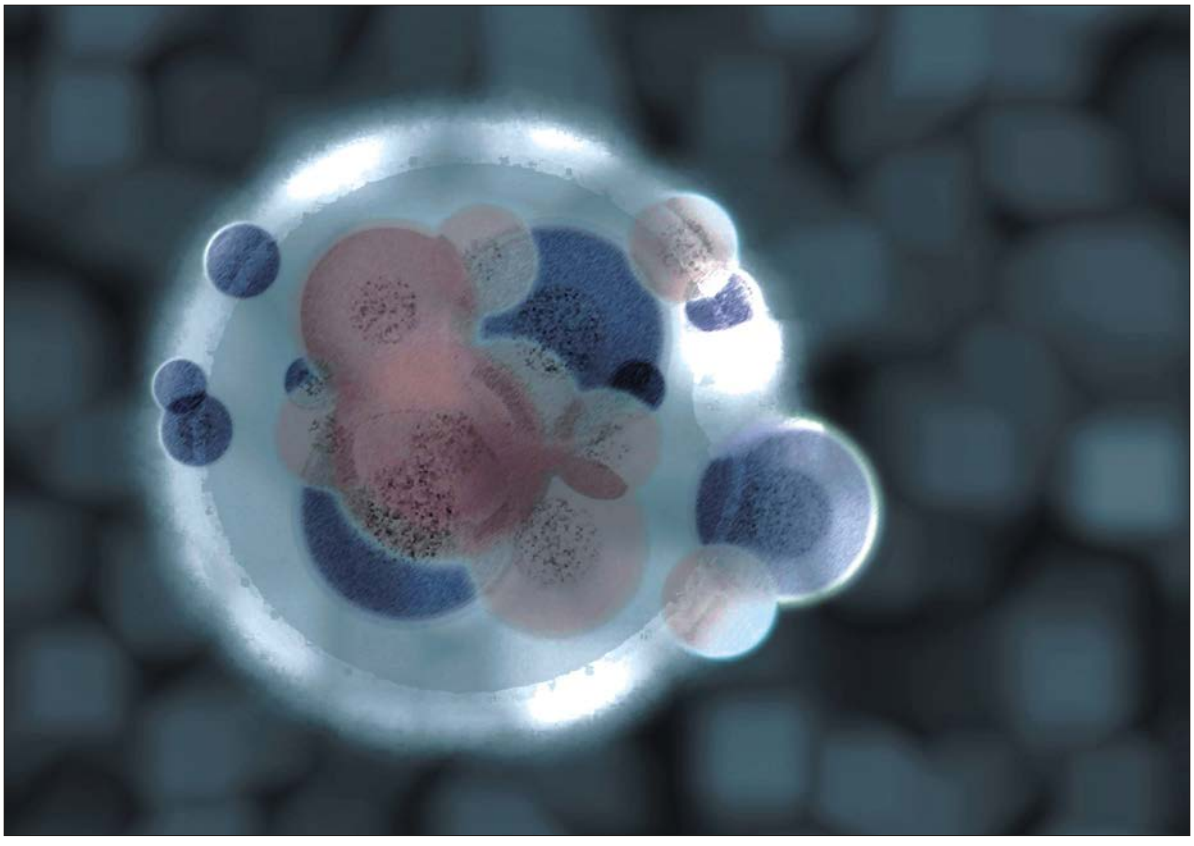

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Debacterification of Water in Areas of Lahore

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Abstract: Samples of water were collected from seven different localities and subjected to bacterial examination. The addition of silver nitrate at different concentration and its bactericidal effect was observed, fifteen minutes after addition. The tests were conducted for bacteriologic analysis of water through plate counts and also for the presence of coliform organisms. The microbial examination of untreated water samples showed remarkable variation in total viable count and coliform organisms. The total viable count and coliform in untreated water ranged from 38×10^5 - 135×10^5/ml and 6 - 150/100 ml, respectively. When the addition of silver (as silver nitrate) was done at a concentration of 50 μg/L, bacteria were altogether absent in almost all the water samples.

Key words: Water, debacterification, water purification, Lahore

Introduction

The 3/4th part of our earth is filled with water and it is a biological necessity of all forms of life. It can be considered as a universal solvent because more substances can be dissolved in it than in any other solvent. All activities in the body cells take place in a watery environment (Mita *et al*., 1992). The principle sources of water can be classified as Rain water, Surface water, Underground water and Sea water which are not fit for drinking purposes due to impurities. Bacterial contamination of natural water occurs mainly, by soil, air and sewage system. The diseases most often spread by contaminated water are typhoid fever, bacillary dysentery, asiatic cholera, amoebic dysentery and para typhoid fever (Yano, 1994).

Exposing water long enough to adequate concentration of different chemicals will disinfect it. Chemical disinfectants include oxidizing agents which comprise halogens, ozone and potassium peroxide. It also includes metal ions, principally silver ions (Nonaka *et al*., 1996). A disinfectant is any agent, which interferes with the metabolic activities of the bacterial enzymes or with the structure of bacterial cell and causes it to become moribund and eventually to die. It should be lethal to microorganism but non injurious to human and other animals. Heavy metals and their compounds act as anti-microbials by combining with cellular-proteins and inactivating them (Pelczer *et al*., 1986). They are fast and inexpensive and no special equipment is required for them. Some compounds of heavy metals that have anti-microbial activity are of Hg, Cu, Ag, Zn and As. Silver is used as silver nitrate, silver picrate and silver lactate. In aqueous solution they dissociate to form Ag^+ ions, which combine the proteins of a microorganism's protoplasm. The main objective was how, water born diseases can be reduced by silver nitrate.

Materials and Methods

The water samples were collected under aseptic conditions, in one litre sterile cotton wool plugged bottles from seven different localities of Lahore namely Samnabad, PCSIR laboratory, Shadbagh, Mozang Chungi, Ravi Road, Defence and Govt. College, Lahore. The bacteria in water were cultivated in petri-plates and test tubes. Dilutions of samples were prepared using sterilized saline water from 10^{-1} – 10^{-5}. Media for testing were prepared by dissolving all the ingredients in 1000ml distilled water and the media were sterilized with a high-press steam system (autoclave) at 121°C under 15 lbs pressure for 15 min.

Total viable count/ml: The pour plate method was carried out to estimate the number of living and infective bacteria. For this, nutrient agar medium was used containing g/l., peptone 6 gm, casein (hydrated) 4 gm, yeast extract 3 gm, glucose 2 gm, beef extract 1.5 gm, agar 1.5 gm and 1000 ml distilled water. Medium was poured in sterilized petri- dishes and cooled to solidify. Plates were then inoculated with 1ml, dilution of samples on the surface of agar medium. The finished plates were then incubated at 37°C for 24-48 hours allowing bacteria to develop into colonies. After incubating, the number of colonies was counted for 1.0 ml on each plate. One colony was supposed to be developed from a single bacterial cell was counted for 1.0 ml on each plate. Only one dilution resulted in separating the organisms sufficiently to yield an easily countable plate. Counting of bacterial colonies was under taken on that plate.

Coliform

Presumptive test: Coliform organisms were determined by standard multiple tube fermentation technique (De Man, 1977). Cotton plugged test tubes containing lactose broth medium consisting of g/l, meat extract 3.0, peptone 10, lactose 5.0, bromothymol blue indicator 1.0, distilled water 1000ml. After sterilization, the medium was cooled at room temperature. Test tubes were incubated at 37°C for 24-48 h, after inoculation. After incubation test tubes were examined for colour change and gas formation in the form of bubbles in Durhum tubes. The number of coliform organisms/100ml of water was determined by recording the number of fermentation tubes showing the presence of gas for each sample size and comparing this data with a statistical table. Most probable No. system (MPN) was used.

Treatment procedure of water by silver nitrate: Formula weight of silver nitrate is 180 g and it contains 108 g silver. Accordingly 1 g silver (in 1.6 g silver nitrate) was dissolved in 1L of distilled water. 1ml of this solution was added to one litre distilled water. Now each ml of this solution contained 1.0 μg silver or 1.6 μg silver nitrate. For treatment of a sample of water with silver at a concentration of 15 μg/L, 15 ml of this solution was added to the water sample. Similar treatment was done at 25 μg/L and 50 μg/L.

Results and Discussion

Total viable count and coliform varied from 38×10^5-135×10^5/ml and 6-53/100 ml in untreated water samples (Table 1). The highest microbial load was in water sample obtained from Ravi Road. The variation in the total viable count and coliform may be due to the poor sewage system, corroded pipes, sampling error and other factors.

Table 2 showed bactericidal effect of silver at the concentrations of 15 μg/L, 25 μg/L and 50 μg/L. The addition

Table 1: Determination of Total Viable Count and Coliform Bacteria in Untreated Water Samples

No of Obs.	Locality	Replicates	Total Viable Count/ml	Coliform (MPN)
1	Samnabad	3	116×10^5	44
2	PCSIR Laboratory	4	75×10^5	19
3	Shadbagh	5	128×10^5	53
4	Mozang Chungi	4	64×10^5	11
5	Ravi Road	4	135×10^5	150
6	Defence	3	92×10^5	16
7	Govt.College Lahore	4	38×10^5	6

Table 2: Effect of the Addition of Silver (15µg/l,25µg/l and 50µg/l) to Different Water Samples on the Microbial Load.

No of obs	Locality	Replicate	Addition of Silver at 15 µg/L		Addition of Silver at 25 µg/L		Addition of Silver at 50 µg/L	
			Total Viable Count/ml	Coliform (MPN)	Total Viable Count/ml	Coliform (MPN) Count/ml	Total Viable Count/ml	Coliform (MPN)
1	Samnabad	3	73×10^3	7	29×10^2	3	0	0
2	PCSIR Lab.	4	47×10^3	6	7×10	0	0	0
3	Shadbagh	5	79×10^3	9	31×10^2	3	1×10	0
4	Mozang Chungi	4	25×10^3	3	4×10^2	3	0	0
5	Ravi Road	4	84×10^3	12	37×10^2	6	0	0
6	Defence	3	61×10^3	3	3×10^2	6	0	0
7	Govt.College Lahore	4	19×10^2	3	3×10	0	0	0

All the samples were analysed 15 minutes after the addition of silver salt solution

of $AgNO_3$ solution decreased the microbial load in water. When the addition of silver (as silver nitrate) was done at a concentration of 25 µg/L, coliform were absent in some samples while microbial load was remarkably decreased in water sample. The detrimental effect of silver nitrate was maximum at this concentration, as no bacteria could be detected in almost all the water samples. This concentration of silver (as silver nitrate) when added to water will make water safe for drinking as it will be free from pathogens. Young (1961) pointed out that the good water supply must be adequate in large amounts at all times and seasons. It should be free from turbidity, colour, odour, taste and pollution. The methods chosen for water treatment and purification will depend on what needs to be done to the water.

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