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Keeping Quality of Drinking Water

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ABSTRACT The present study was undertaken to assess the disinfecting quality of various material for the purpose of evaluating the keeping quality of drinking water. The drinking water was stored in the container of copper, brass, earthenware, stainless steel and plastic and was contami-nated with sewage diluted to 10^4 times. Water sample were withdrawn from all these vessels to determine the bacterial population (MPN) of coli form organisms. Copper was the best material as the rate of decay of microorganism was highest in it followed by brass, earthenware, and stainless steel. Plastic had nastiest disinfecting quality so it is not good for water storage.

Water is the basic necessity of all living creatures and its important use is for drinking purpose. Man can live without food for two months, but can live only three to four days without water (Wright, 1960). Drinking water should be pure for consumption but majority of our population in our country is not consuming the pure water. Drinking water must be free from chemical substances and microorganisms, which might be dangerous to the health of the user. Sources of water like tube well, ponds, hand pump, tanks, rivers and municipal taps are sometimes contaminated with faecal matter, which make the water unhygienic. The basic problem of safe water supply and sanitation is yet to be solved. Utilization pattern of water is also not safe and healthy. Quality of water is poor, which it may be due to either inherent in sanitary water supply source or unhygienic water storage methods.

Many dreadful diseases and illness are associated with water, directly or indirectly. Impure drinking water leads to various water borne diseases, some of these diseases can even result in death (Park, 1994). Keeping this fact in mind, present study was undertaken with the objective to assess the bacteriological quality of drinking water stored in vessels of different material.

METHODOLOGY

Presumptive coliform count technique i.e. most probable number (MPN) was used for determining the number of microorganism present in the water. The vessels used for study were brass, stainless steel, copper, plastic and earthenware. Water was contaminated with sewage diluted to 10^4 times; 1 ml of sewage was added to 10 ml of sterilized water, and from this one ml was added to one litre of drinking water. At various time interval, water sample were withdrawn from all these vessels to determine the bacterial population (MPN) of coli form organisms. First day, the withdrawal of sample was done six hourly, second day twelve hourly and afterward 24 hourly. After withdrawal of water sample from the vessels they were immediately inoculated aseptically in lactose fermentation tubes. The water was stored in the vessels, until no organism could be detected from the sample consecutively for two times.

Ten ml of lactose broth was taken in the test tube; an inverted Draham's tube (small glass tube) was inserted in each test tube containing lactose broth. Mouth of these test tubes was covered by cotton plug. These test tubes (fermentation tubes) were sterilized at 15 Psig. Pressure at 121^0C for 15 min. With the help of sterilized pipette, sample water of 10 ml was inoculated aseptically, in double strength fermentation tube and sample water of 1 ml and 0.1 ml was inoculated in single strength fermentation tube as recommended by Standard method (1976). These inoculated fermentation tubes were kept in incubator at 35^0C for 48 hours. The manifestation of gas collection in Darham's tube indicated the gas production by microbes and hence was a positive indication of presence of coli form in sample water.

The number of positive finding of coli form group organism resulting from multiple portion decimal dilution planting was computed as the combination of positive and was recorded in

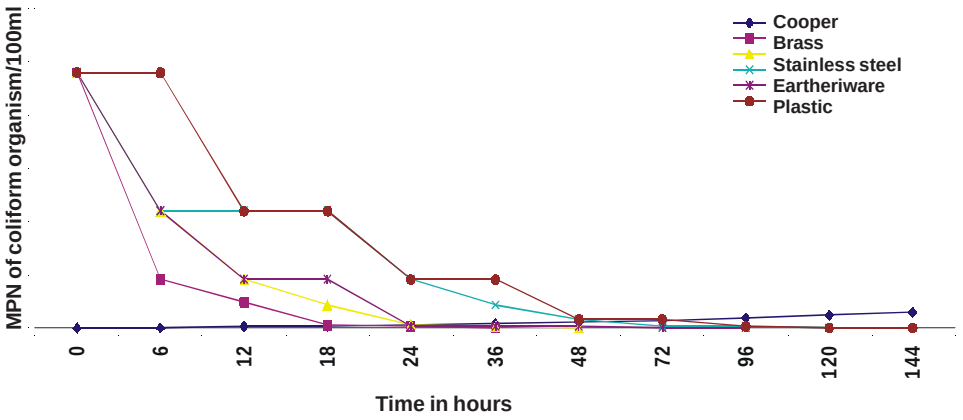

Fig. 1. MPN of coliform organism/100ml

Table 1: MPN of coliform/100 ml and log N/N_o value of contaminated water

	Time			*Copper*			*Brass*			*Stainless steel*			*Earthenware plastic*		
	a	*b*	*c*	*a*	*b*	*c*	*a*	*b*	*c*	*a*	*b*	*c*	*a*	*b*	*c*
0 hrs	3-3-3	2400	0	3-3-3	2400	0	3-3-3	2400	0	3-3-3	2400	0	3-3-3	2400	0
6 hrs	3-3-1	460	-1.6519	3-3-2	1100	-0.7801	3-3-2	1100	-0.7801	3-3-2	1100	-0.7801	3-3-3	2400	0
12 hrs	3-3-0	240	-2.3025	3-3-1	460	-1.6519	3-3-2	1100	-0.7801	3-3-1	460	-1.6519	3-3-2	1100	-0.7801
18 hrs	2-2-1	28	-4.5100	3-2-2	210	-2.4361	3-3-2	1100	-0.7801	3-3-1	41	-1.6519	3-3-2	1100	-0.7801
24 hrs	1-0-1	7	-5.8373	3-2-0	21	-4.7347	3-3-1	460	-1.6519	2-1-1	20	-4.7874	3-3-1	460	-1.6519
36 hrs	0-0-0	3	-6.6846	1-1-1	11	-5.3953	3-2-2	210	-2.4361	2-0-1	14	-5.1441	3-3-1	460	-1.6519
48 hrs				0-0-0	3	-6.6845	3-1-1	75	-3.4657	2-0-0	9	-5.5859	3-3-1	75	-3.4657
72 hrs							2-1-1	20	-4.7874	1-0-0	4	-6.3969	3-1-1	75	-3.4657
96 hrs							1-1-1	11	-5.3853	0-0-0	3	-6.6846	2-0-0	9	-3.4657
120 hrs							0-0-0	3	-6.6846				1-0-0	4	-5.5859
144 hrs													0-0-0	3	-6.3969
															-6.6845

a- MPN
b-Value of MPN
c-Log N/N_o value

terms of MPN. The MPN of variety of planting series and result was computed from statistical table (Standard Method, 1976).

Coliform Organism Reducing per hour

A semi log plot was made between the log N/N_0 and time as per the formula:

$$\text{Loge } N / N_o = kt$$

$$\text{Loge No} / N^{o} = -kt$$

Where, N and N_o is the coli form organism surviving at any time t and initial number of coli form in the vessel, respectively. K is the decay rate constant t is the time of contact. Log value of coli form organism reduced was calculated by plotting the semi log plot i.e. by plotting log N/N_0 against the time. Log N/N_0 was taken on Y-axis and time period t on X-axis.

RESULTS

It is clear from the table 1 and figure 1 that, there is decrease in MPN of coli form organism/ 100 ml in all the vessels. Decrease in MPN/100 ml of coliform organism was as follows:

Copper: With the storage of contaminated water in the copper vessel, there was decrease in MPN of coli form organism, after 6 hours. Within 36 hours of storage of water, the MPN of coli form

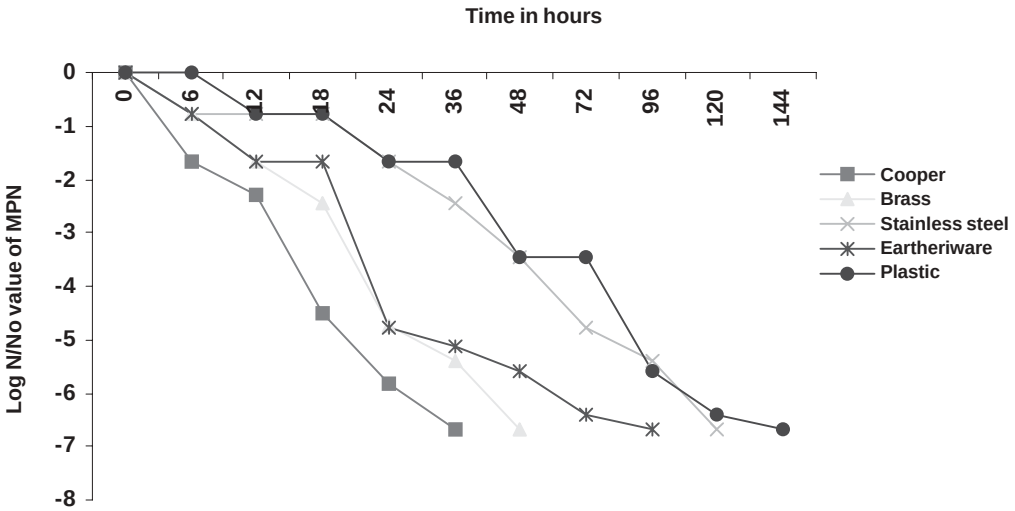

Fig. 2. Rate of decay of coliform organism/hrs

organism present in the water was negligible, which indicate that copper has disinfecting quality.

Brass: In brass vessel also, there was decrease in MPN of coli form organism after six hours of storage, and with 48 hours of storage, MPN of coli form was negligible this shows that brass also has disinfecting quality, but not as much as the copper.

Stainless Steel: In stainless steel, there was some decrease in the MPN of coli form organism after 6 hour of storage, and there was sufficient decrease after 24 hours, but it took 120 hours (5 days) to reach the state of negligible MPN of coli form.

Earthenware: In 6 hour of storage, there was some decrease in MPN of coli form organism, after 12 hours decrease in the MPN of coli form organism was quite fast, and after 96 hours (4days) this decrease of MPN of coli form organism was negligible. So earthenware also has some disinfecting quality.

Plastic: With the storage of water in plastic vessel, there was no decrease in MPN of coliform by 6 hours; decrease started after 12 hours and by 24 hours, there was significant decrease. After 144 hours (6 days) decrease of MPN of coli form was negligible.

On the basis of above it can be concluded that different materials has different water disinfecting quality. Highest disinfecting quality was for copper, followed by brass, earthen ware, stainless steel and least for the plastic. Whereas, in practice copper and brass were least used and plastic & stainless steel were maximum used by the users. Hence, the use of plastic and stainless steel should be avoided instead of it copper, brass and earthenware should be used.

Coliform Organism Reducing per Hour

A semi log plot was made between the log N/N_0 and time as per the formula (Fig. 2). For each vessel the initial number of organism was constant, whereas the number of coli form changed (reduced) every hour with each vessel. The value of log N/N_0 was calculated for all the time (Table 1). From figure2 value of k constant was calculated (Table 2)

Higher the value of k faster is the decay of coli form organism. Value of k in descending order for copper, brass, earthenware, stainless steel and plastic, which indicate that rate of decay of microorganism, was highest for copper followed by brass, earthenware, stainless steel and least for plastic. The storage of water in

Table 2: k value for different materials

S. No.	*Materials*	*K value*
1	Copper (k_C)	0.21/hour
2	Brass (k_B)	0.13/hour
3	Earthenware (k_E)	0.09/hour
4	Stainless steel (k_S)	0.06/hour
5	Plastic (k_p)	0.05/hour

copper, brass and earthenware vessels can disinfect the water to higher extent and thus eliminate the use of disinfecting chemicals. Plastic and stainless steel can disinfect the water to lesser degree, which was quite negligible, and hence not serving the purpose of disinfection.

SUMMARY

In order to disinfect the water i.e. to make it pure for drinking purpose, usually different chemicals were used, which some times have side effects also. Storing water in different materials, which have disinfecting quality, can also disinfect it. For this purpose copper was the best material as the rate of decay of microorganism was highest in copper followed by brass, earthenware, and stainless steel. Plastic had nastiest disinfecting quality so it was not recommended for water storage.

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