Research Article

DISINFECTION OF WATER BY USING SODIUM CHLORIDE (NaCl) AND SODIUM HYPOCHLORITE (NaOCl)

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ABSTRACT

Safe water is vital for improving the health and quality of life and for alleviating poverty. Non–availability of safe and inadequate water in human settlements affects physical well being of the people especially living in rural / tribal area. Disinfection of water is the most essential single step which can prevent epidemics of water borne diseases. In the present research work use of Sodium Chloride (NaCl) and Sodium Hypochlorite (NaOCl) is made for the disinfection of water. It is observed that for 30 min. contact time percentage reduction in bacterial population was found 82.05 % by using Sodium Chloride (NaCl) and 89.74% by using Sodium Hypochlorite (NaOCl).

KEY WORDS Disinfection, Sodium Chloride (NaCl), Sodium Hypochlorite (NaOCl).

INTRODUCTION

Water is the most important resource and is vital for all life on the earth. The well-being and development of our society is dependent on the availability of water. The most precious resource is sometimes scarce, sometime abundant and is always very unevenly distributed.

Estimate of total amount of water available on the earth vary. The ocean which cover 70% of the surface area of earth and which have an average depth of 3.8 km hold as large as 97% of the earth's water, while 2% is frozen in ice caps. The deep ground water accounts for 0.31%. This 99.3% of water is no use to man. The remaining 0.69% represents the fresh water resource with which the man has to deal. Surprisingly, at any given instant of time, rivers and lakes hold only 0.3% of fresh water. In the ancient time human required for the drinking, bathing, cooking etc. but with the advancement in the civilization, the utility of water enormously increased. Water is the good carrier of disease, germ, and may be responsible for water born diseases. Therefore, water which is required by public should be wholesome and must be free from pathogens [(1)]. The water borne diseases are fall into five categories, according to the nature of organisms, causing disease viz. bacteria, protozoa, worms, viruses and fungi. The water born diseases are typhoid fever, paratyphoid fever, bacillary dysentery and cholera. Therefore it is very important that water works must remove the bacteria's from the water and make it wholesome.

The chemicals which are used for disinfection [(1)] are generally the chlorine compounds, chlorine may be applied in the form of compounds such as bleaching powder or hypochlorite, chloramines free chlorine gas and chlorine dioxide. The chemicals other than chlorine compounds are halogen, ozone, potassium permanganate [(2)] etc This present research work is carried out for the disinfection of water by using Sodium Chloride (NaCl) and Sodium Hypochlorite (NaOCl). Using these disinfectants, pathogenic bacteria from the water can be killed and made water safe for the user. These Disinfectants are easily available and economical.

MATERIALS AND METHODS

Sodium Chloride: The multiple chemical and physical properties of Sodium Chloride (NaCl) make possible 14,000 known uses. From the days of the cave men, humans have discovered ingenious means to use salt to enhance the quality of our lives. So valuable is this common mineral that wars have been waged and revolutions fought for access to salt. Its largest use is largely invisible to the public: about 40% of salt worldwide is used as the raw material that chemical companies transform into chlorine and soda ash, the foundations of inorganic chemistry. It can be effectively used for water disinfection.

Sodium hypochlorite (NaOCl): It is a compound that can be effectively used for water purification. It is used on a large scale for surface purification, bleaching, odor removal and water disinfection. Sodium hypochlorite is used on a large scale. For example in agriculture, chemical industries, paint- and lime industries, food industries, glass industries, paper industries, pharmaceutical industries, synthetics industries and waste disposal industries. In the textile industry sodium hypochlorite is used to bleach textile. It is sometimes added to industrial waste water. This is done to reduce odors. Hypochlorite neutralizes sulphur hydrogen gas (SH) and ammonia (NH_3). It is also used to detoxify cyanide baths in metal industries. Hypochlorite can be used to prevent algae and shellfish growth in cooling towers. In water treatment, hypochlorite is used to disinfect water. In households, hypochlorite is used frequently for the purification and disinfection of the house. By adding hypochlorite to water, Hypochlorous acid (HOCl) is formed:

$$NaOCl + H_2O \rightarrow HOCl + NaOH$$

Hypochlorous acid is divided into hydrochloric acid (HCl) and Oxygen (O). The oxygen atom is a very strong oxidator. Sodium hypochlorite is effective against bacteria, viruses and fungi. Sodium hypochlorite disinfects the same way as Chlorine does.

Presumptive Test [3] : This test is used to determine the most probable number (MPN) of coliforms (E. *coli*) present per 100 ml of water. In this test a series of nine tubes of lactose broth are inoculated with measured amounts of water to see if the water contains any lactose –fermenting bacteria that produce gas. If, after incubation gas is seen in any of the lactose broths, it is presumed that coliforms are present in the water sample.

In this MPN test, set up used is consist of three double strength lactose broth (DSLB) tubes and six single strength lactose broth (SSLB) tubes as per the quantities given in the table – 1

Table-1: Test set up

Set	No. of Tubes	Strength	ml of Media	ml of Sample
1	3	. DSLB	10 ml	10ml
2	3	SSLB	5ml	1ml
3	3	SSLB	5ml	0.1 ml

Fig.1: Test Tubes (MPN Determination)

After test set up, incubate the tubes at 35^0 C for 24 hours and examine the tubes to record the number of tubes in each set have 10% gas or more to determine MPN by using Multiple Tube Test standard table[3]. (Fig. - 1)

RESULTS AND DISCUSSION

The percentage reduction in bacteria population by using disinfectants NaCl and NaOCl for 10% concentration at different contact times are given in Table.2. The percentage reductions in bacteria population by using same disinfectants at different percentage concentration are given in Table.3. It was observed maximum reduction in bacteria for 30 minute onwards contact time, so 30 minute is an optimum contact time for both the disinfectants.

Also it was observed maximum percentage reduction in bacterial population at 10% concentration of disinfectants.Even at 3% concentration of NaOCl and 5% concentration of NaCl, they were found effective to reduce bacterial population above 70%. The effects of contact time on MPN Index per 100 ml for NaCl & NaOCl are as shown in fig. 2 & 3. The effects of different concentrations of disinfectants used on MPN Index per 100 ml are as shown in fig. 4 & 5. The percentage reduction in bacteria populations with contact time are as shown in fig. 6 & 7.

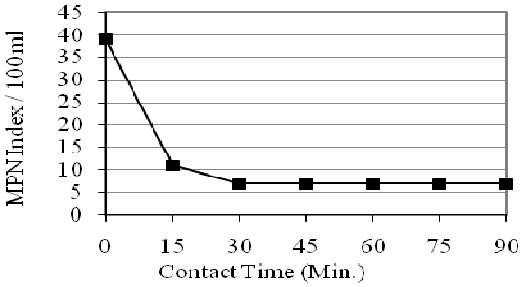

Fig.2: Effect of Contact Time on Disinfection (Disinfectant NaCl)

Table 2: Effect of Contact Time on % age reduction in Bacterial Population

Contact Time(Min)	0	15	30	45	60	75	90
% Reduction in Bacteria Population By using Disinfectant NaCl	0	71.79	82.05	82.05	82.05	82.05	82.05
% Reduction in Bacteria Population By using Disinfectant NaOCl	0	82.05	89.74	89.74	89.74	89.74	89.74

Table 3: Effect of Conc. of Disinfectant on % age reduction in Bacterial Population

% age Conc. of Disinfectant	1	2	3	4	5	75	7	8	9	10	11	12	13	14	15
% age Reduction in Bacteria by NaCl	64.1	64.1	64.1	64.1	71.8	71.8	71.8	76.9	76.9	82.1	82.1	82.1	82.1	82.1	82.1
% age Reduction in Bacteria by NaOCl	64.1	64.1	71.8	71.8	71.8	76.9	76.9	82.1	82.1	89.7	89.7	89.7	89.7	89.7	89.7

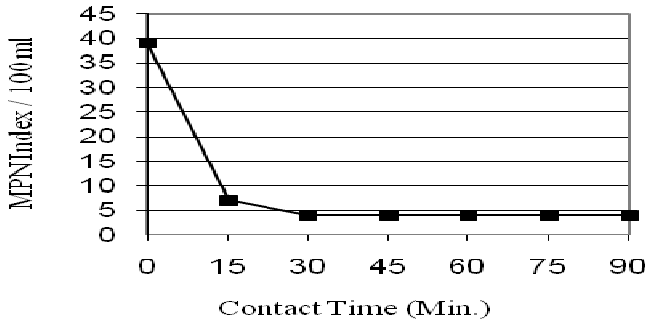

Fig.3: Effect of Contact Time on Disinfection (Disinfectant NaOCl)

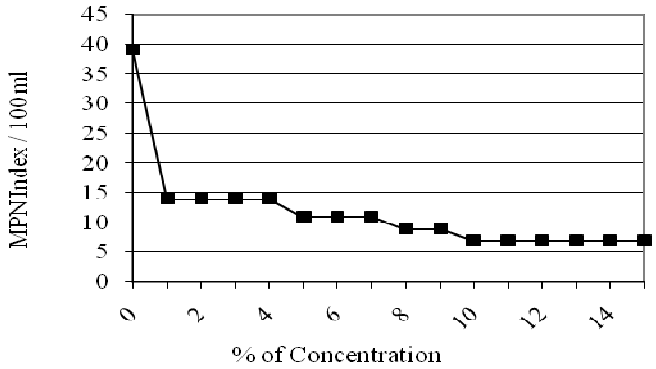

Fig.4: Effect of Different Conc. of Disinfectant (NaCl) on Disinfection

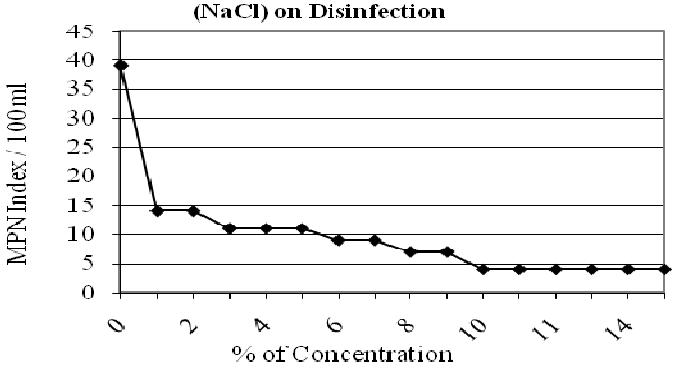

Fig.5: Effect of Different Conc. of Disinfectant (NaOCl)on Disinfection

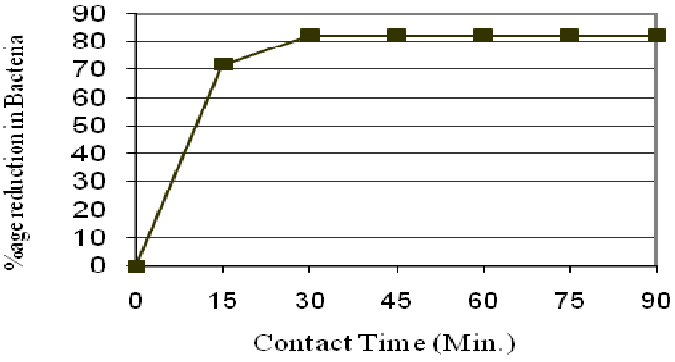

Fig. 6 : Effect of Contact Time on % age reduction in Bacterial Population (Disinfectant NaCl)

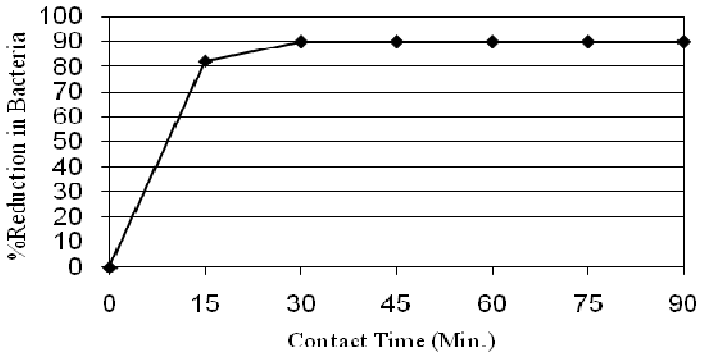

Fig. 7 : Effect of Contact Time on % age reduction in Bacterial Population (Disinfectant NaOCl)

CONCLUSION

Sodium Chloride (NaCl) and Sodium Hypochlorite (NaOCl) can be effectively use as a disinfectant. Using these disinfectants, pathogenic bacteria from the water can be killed and made water safe for the user. These disinfectants are easily available and economical.

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