

A Novel Approach towards Reuse of Waste Water and Brief Study of Water Purification

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ABSTRACT: *water is the most essential part of our life. without water, life is not possible on earth. It is assumed that useful water present on earth is limited but unfortunately, wastage of water is also increasing day by day. In this research work, a brief discussion is done regarding methods and techniques of water purification along with the information about the situations in which specific method is used. A novel approach is suggested in this research work in order to recycle the use of waste water that can control the usage of water ultimately. From future perspective, the purposed technique can be used at a large scale in domestic areas and in public areas as well.*

KEYWORDS: *Methods of water purification, Membrane, Role of water in life, Waste Control, Uses of water, Treatment, Consumption.*

1. INTRODUCTION

Water is as essential as oxygen for all living beings on earth. Without water life cannot be imagined. In our daily life water is used in many ways such as personal use like drinking cooking bathing, cleaning, clothes wash, dish wash, car wash. Except these at commercial level, water is being used in construction, hydroelectric plants, in water parks, in sewage treatment, irrigation and agriculture fields, production of water based products, in medical and hospitals, in hotels swimming pools and in many more places. However, with all the uses of water there are two things that requires a strict focus. In Figure 1, a sequential water cycle is shown in which three main steps are illustrated. These two points are:

- Wastage of water
- Towards the treatment of waste water

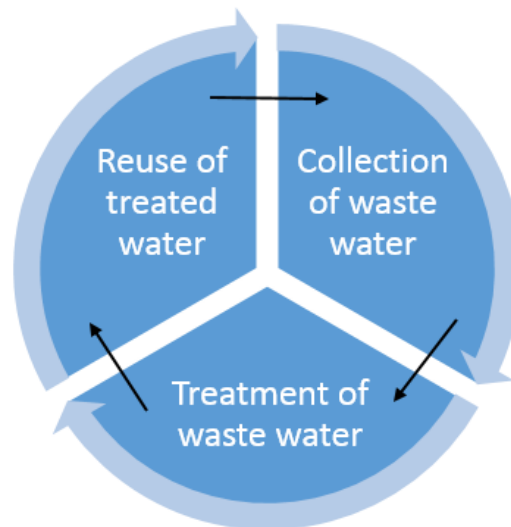


Figure 1: Water Re-Cycle

These three steps are the role changing techniques in context of water recycling process which can be used at domestic as well as industrial places and water can be saved.

1.1. Contamination of Water

The addition of any kind of impurities in to pure form of water, is known as contamination of water and the water with impurities is called contaminated water. Contamination can be done by many factors. The outlet pipes from domestic areas and residential homes, industries and factories releases contaminated water outside in environment. The quality of this contaminated water is so low that if someone drink it may die immediately because this contaminated water attack internal body parts of body and damage the intestines and other functional organs such as stomach, digestive system etc. There are many factors that are responsible for contamination of water such as:

- Micro biological pathogens present in water.
- Harmful chemicals excreted from industries and get mixed in water.
- Various natural chemicals that are found in environment, that pollute water.

Presence of these infectious particles can damage health and cause severe issues. Thus various methods are going to be discussed in this paper in context of purification of water. Figure 2 shows various treatment and purification of water methods in a pictorial view.

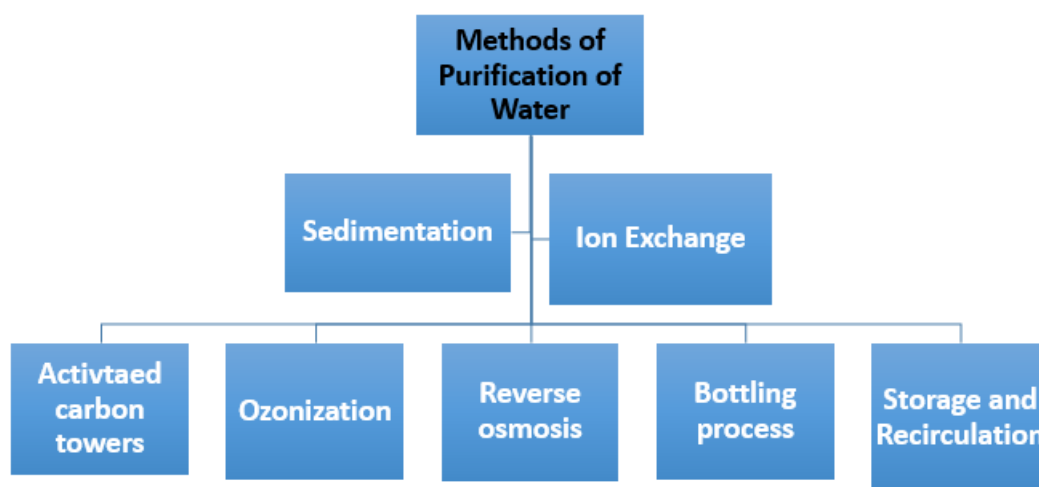


Figure 2: Various Method of water purification.

These are some commonly used methods for the purification of water. The most common is reverse osmosis (RO) by majority of people these days.

1.2. Various Techniques of Water Purification

This section covers, the brief description of various types of methods used for the purification of water. Every method has its own, effectiveness and resultants. Some of the impurities can be filter out by some specific method where on the other hand, other methods are able to filter out some other impurities. Some commonly used methods are listed below as:

1.2.1 Boiling:

Boiling is the basic method that is used to kill microorganism presents in water. It is quiet effective and used from ancient times. According to World Health Organization, in order to kill the microorganisms from a water body, it should have brought up at a certain level of temperature then only microorganism can be killed. After being boiled, the boiled water can further have stored in a clean utensil or case to let it cool down. This method is easy to use and effective too but, it costs the burning of fuel which emit pollutant gases such as carbon dioxide and, results in left ash or residue which pollute the environment due to incomplete combustion.

1.2.2 Slow Sand Filtration Method:

In this method, the water is placed in a container connected with a supply of water, at a higher level (Figure 3). The outlet of this container is set in such a manner that next vessel is at a lower height in comparison of first main container. In this vessel the water is suspended for some time so that, the sand particles and dust particles settled down and pure water comes up that can be moved through in a next container.

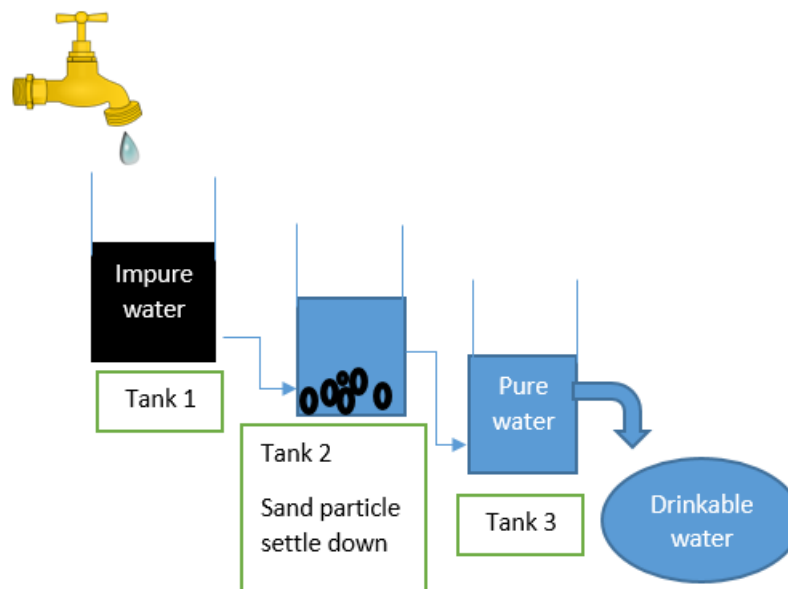


Figure 3: Slow Sand Filtration Process

In this process of filtering, tank 1 is at highest level which is connected to main supply of water. Tank 2 is the filtering focus in which sand particles are let to be settled down and tank 3 consists of purified water that can be used for drinking purpose.

1.2.3 Chlorination:

This method is widely used due to ease of use and highly effectiveness properties. In this method, a chlorine tablet is putted in water container that react with impurities and form compounds and thus water become impurity less. One thing is most important in this method is that, the use of chlorine should be in a controlled manner and only limited amount of chlorine is used to purify the water. Excess amount of chlorine can be dangerous to health. With the help of chlorine compounds, the organic matter gets oxidize [1].

1.2.4 Storage and sedimentation:

In this method, the large amount of water is being stored in reservoir form so that, restoration of water for several hours or may be few days can let the suspended particles to settle down. There is various method of construction of reservoir such as with a lining of plastic sheets so that water can be separated, except this concrete and brick construction material can also be used [2].

1.2.5 Ion Exchange:

Ion exchange method is the process of water treatment that is a reversible exchange of ions in between the liquid and the solid phases. The solid particles are known as ion exchanger which is insoluble in liquid phase. In this process, cation and anions flows through liquid. This process is known as amphoteric ion exchange. There are various target lines that are required to achieve in this process that is, hydrophilicity and sufficient ion exchange capability. Along with this, relative speed of exchange of ions and physical stability are also necessary. Various type of ion exchange resins there involved in this method such as: strong acid cation resin and weak acid cation resin. Strong base anion resin and weak base anions resin also present on another hand [3].

2. LITERATURE REVIEW

Reza Zolfaghari et al. presented a research work regarding the techniques of de-emulsification of water in oil and oil in water in the field of petroleum industry. In this research work, author had given a brief description about de-emulsification of water in two ways. First one is water in oil emulsions and oil in water emulsions. Another type of de-emulsification is explained by author that is based on chemicals such as hydrophilic – lipophilic balance, purification based on relative solubility numbers and its calculations along with R ratio, purification based on influential parameters has been considered as important factors such as salinity, temperature, PH value, water content and oil content, agitation speed and duration. Various de-emulsification materials has been briefly discussed by author such as non-ionic surfactants, ionic surfactants and many more [4].

A.K. Priya et al, conducted a research project about the purification of water using Nano membrane technique. In this research work, author focus on the 90% flow of water that is incoming and this controlling activity is not affecting the consumption and uses of water by users. the materials and methods that are being used during this research are, poly-sulfone membrane of ultrafiltration. Observational comparison is done by author using Nano-membrane and another membrane that is equivalent to Nano-membrane. The reading has been taken from both membranes in order to compare which one filters best. Nano-membrane consists of a rubber casing with central membrane that is the main functioning part for the purpose of filtering. The procedural features of Nano-membrane are that it minimizes the coloration of water along with the time duration of 2hours to purify 1 liter of water. Components are set in compartments so that cleaning and removal of filtered out particles can be made easily.

Guohua Chen et al, conducted a research work in which electrochemical technologies are being used in waste water treatment. Author discussed about electrochemical reactors for metal recovery in the form of electrometallurgy that has been used since long time ago. In this process, various factors are considered like typical reactor application in which combination of some rods of anode and cathodes polarity was used. Second factor considered was material of electrodes. Anode electrodes materials used for the recovery of metals are steel or dynamically stabled anodes (DSA). A method of electrocoagulation is also discussed in this research work which is a process of generation of coagulants in situ by mixing them electrically either aluminum or iron ions from respectively aluminum or iron electrodes. Sometimes this process is named as electrocoagulation and factors that affecting are current density/ charge loading, presence of NaCl, PH level and so on [5].

Mark A. Shannon et al. discussed about the scientific concept and technology used for the water purification. Various terms such as disinfection, decontamination, reuse and reclamation, and desalination. In this research work, author discussed about the problematic issue that is faced by many people to access fresh and clean water. According to author, these methods can improve the quality of water and reduce the amount of impurities from the water in order to make it more capable of drinking. Author had presented a pictorial view of waterborne virus attachment head along with receptor on a host cell. In an another pictorial view author showed the lead DNA sensor with a micro-Nano-fluidic device. Third approach is towards membrane bio reactor treatment system for direct conversion of water [6].

Heikki Sarkka et al. presented a research work manuscript in which the author discussed about recent developments of electro-oxidation in treatment of water. In this paper, author described, about electro chemical oxidation method can be used for the treatment of waste water. Here, author elaborated few terms such as electrode material, hydroxyl radicals, hypochlorite, waste water disinfectant, electrochemical oxidation. A brief explanation and research is done by author about the mechanism of electro-oxidation process. In a tabular form, the comparison between different type of electrode material is done that plays a vital role in EO process. Various catalyst has been discussed in enhancement of EO treatment. Various methods of treatment of waste water has been explained and analyzed [7].

3. METHODOLOGY

In this purposed methodology some basic ideas are suggested by following them, water consumption can be controlled and overall water can be saved. Wastage of water ultimately results in lack of fresh water on earth one day. Thus to save water, and to control consumption of water and, to reuse waste water here are some basic practices that are suggested in two categories. The first category is for domestic level consumption and second one is for industrial level consumption. These methods are being shared with around 100 people of a society, out of which 70 people adopted these changes and their results is being shared in Table 3.

- For Domestic Level Consumption
- For Industrial level consumption

Domestic level consumption of water means the rate of usage of water in household works can be planned in such a way that, used water can again be re-used again in some other task. There are few major change that can be done in order to change the amount of water wasted. In Table 1, some reuse ideas for domestic levels are being advised. In Table 2, some basic ideas are suggested that can be used in order to save water and to control wastage of water.

Table 1: Basic Changes in Household Activities.

Serial no.	For domestic Level
1.	The water which is used to wash vegetables and fruits in kitchen can be used to water plants in garden.
2.	The water that is outlet from wash basin can be used in flushing purposes in rest rooms by joining pipe of washbasin outlet to inlet of flush tank so that used water can be reused.
3.	Motors are used to supply water in water tanks and when water tanks overflow a large amount of water is being wasted even unused. Here water wastage can be prevented by installing water level indicators in water tanks to stop overflowing of water.
4.	Overflowing of water in loose taps can be replaced by using taps that works on sensors. Water will be released only when hands are being sensed under water, otherwise, water will not be wasted due to such reasons of overflow and loose taps.

Table 2: Changes at Industrial Levels.

Serial no.	For Industrial Level
1.	In textile industries, water is being used to wash textile cloths that can be reused after filtering for washing and cleaning floors.
2.	In food confectionary factories, a lot of water is being wasted in washing and cleaning that can be directly supplied to farms and fields for irrigation purposes.
3.	In chemical industries, water is being used as a solvent and in case of fire, or combustion, water is stored in large amount in boilers and tanks. Large amount of consumption leads to large wastage as well, this can be prevented by monitoring the water levels and using of water alarms.
4.	Water supplying bodies, such as Delhi Jal Board and similar bodies should keep a track on leakage of pipelining of water in order to prevent wastage of water.
5.	Waste water treatment can be done in such a manner that, water bodies present in localities such a ponds or lake can also consume recycled water because, waste water can pollute environment as well and can cause diseases such as malaria or typhoid.
6.	Surveys (door to door) should be done in order to estimate the correct consumption of water in industries and factories.

The domestic level ideas when shared with 70 people in a society, it results in effective meter readings. People found its result in terms of less billed amount for two months in comparison of last month billed cycle.

Table 3: Resultant effect in terms of average water bills of different people.

No. of people	Average Water bill for previous months	Average Water bill for last two months	Water meter reading difference	Changes done
20	754.56INR	640.20INR	32	Used water level indicator at water tank
35	956.85INR	723.51INR	48	Replaced old taps with sensor taps
15	412.78INR	315.45INR	36	Controlled wastage of water

The resultant effect is being shared here that proves that small changes in the pattern of consumption of water can control the wastage of water and as well as, consumption of overall water at a small scale.

4. RESULT & DISCUSSION

Above results shows that, there is a visible impact of changing the water consumption pattern in normal household patterns in terms of water billing. When these changes will be applied to a large scale such as a no. of societies or in a city, it is assumed that there will be huge impact of these changes on overall water consumption and less water will be wasted. Government are willing to do such works in order to save water and smart products are being designed that controls the water level and overflowing tanks, sensor based taps and many more items are being developed so that wastage of water can be minimized up to an extent. There are many other bodies where water is consumed for multiple purposes such as power electricity plants. In reservoirs, irrigation etc. if water is kept consumed in an irregular pattern by millions of people, definitely

one day, scarcity of water will be there in front of human beings. Thus, for the continuation of life cycle, of human beings and wild life as well water consumption and waste water should be taken under control.

5. CONCLUSION & FUTURE PERSPECTIVE

It can be concluded from above study that, water wastage can be controlled by changing the pattern of water usage and consumption. A large amount of water can be saved by adopting such ideas. Water awareness surveys should be conducted regularly so that, in future, water scarcity situation may not arise. It is well known fact that water is a limited natural resource and by using it so frequently with both open handed may leads to a million tons of waste water. To recycle this waste water, large amount of money will be required. Therefore, one's focus should be correct pattern of water consumption in everyday life. However, it is not possible to control the overall consumption of water in nation or worldwide as it is a long process but, if practices being started now, in few years, the situation can be taken under control.

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