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Chemistry

WATER TREATMENT TECHNIQUES SYSTEM IN ANCIENT INDIAN CULTURE

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ABSTRACT The ancient Indian custom of storing drinking water in brass vessels for good health has now been proved scientifically by researchers. Microbiologist affirm that water stored in brass containers can help combat much water borne diseases and should be used in developing countries rather than their cheaper counterparts' i.e. plastic containers.

Water is an essential renewable resource, increasing population, deforestation and degradation and desertification, soil and water pollution and the effects of climatic change and consequences such as droughts, changes in weather pattern has ultimately increases the demand for fresh portable water. Thus the need for reclamation of used water has been realized. Author has given more priority to water purification techniques in terms of preliminary, primary and secondary levels including the final polishing to meet the acceptable standards for reuse.

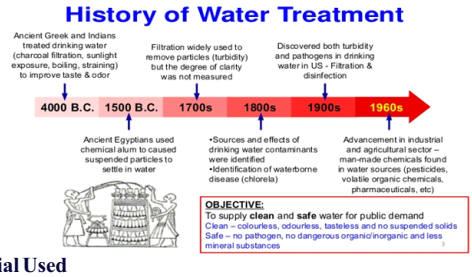
KEYWORDS :

INTRODUCTION

Ancient India is often called the Harappan Civilization because one of the ancient cities was called Harappa. Harappa was just one of 1500 cities in the Indus River Valley. Another well-known city is called Mohenjo-Daro. Historians estimate Ancient India to be the biggest of all four early civilizations. This civilization was not discovered until the 1920's CE, and much of this civilization remains a mystery. One reason the Indus Valley civilization is so mysterious is because historians have not been able to translate their complicated written language called Indus Script. There are thousands of artifacts with 400-600 different written symbols. Most of these symbols were pressed into soft clay with seals. A seal is similar to a stamp that makes an impression in the soft clay. Seals are sometimes in a cylinder shape so they can be rolled on the clay. Indus Script symbols have been discovered in mespotamia, this suggests they maintained a regular trade.

Ancient Sanskrit and Greek writings recommended water treatment methods. Dating back 6,000 years such writings describe early water treatment as: "Impure water should be purified by being boiled over a fire, or heated in the sun or by dipping a heated iron into it and then allowed to cool, or it may be purified by filtration through sand and coarse gravel." The Susruta Sanhita, Sanskrit writings about medical concerns, dates from approximately 2000 B.C. and offers evidence of water treatment (Kathy, 2006). Paintings on Egyptian tombs dating to 1500 B.C. showed men filtering water using wick siphons. Egyptians at this time also reported to have used the chemical alum to assist in settling particles and improve the clarity of water. The Egyptians repeatedly used the chemicals like alum and differs from variety of clays, bauxite or alum from alunite known today potassium alum ($K_2SO_4.Al_2(SO_4)_3.24H_2O$), Sodium alum($Na_2SO_4.Al_2(SO_4)_3.24H_20$), Chrome alum ($K_2SO_4.Cr_2$ $(SO4)_3.24H_2O$), Ammonium alum ($NH_4Al(SO_4)$. $12H_2O$).These coagulants are still used nowadays. (Bharthi,2000).

Water is an essential renewable resource, increasing population, deforestation, soil degradation and desertification, soil and water pollution and the effects of climatic change and consequences such as droughts, changes in weather pattern have ultimately increases the demand for fresh potable water, thus the need for reclamation of used water is being realized. Several countries successfully recycle the water up to the consumable standards. Through worsen the surrounding it varies depending on the treatment systems, limiting the uses, public acceptance. Social and health related controversy is still an international issue. Increasing population and urbanisation increases the need of sophisticated techniques to handle waste water, in many areas contamination of harmful industrial or municipal waste water in to drinking water ways created severe threat to the society, or unsanitary waste water discharging practices have worsen the surrounding environment due to odour, providing sink for pathogens, breeding grounds for mosquitoes and other vectors.



Material Used

To disinfect water, many ancient cultures would use copper, iron or hot sand in conjunction with boiling it. Herbs were often used in well filtration, such as amla, which is high in vitamin C, and khus. Plants were sometimes used to purify water, such as water lily roots and the seeds of the nirmali (Strychnos potatorum).

In ancient Egypt, aluminium sulphate, iron sulphate or a mix of the two was used to extract suspended solids. In Greece, a fabric bag, called the Hippocrates Sleeve, was used to strain water before boiling it. In ancient India, sand and gravel were used to filter water before boiling it. This method was from the Sanskrit manuscript called the Susruta Samhita.

How Water Was Judged

Ancient civilizations didn't know about tasteless toxins that can grow in water. The main way of testing water purity was through its clearness, taste and odour.

Storage

Certain metals disrupt bacteria cycles, including copper. In ancient India, brass, an alloy of copper and zinc and sometimes with other metals, was used to store water. The ancient Greeks and Romans used basins or reservoirs as a means to let particles settle out of water.

Considerations

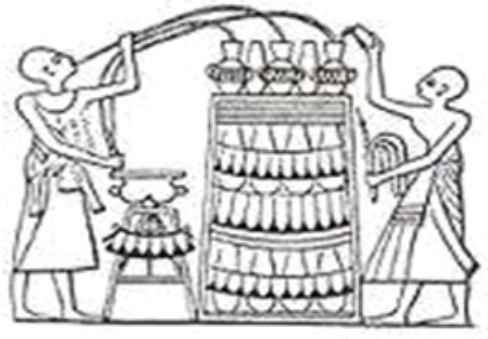
Indians, Romans,are used aqueducts to keep water pure. When these cultures fell, water purification advancements were halted. Hundreds of years later, in 1627, Sir Francis Bacon began to experiment with salt water purification. He tried to remove salt from water using sand, and though he failed, he helped to restart interest in water filtration.

Water purification methods:

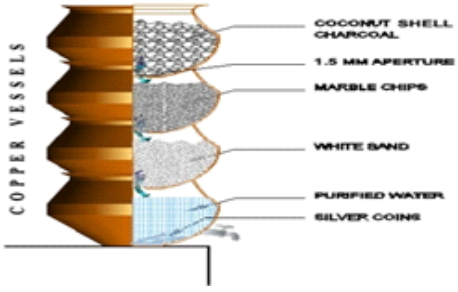
As far as water purification methods are concerned those involving naturally occurring substances such as mixtures of herbs including Amla and vetiver were used. These herbs used introduced in water in wells for purification purposes. Other methods used for water purification, based on herbs and naturally occurring products and materials are nirmali seeds, rhizomes of algae's, roots of water lily and different types of stones such as quartz crystals, garnet and peals.

Water is a rare commodity in certain parts of India. There is a proverb in Tamil, "Treat Water as Precious" – "Neeraiyum Seeraadu". Villagers have to walk miles together just to get some water for their day to day essential use. Even that water is murky or muddy. Indian literature is full of stories about mass migration due to big droughts. We read about the droughts and migration in Vedic literature and later Tamil literature. Indus valley civilization was also affected by acute drought. Mahabharata described the drought in Saraswati River basin and how the Brahmins moved out of that area. I have collected all the references to drought in the Vedas and Tamil literature for my research.

Even in the areas where water is available, there were certain periods of acute scarcity. So the ingenious people have found out some techniques for water purification. Usually they dugout water springs in the dry river beds or some places identified by the trees. The villagers living in arid areas will be benefitted if they follow ancient scriptures. In African countries they use the seeds of Moringa oleifera, a common vegetable used in South India.



Hippocrates: Father of water Filters makers



common man's water Filter Change

Moringa oleifera = Drum stick tree = Murungai Kay in Tamil

Among all the plant materials that have been tested over the years, power processed from the seeds from Moringa oleifera has been shown to be one of the most effective as a primary coagulant for water treatment and can be compared to that of alum (conventional chemical coagulant) (Madsen et al, 1987; Oslen, 1987; Postnote, 2007).

For disinfection purpose, boiling was considered to be the best method followed by exposure of water to sunlight or introduction of water in iron and copper pots. It is well known that copper interferes with the lifecycle of bacteria. Infact the use of brass container to store the water was already a common practice in ancient Indian civilisation. By 2000 B.C., the people of india were filtering water through charcoal and persevering it in copper pots.

During the 1700's, filteration was established as an effective means of removing particles from water. From these modest beginnings the thought for better, safer and more plentiful drinking water was evolved. But the transition from an individual household water purification to community level took many centuries. In 1685, a physician published the first known illustration of sand filters, and by the mid-1700s, described a water filter using carefully placed graded layers of sand and gravel.

An intermittent slow sand filter was constructed and operated at Lawrence, Massachusetts in 1893 due to continuing typhoid fever epidemics caused by sewage contamination of the water supply (Baker, 1981).

During the late nineteenth and early twentieth centuries, scientists discovered that turbidity was not only the reason of water contamination but the actual reason was the particulate matter such as faecal matter, could harbour many pathogens. Therefore, the design of most drinking water treatment systems built during the early 1900s was driven by the need to reduce turbidity.

While filtration was a fairly effective treatment method for reducing turbidity, disinfectants like chlorine that played the largest role in reducing the number of waterborne disease outbreaks in the early 1900s. In 1908, chlorine was used for the first time as a primary disinfectant of drinking water in Jersey City, New Jersey. The use of other disinfectants such as ozone also began in Europe around this time. (EPA, 2000).

In the 1970s and 1980s, improvements were made in membrane development for reverse osmosis filtration and other treatment techniques such as ozonation. Some treatment advancements have been driven by the discovery of chlorine-resistant pathogens in drinking water that can cause illnesses like hepatitis, gastroenteritis, legionnaire's disease and cryptosporidiosis. Other advancements resulted from the need to remove more and more chemicals found in sources of drinking water.

Today, a variety of methods are used for household level water purification like coagulation, flocculation, sedimentation, filtration, membrane filtration, Reverse Osmosis, Nano Filtration, Adsorption, Ion Exchange, Disinfection, etc. World Health Organization now endorses effective household water treatment as a means of achieving the health gains associated with safe drinking water to those not yet served by reliable piped-in water.

Potassium Permanganate Water Treatment

Potassium permanganate, or KMnO4, is a common inorganic chemical used to treat drinking water for iron, manganese and sulphur odours. It can be used as a disinfectant as well, keeping drinking water free of harmful bacteria. Drinking water facilities commonly use potassium permanganate in the early part of the disinfecting process to reduce the amount of later disinfectants, like chlorinated compounds, that must be used.

Iron and Manganese Removal

If the amount of oxygen in drinking water is low, iron and manganese may stay in the solution. Both metals cause dark colours in drinking water that may be harmful to plumbing fixtures and laundry. Potassium permanganate is commonly used to remove them. Potassium permanganate oxidizes iron and manganese, causing the metals to precipitate out of the solution. Iron is converted from a ferrous--two-plus electrons--to a ferric state--three-plus electrons), while manganese is converted from a two-plus to a four-plus state. This

reaction takes about five to 10 minutes in drinking water that has a pH at or above 7.00.

Odour Control

Organic matter can cause unpleasant odours in drinking water. Examples of this can be found especially in water taken from a lake or a well. Potassium permanganate can be used to neutralize these smells and disinfect the drinking water at the same time. KMnO4 can be found at chemical warehouses or pool stores for use in treating drinking water. The pure form can be toxic and dangerous. A professional in the water treatment and regulation field should be consulted before self-treating any drinking water.

Control of Nuisance Species

Potassium permanganate has been found to control some species of fresh water mollusks that pervade drinking water reservoirs. According to the Environmental Protection Agency, juvenile Asiatic clams can be controlled at a potassium permanganate concentration of 1.1 to 4.8 mg/L. It is also useful for killing zebra mussels, another invasive species. The concentration needed for this is approximately 0.5 to 2.5 mg/L.

Reducing Disinfection By products

Potassium permanganate is very valuable as a drinking water disinfectant. Unfortunately, it is not as cost effective as other more widely used disinfectants, like chlorinating reagents. The by-products from these various chlorinating reagents can be harmful at high levels. Minimizing their production is essential for all drinking water treatment purposes. When used in the first treatment step, potassium permanganate oxidizes the organic compounds that tend to create harmful by-products later in the process. This is one way in which water treatment plants can effectively use permanganate and chlorinating reagents together cost effectively.

The Treatment Process

Water treatment specialists determine the appropriate concentration of the potassium permanganate solution for the specific drinking water they're treating. This solution is then injected into the treatment plant's water intake, or where the source water enters the system. This can be a tube, reservoir or other water containment device. The point of injection is far enough away from the water filters to allow time for the potassium permanganate to react sufficiently with the iron, manganese and organic matter. This way when the drinking water reaches the filters, all precipitate from the permanganate reaction will be removed. The water then continues through the rest of that facility's treatment process.

Water: The ancient Ayurvedic masters have recognized the importance of pure water in the maintenance of good health. Water has been recognized not only as making a positive contribution to Man's health and well being in assisting him to create a clean and healthy environment but also a potential hazard when acting as a vehicle for water borne and water related diseases. Hence we find that details of diseases spread through poor quality of water were included in the great ancient ayurvedic works like “Caraka Samhita”, “Susruta Samhita”, “Astanga Sangraham”, “Bhavaprakasham” etc. Many verses in these works deal with the relationship between quality of water and health. Caraka described the characteristics of contaminated water as:

“Picchalam Krimilam Klinnam Pana Saivalakardemaih Vivarnam virasam sandram durgandham nahitamjalam”

Which means that water that is viscous or oily, contaminated with worms, microorganisms, leaves, moss, and mud, spoiled in taste and colour, foul, smelling and stagnant are unwholesome and unhealthy. This statement is strikingly similar to that of the present concept of wholesome and palatable water described in modern medical texts as “To be wholesome water must be free from disease causing Organisms, poisonous substances, and excessive amount of mineral and organic matters are to be palatable it must be significantly free from colour, turbidity, taste and odour well aerated”.

Contaminated water according to Vaghbhata causes many diseases pertaining to throat, alimentary canal, digestion, flatulence, cough, fever, goiter, skin diseases etc. One get more surprised again to learn about the purification of water by heating, boiling and filtration suggested by Susruta and Vaghbhata. Bhavamisra while referring Susruta says that water which is constantly in touch with the sun-rays during the day time and moon rays during night time is called “amsudakam”, and can thus become wholesome and palatable. We now know that exposure to sunlight is effective in destroying the bacteria, primarily because of the ultra-violet rays. Bhavamisra also recommends the addition of some aromatic compounds derived from some plants, certain minerals and metals for purification and improving the palatability of water.

Bhavamisra also describes in details the seasonal variations in the quality of rain water and its properties. It may be pointed out here that the modern scientists understood this seasonal variations in the quality of rain water very recently only. In a world faced with water pollution and shortage of potable water, it will be worthwhile to have serious look into the methods of water purification described by these ancient Ayurvedic masters. Their methods of water purification are scientific and cheaper, free from any toxic effects since no toxic chemical treatment is involved and therefore, will be wholesome and palatable.

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