CHAPTER VII

TRADITIONAL KNOWLEDGE FOR DRINKING WATER TREATMENT
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Introduction

The greatest impact of water pollution on human health comes through drinking water, the source of which may be degraded by municipal sewage, storm water run off, cattle feed lot drainage and discharges from meat and poultry processing plants. Ground water used by about 60 million people is untreated or partially treated. Private to marginally treated public supplies is not always free from contaminants. Contaminated ground water supplies were responsible for over 50% of the water borne out breaks during the period 1940 – 1970.

Nearly 70% of the present global population lives in the developing parts of the world and since the rate of increase in the population in many such areas is also higher than in industrialized countries, the share of the third world population will have increased to almost 80% by the year 2000. Many developing countries either suffer from chronic shortages of fresh water or the readily accessible water resources available there are heavily polluted, mainly with domestic wastes. The larger proportion of the
population in developing countries lives in rural and suburban areas and conventionally treated drinking water is generally available in such settings. Even though urban centres in these countries have centralized facilities for conventional treatment of drinking water, the quality of such treated water is often suspect, either because of improper treatment or as a result of its contamination during distribution or storage. This lack of sufficient quantities of fresh water and the consumption of unsafe water are known to be responsible for a large proportion of the disease burden in these regions. Therefore, provision of adequate quantities of safe water for the growing population of the developing world has become a challenging task. Provision of safe drinking water in the home with in 15 minutes walking distance was one of the objectives of primary health care in the global strategy for the health of all by the year 2000.

Safe water is defined as water that does not contain harmful chemical substances or microorganisms in concentrations that could cause illness in any form. An adequate water supply is one that provides safe water in quantities sufficient for drinking and for culinary, domestic and other household purposes so as to make possible the personal hygiene of members of the household. A sufficient quantity of the safe water should be available on a reliable, year-round basis, near to or within the household.
where the water is to be used. The daily per capita consumption of drinking water in the rural areas of the developing world ranges between 35 and 40 liters. In urban areas where house connections are available the water consumption rate may be as high as 150 liters per day.

**Basic Considerations in Domestic Water Treatment**

The most desirable drinking water supply is one that requires no treatment at all. Unfortunately, the widespread pollution of water has rendered readily accessible sources of water undesirable for human consumption, without some degree of treatment. This is also true of ground waters in many areas of the world. In fact, in some tropical countries the combined influence of high population density, rampant pollution of available raw water that its treatment for drinking virtually accounts to waste water reclamation.

The general lack of sufficient quantities of safe drinking water in the developing world continues to be a serious problem; this is particularly true for rural and suburban communities. Thousand to two thousand years ago, people living in what are now developing regions had better systems of water supply than they do today. This is not only a reflection of the high priority ancient civilization has placed on this issue, but it is also an example
of development moving backwards. The increasing awareness of the importance of water in economic development is putting ever greater pressures on the best available water resources. Since new water resources are not available in many areas, there are fears of an impending water crisis. But very little information is available thus far on the removal and inactivation of harmful micro organisms by processes and devices which appear to show some promise.

The use of chlorine (in the form of calcium hypochlorite) is likely to continue as the most appropriate form of drinking water disinfection in rural communities of the developing world because of its relatively low cost, residual effect and broad spectrum of activity.

**Home Treatment Activities**

There are a number of devices that have been developed for home treatment of public water supplies. Such devices use a variety of basic process concepts [filtration, adsorption, ion exchange, reverse osmosis and distillation] to achieve a desired contaminant reduction. Water purifiers are treatment devices that must remove all types of pathogenic organisms from the water so that the processed water is safe for drinking. Inclusion of silver
as a bactereostatic agent appears to be of limited benefit in controlling the bacterial quality of the product water [Gorden, 1974].

Many communities boil their water before drinking which destroys a wide variety of infectious agents and requires wood. The increasing shortage of burning wood makes this method undesirable unless alternate sources of energy are available. The use of solar energy shows some promise in this regard. The use of a variety of devices for the in–home filtration / or disinfection of water is rapidly increasing in many parts of the developing world and greater efforts are required to control their quality and assess their suitability for tropical settings.

Providing safe drinking water can immediately and dramatically improve the health of many communities and can also lead to the elimination of serious diseases. Any attempt at providing safe and adequate quantities of water to the developing regions of the world must be properly integrated with other aspects of development such as sanitation and education. Many developing countries either suffer from chronic shortages of fresh water or the readily accessible water resources available there are heavily polluted, mainly with domestic wastes.
Having a clean, safe supply of drinking water is still not possible in our towns and cities. Most of us either install a water filter or boil the water we drink to stay away from water borne diseases. Existing health risks from poor quality water are even higher in a country with greater water consumption. Water purification according to methods applied in public drinking water treatment facilities are not fit for native household. The United Nations warns that unless action is stepped up the number of people without access to safe water will increase to 2–3 billion by 2005, with the number of those who die from unsafe water expected to jump sharply as well. How did people manage in the past? What were the traditional ways of purifying water before drinking it?

One way mentioned as early as in the Sushrutha Samhita is using the seeds of the Nirmali tree [Strychnos potatorum]. [Gorden, M] These seeds are rubbed on the inner walls of the khada [Matka] before water is poured into it, so that once the water is poured in, it will purify it. The ripe seeds are used for clearing muddy water. They are reported to be very effective as coagulant aids. Alum added by the seeds has been found to be very effective in removing the suspended impurities from coal washing wastes. The clarification is due to the combined action of colloids and alkaloids in the seed. The albumin and other colloids sensitize the suspension, and the
Coagulation is then caused by the alkaloid ions. The trees are found in the deciduous forests of Andhra Pradesh and Kerala.

In Sushruta Samhita, it is also said that the seeds of drum stick tree are also used as water purifiers. Research shows that these seeds known as Moringa seeds can replace the costly alum used in most water treatment plants used today. These seeds are so effective that just 30 seeds can purify as much as 40 liters of water. At present, the Universities of Malawi [Africa and Leicester [U K] are carrying out a conjoint research study on how Moringa seeds can be used to meet contemporary needs.

In certain parts of our country copper bottomed vessels were used for storage of water. In other parts of India, such as Kerala wells were regularly cleaned by throwing in burnt coconut husks, Tulasi leaves and amala wood have also traditionally been used for water purification.

People of Kerala have used plants like Brahmi, Lagenandra [Kinar vazha], etc. into their domestic wells to purify water. They can be used in cases of moderate pollution only. Fishes like Carp, Channa, Tilapia, etc. were used to treat water in open wells.
Bentonite and Kaolinite clays were also found to be helpful in water purification. Activated charcoal and bone char also are reported as water treatment components.

The tribal people of Wayanad, Kerala have their own culture and indigenous knowledge. They construct a structure called keni to conserve water. They used barks of Nelli, Pana, Angili, etc. trees to make kenis. They were planting Acorus calamus near the springs which will purify the water.

The traditional technologies for drinking water treatment has been practiced in many parts of India, Africa and South America. The preliminary aim of water purification is to remove any potentially dangerous chemicals or microorganisms and also to render the water aesthetically appealing. The drinking water should be free of colour, odour, turbidity and microorganisms.

In Western Sudan, rainwater is stored in the live, hollowed out Tibaldi trees. This tree is thought to produce bactericidal substance that leaches into the stored water. A hole is made in the trunk at the level of the first branches, and the inside of the tree is dug out for the water storage area. After filling the tree with rain water, the opening is closed with a mixture of soil and animal dung. The water can be stored in this way for long periods.
and is still potable up to ten years. The tree is not damaged by this use. Chinese folklore texts from the 19th century refer to water clarification using the sap from the ‘funa’ cactus [Opuntia fiscus indica]. The traditional use of the M. olefera seeds for domestic household water treatment has been limited to certain rural areas in Sudan. Village women collecting water from the River Nile would place powdered seeds in a small cloth bag to which a thread is attached. This would then be swirled around the turbid water. The powdered seeds attach themselves to and bind between the suspended particles forming solids which would then be allowed to settle prior to boiling and subsequent consumption of the water.

Ruwaq is a form of bentonite used by villagers of Sudan for the treatment of turbid water. Many rural people use sand and rice hull ash filters for filtering drinking water. In Indonesia, water filters made of fibrous materials like coconut husk and charcoal from rice hull are in practice for the treatment of drinking water.

Existing health risks from poor quality waters are even higher in a country with great water consumption. Water purification according to methods applied in public drinking water treatment facilities are not fit for native households. Providing safe water can dramatically and immediately improve the health of many communities and can also lead to the
elimination of serious diseases. Many developing countries either suffer from chronic shortage of fresh water or the readily accessible water resources available there are heavily polluted, mainly with domestic wastes. Hence, it is essential to develop an eco-friendly home treatment method for purifying drinking water that can be adopted by common man.

**Methodology**

It is believed by the people of India that when Rudraksham (Elaeocarpus sphaericus) is put in a glass of water before going to sleep and in the morning, drink the water, no illness will occur. Rudraksham, which has five faces (panchamukhi) and taken from the tree directly are used for this purpose. In North India, a lot of research has been conducted about the Rudraksham. It has electromagnetic properties. Our ancestors have given a sacred place for Rudraksham. It is believed that Rudraksham is Lord Siva himself [Mohan Makkar, ] [Rajappan Nair, 2004], [ Narain Bhatia,2004). The traditional knowledge prevalent among the people of North Malabar for purifying well water is to put a powdered mixture of Gooseberry (Emblica officinalis), Muthange (Cyperus rotendus) Vertiver (Vertiveria squarosus), Thettamparal (Strychnos potatorium) Kudangal (Centella Asiatica), and grains of Amaranthus, wrapped in a cloth bag [Sree kumar et al., 2006].
Experiments were carried out in the laboratory to find out the efficiency of Rudraksham and the mixture of plant materials in improving the water quality.

MATERIALS USED FOR WATER TREATMENT

(a) Rudraksham (Elaeocarps sphacricus)

This tree is found in the Himalayas. This is commonly known as the rosary nut and the fruits are used as medicine for a variety of diseases. The alkaloids present in Rudraksham are iso elaeo carpilin, elaeo carpilin, elaeo carpidine and iso elaeo carpin. It is used as medicine for small pox, chicken pox, measles, hypertension, mental tension and vata-pitha doshas.

(b) Strychnos Potatorum [Thettamparal]

The Sanskrit name is Nirmala, which means that purifies. The tree is found to be present in the deciduous forests of Kerala [Marayoor], Maharashtra and Andhra Pradesh. An alkaloid namely diabolin is separated from it. Other constituents are b – cita sterol, stigma sterol, oleanoic acid, 3-b-acetate, suphanin, galactose, mannose4, etc. It has been used as medicine for eye diseases, diabetis, leprosy, etc. It can cure kapha-pitha diseases.
(c) Emblica Oficinalisis [Goosberry]

It is rich in Vitamin C. It is used in Ayurveda treatments as a resayana medicine. It contains large quantities of pectin, Vitamin C, B complex, calcium, iron, gynic acid, tannic acid, resin, sugar, carbohydrate, protein, albumin, cellulose, etc. It is used to cure vata – pitha –kapha diseases, hyper acidity, diabetis, etc. It can give coolness to the eyes and increases eye sight. It can give strength to nadis and increases intelligence.

(d) Vertiveria Squarosus [Ramacham]

The roots contains a –vertivone and b – vertivone. It also contains khusol, iso – bisobolin, C -14 –Ketone, cisanoin, livogaisol, epi cisanoic acid, etc.

(e) Cyperus rotundus [Muthanga]

It contains carbohydrate, sugar, resin, albumin, perfumed oil, alkaloids, etc. It is used as medicine.

(f) Centella Asiatica [Kudangal]

It is used in Ayurveda medicine. It contains amino acids, aspartic acid, glycine, glutamic acid, phenyl alanin, etc. Its ash contains chloride,
phosphate, iron, calcium, magnesium, sodium, etc. Gacitosterol is isolated from kudangal. It is used to cure kapha – pitha diseases.

(g) Amaranthus (Grain)

The grains of amaranthus is also used for water treatment after grinding well. Experiments conducted in the laboratory shows that it can destroy bacteria (E.coli and Streptococci).

RESULTS AND DISCUSSION

Goseberry, Ramacham, Muthanga, Amaranthus grain, Thettamparal and Kudangal are taken in equal quantities ground well, wrapped in a cloth bag sterilized and put in the well for water purification. 50g of the mixture is needed for a normal well. The quantity of mixture can be increased according to the rate of pollution. This mixture can be applied in the case of well water samples, whose hardness is very low because the mixture increases hardress slightly. Strychnos potatoum can be employed for water treatment. Recent studies revealed that it can remove all the dissolved constituents from water and destroy bacteria. Studies were conducted in the laboratory to find out the efficiency of this nut. The study revealed that it can destroy E coli and Faecal streptococci from water. It can be employed to treat the well water samples whose hardness values are higher.
Experiments conducted in the laboratory shows that maximum reduction of bacterial density occurs within 1 hour time period with the mixture. Presence of Amaranthus grains in the mixture increases the rate of bacterial removal.

Experiments were conducted in the laboratory to find out the efficiency of Rudraksham in water treatment. Panchamukhi Rudraksham [which has 5 faces], taken fresh from the tree has been used for the study. Experiments conducted in earthen pot gave better results than using glass vessel. One Rudraksham which has a weight of approximately 3 gm is placed in a glass of water before going to sleep. In the morning, after removing the Rudraksham and the water can be used for drinking purposes. The results of nine days’ analysis are given in the Tables 7.1 and 7.2. The salient findings are given below.

(i) pH has been found to be neutralized (ie.7) irrespective of it was acidic or alkaline before

(ii) There was a slight reduction in conductivity, and inorganic constituents like hardness, alkalinity, chloride, etc.
(iii) There was reduction in MPN index, the density of E. coli and Faecal streptococci were also found to be reduced. The reduction has been found to be maximum within 1 hour time period.
Table 7.1

Treatment of water using Rudraksham in earthen pot same Rudraksham has been used for all the days

Wt Rudraksham = 3gms (1no)
Vol of water = 700ml

<table>
<thead>
<tr>
<th>After 15hrs.</th>
<th>1st day</th>
<th>2nd day</th>
<th>3rd day</th>
<th>4th day</th>
<th>5th day</th>
<th>6th day</th>
<th>7th day</th>
<th>8th day</th>
<th>9th day</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pH</strong></td>
<td>7.1</td>
<td>7.6</td>
<td>7.4</td>
<td>7.2</td>
<td>7.3</td>
<td>7.2</td>
<td>7.5</td>
<td>7.2</td>
<td>7.1</td>
<td>8.2</td>
</tr>
<tr>
<td><strong>EC</strong></td>
<td>70</td>
<td>60</td>
<td>60</td>
<td>70</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td><strong>Total Hardness</strong></td>
<td>9</td>
<td>8</td>
<td>13</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td><strong>Alkalinity</strong></td>
<td>18</td>
<td>10</td>
<td>10</td>
<td>15</td>
<td>14</td>
<td>17</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td><strong>Chloride</strong></td>
<td>26</td>
<td>25</td>
<td>25</td>
<td>24</td>
<td>18</td>
<td>17</td>
<td>17</td>
<td>24</td>
<td>19</td>
<td>26</td>
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<tr>
<td><strong>Iron</strong></td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td><strong>MPN / 100ml</strong></td>
<td>1100</td>
<td>210</td>
<td>210</td>
<td>120</td>
<td>120</td>
<td>43</td>
<td>43</td>
<td>28</td>
<td>28</td>
<td>≥2400</td>
</tr>
<tr>
<td><strong>E coli</strong></td>
<td>+Ve</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+Ve</td>
</tr>
<tr>
<td><strong>Fecal streptococci</strong></td>
<td>1100</td>
<td>210</td>
<td>210</td>
<td>93</td>
<td>93</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>≥2400</td>
</tr>
</tbody>
</table>
Table 7.2
Experiments with the mixture after 1hr in glass vessel

Wt mixture = 30gm.
Vol of water = 1000ml

<table>
<thead>
<tr>
<th>After 1hour</th>
<th>Mixture in glass vessel</th>
<th>Mixture put in clay pot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>After Treatment</td>
<td>Control</td>
</tr>
<tr>
<td>pH</td>
<td>8.5</td>
<td>6.7</td>
</tr>
<tr>
<td>Ec (Micro mhos/cm)</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>MPN / 100ml</td>
<td>28</td>
<td>2400</td>
</tr>
<tr>
<td>Fosecal streptococci</td>
<td>20</td>
<td>2400</td>
</tr>
</tbody>
</table>