



## Water Pollution and New Purification Techniques

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### Abstract

The presented paper highlights the condition Water is a critical resources in the lives of people who both benefit from its use and who are harmed by its misuse and unpredictability (flooding, drought, salinity, acidity, and degraded quality) water is a finite and vulnerable resources. It is also the duty of every citizen under article 51 (A) g to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures. To control the pollution of water the Prevention and Control of water pollution act, 1974 was enacted. People are not much aware about the causes and remedies of water pollution. They do not know, how to check the water supplied to them and what type of water is suitable. The punitive measures are also not strong enough to control the water pollution. The purpose of this research paper is to point these problems and the solution.

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**Introduction** - Water is that chemical substance which is essential for every living organism to survive on this planet. Water is needed by every cell of the organism's body to perform normal function. Water covers 71% of the earth's surface, mostly in oceans and other large water bodies, with 1.6% of water below ground in aquifers and 0.001 % in the air as vapor, clouds and precipitation (U.S. geological survey 2000). In recent years, water pollution has become a serious problem across the country, mostly due to presence of untreated effluents, chemicals, and pesticides in it. (2) There are many causes of water pollution. These causes can be removed or at least controlled with the awareness amongst the people and by the strong implementation of the legislative measure. If the water is not clean or is pollution then constitution of India also provides remedy which can be claimed under the law of torts and under article 226 of constitution in the form of filling writ In the high court of the respective state and under article 32 writ can be filed in supreme court for preventing the causes of water pollution and providing compensation to the victims. Shortage of clean water in the country, the uncontrollable causes of water pollution, lack of awareness about the right to clean water and lack of strict implementation of the preventive measure are the main reasons for choosing this topic for research purpose. For complementing this research work I have used the doctrinal method of research. I have studied various reports, newspapers and consulted various websites.

The main objectives of this study is to highlight the impact of various water pollutants which have rendered the water unsuitable for drinking and other domestic purposes and to enumerate new and affordable techniques which can be used to purify water for various purposes.

**Some Facts And Figures Related To Water Pollution** - Disease spreads by consumption of polluted water it has been estimated that 50,000 people die daily world-wide as a result of water-related diseases (Nevondo and cloete 1999). A large number of people in developing countries lack access to adequate water supply. In south Africa, it has been estimated that more than 12 million people do not have access to an adequate supply of potable water (Nevondo and cloete 1999). Polluted water also contains viruses, bacteria, intestinal parasites and other harmful microorganisms, which can causes waterborne diseases such as diarrhea, dysentery, and typhoid. Due to water pollution, the entire ecosystem gets disturbed. Unsafe drinking water, along with poor sanitation and hygiene, are the main contributors to an estimated 4 billion cases of diarrheal disease annually, causing more than 1.5 million deaths, mostly among children under 5 year of age (WHO 2005). Contaminated drinking water is also a major source of hepatitis, typhoid and opportunistic infections that attack the immune-compromised, especially persons living with HIV/AIDS (UNICEF 2011). Almost 1 billion people lack access to safe and improved water supply. More than 50 countries still



report cholera to WHO (world health organization). Millions are exposed to unsafe levels of naturally occurring arsenic and fluoride in drinking water which leads to cancer and tooth/skeletal damage. An estimated 260 million people are infected with schistosomiasis (WHO 2004). 1.3 million People die of malaria each year, 90% of whom are children under 5. Impoverished slum dwellers in Angola draw drinking water from the local river where their sewage is dumped. Farmers on the lower reaches of the Colorado River struggle because water has been diverted to cities like Africa; more than 60 % of city dwellers are in fact slum dwellers. For many of them, water comes not from faucets inside their shacks but from water tankers or standpipes, neither of which is reliable as a water source. Open sewers increase the risk of water-borne diseases (UN work 2010).

**Cause And Effects of Water Pollution** - Pollution of water means rendering the water unfit for human consumption by bringing changes in its natural quality. Water pollution can be defined in many ways. Usually, it means one or more substances have built up in water to such an extent that they cause problems for animals or people. Pollutants in water include a wide spectrum of chemicals, pathogens and physical changes. Many of chemical substances are toxic. Pathogens can produce water-Borne diseases. Alteration of water's physical chemistry includes acidity, electrical conductivity, temperature and eutrophication. Human infectious diseases are among the most serious effects of water pollution. In India, every year approximately 50000 million liters of wastewater, both industrial and domestic, is generated in urban areas. If the data of rural area is also taken into account, the overall figure will be much higher. According to a united nation report released on March 22, 2010 on world water day, 80% of urban waste in India ends up in the country's rivers, and unchecked urban growth across the country combined with poor government oversight means the problem is only getting worse. A growing number of bodies of water in India are unfit for human use and in river Ganga holy to country's 82% Hindu majority is dying slowly due to unchecked pollution. Water pollution is a major problem in India. Only about 10% of waste water generated is treated; the rest is discharged as it is into our water bodies. Due to this pollutant enter into groundwater, rivers and other water bodies. Contaminated water put serious effect on human body. Accumulation of heavy metal and some organic metal have been linked to cancer, reproductive abnormalities and other serious effects. One cause cannot be responsible for polluting the water. There are many causes responsible for polluting it. Uncontrolled population, industrialization and urbanization are the main factors of water pollution which include in it a number of sub-factors responsible for water pollution. We can divide the causes of water pollution into two parts one is direct and second is indirect.

#### **Involvement of human activities in water pollution -**

Virtually all human activities produce some kind of environmental disturbance that contaminated surrounding waters. Eating (body wastes), gardening(pesticide and sediment ran off) and many other activities create byproducts that can find their way into the water cycle. For convenience, we can assign the large majority of sources of water pollution to three broad categories of waste (Mckinney and schoch 2003)

- a. Industrial
- b. Agricultural and
- c. Domestic wastes

**Industrial wastes** - Wastes from industry serve as major sources for all water pollutants. Many major industries contribute significantly to water pollution, but some of the important are the (1) manufacturing (2) power generating (3) mining and construction, and (4) food processing industries (Mckinney and schoch 2003).

Manufacturing industries like chemical, oil refining, steel etc contribute many of the most highly toxic pollutants, including a variety of organic chemicals and heavy metals (Mckinney and schoch 2003). Other industries have less potential impact but are still



considered highly problematic when it comes to pollution. These industries include the textile, leather tanning, paint, plastics, pharmaceutical and paper and pulp industries (Raja and Venkatesan 2010). In many cases both the products, such as the paint and pesticide, and the byproduct from the manufacturing process are highly toxic to many organisms including humans. Agricultural waste - these are generated by the cultivation of crops and animals. Globally, agriculture is the leading source of sediment pollution which includes plowing and other activities that remove plant cover and disturb the soil. Agriculture is also a major contributor of organic chemicals, especially pesticides (McKinney and Schoch 2003). Pesticides are widely used in modern agriculture in most countries throughout the world and in a large range of environments. But environmental monitoring increasingly indicates that trace amounts of pesticides are present in surface and underground water bodies, far from the sites of pesticide application (Voltz et al 2007). Fertilizers increase the concentration of nitrate level in underground drinking water sources, which can cause methemoglobinemia, the life-threatening "blue baby" syndrome in very young children, which is a significant problem in parts of rural Eastern Europe (Yasno et al 2001).

**Domestic wastes** - these are those that are produced by households. Most domestic waste is from sewage or septic tanks leakage that ends up in natural waters. In the past some cities dumped untreated or barely treated sewage directly into rivers, lakes, or coastal waters. Plant nutrients occur in the form of nitrogen and phosphorus. These come not only from human waste, but also from fertilizer used extensively in household lawns and gardens. Today, many people dump their garbage into streams, rivers, lakes, and seas, thus making the water bodies the final resting place of cans, bottles, plastics, and other household products (ground water quality 2003). Most of today's cleaning products are synthetic detergents and come from the petrochemical industry. Most detergents and washing powders contain phosphates, which are used to soften the water among other things. These and other chemicals contained in washing powders affect the health of all forms of life in the water.

### Some Techniques in Water Purification Process :

1. Point of use water purification using rechargeable polymer beads: 'halo pure' is one such enabling technical advance in the development of an entirely new biocide medium in the form of chlorine rechargeable polystyrene beads that based on patented chemistry inventions from the department of chemistry at Auburn University (Dunk et al 2005). The Discoveries were natural but creative outcome of a series of studies covering more than a decade of research, focused on stabilizing chlorine on water insoluble, synthetic polymer surfaces.

The fundamental principles of the technology are deceptively simple to understand, although their incorporation into a reliably reproducible and practical medium for water sanitation has taken years of intense research and efforts. Porous polystyrene beads are similar to those used for water softener resin beds, are modified chemically so as to be able to bind chlorine or bromine reversibly in its oxidative form. All that is required is enough free chlorine to surround the binding site. Almost no free chlorine is released when the beads are placed into the water flow. Typical levels range from 0.05 ppm to 0.20 ppm free available chlorine. This is not enough to kill anything without lengthy incubation. Hence, the swift efficacy of Halo-pure depends on intimate contact between the microbes and the bound halogen on the polymer. What you have then is a solid surface, effectively biocidal on contact to contaminants in the water and repeatedly rechargeable when periodically exposed to free halogen. In this way a powerful antimicrobial component can be introduced into water purifier that will not run out of steam, and have to be discarded. Instead, it can have its power regularly and conveniently "topped up" by the user. Organism makes contact with display of chlorine, for example, on the surface of beads, and pick up enough halogen to inactivate them in short order. Those not killed within seconds suffer a near-death experience, and succumb quickly in the product water as the adherent chlorine slowly



damages the organism to the point of fatal consequences (Dunk et al 2005).

The technology holds the promise of reducing the impact of water borne diseases throughout the developing world. Its widespread use could contribute to the realization of UN goals for access to safe water for all by 2005. And it could do so without resort to the massive infrastructure investment that are needed to reach this goal using more conventional centralized sanitation and distribution approaches.

**2.** Water treatment using the seeds of the moringaoleifera tree: Using natural materials to clarify water is a technique that has been practiced for centuries and of all the materials that have been used, seeds of moringa have been found to be one of the most effective. Studies have been conducted since the early 1970's to test the effectiveness of moringa seeds for treating water (Patemiani et al. 2010). These studies have confirmed that the seeds are highly effective in removing suspended particles from water with from water with medium to high levels of turbidity (Moringa seeds are less effective at treating water with low level of turbidity)

Moringaoleifera seed treat water on two levels, acting both as a coagulant and an antimicrobial agent. It is generally accepted that moringa works as a coagulant due to positively charged, water-soluble proteins which bind with negatively charged particles (silt, clay, bacteria, toxins, etc) allowing the resulting "flocs" to settle to the bottom or be removed by filtration. The antimicrobial aspects of moringa continue to be researched. Findings support recombinant proteins both removing microorganisms by coagulation as well as acting directly as growth inhibitors of the microorganisms. While there is ongoing research being conducted on the nature and characteristic of these components, it is accepted that treatment with moringa solution will remove 90-99.9% of the impurities in water.

Moringa seeds, sees kernels or dried presscake can be stored for long periods but moringa solutions for treating water should be prepared fresh each time. In general, 1 seed kernel will treat 1 liter (1.056 qt) of water.

**Dosage rates:**

1. low turbidity NTU (neohelometric turbidity units) < 50 1 seed per 4 liters (4.255 qt) water
  2. Medium turbidity: NTU 50-150 1 seed per 2 litres (2.112 qt) water.
  3. High turbidity: NTU 150-250 1 seed per 1 liter (1.056 qt) water.
  4. Extreme turbidity: NTU > 250 2 seeds per 1 liter (1.056 qt) water.
- 3.** Water purification using aerobic granular sludge technology - With the new aerobic granular sludge technology, aerobic (thus oxygen using) bacterial granules are formed in the water that is to be purified. The great advantage of these granules is that they sink quickly and that all the required biological purifying process occur within these granules.

The technology, there for, offer important advantages when compared to conventional water purification process. For example, all the process can occur in one reactor. Moreover, there is no need to use large re-sinking tanks, such as those used for conventional purification. Such large tanks are needed for this because the bacteria clusters that are formed take much longer time to sink than the aerobic granule sludge.

The aerobic granular sludge technology is very promising, and has been nominated for the Dutch process innovation award. The technology is now in the commercialization phase. In the coming years, further research will be continued. Testing of this purification method is being done on a larger scale. The first installations are already in use in the industrial sector.

**4. Resin based treatment for color and organic impurities removal -**

The rapid industrialization during the last few decades has resulted in tremendous increase in demand of water for industries. A large quantity of water used is ultimately



discharged into water bodies and land as waste water from various unit operation related to various industrial processes, and is responsible for their pollution (Kumar and Bhatia 2007). Attempts have been made to prevent the adverse aesthetic effects associated with industrial waste water discharges by accelerating the removal of colour during treatment of the variety of industrial wastes. Colour removal is also important if the water has to be made suitable for drinking purpose because many times underground water comes with colour and this colour has to be removed prior to drinking.

Among the manufacturing operation, the textile dyeing and finishing industries are directly affecting colour; which is the most noticeable characteristics of both the raw waste and treated effluent from this industry. Although biological treatment of these waste waters is usually effective in removing a large portion of oxidizable matter, but it is frequently ineffective in removing colour.

Conclusion - Water is a renewable natural resource. Due to ever increasing industrialization, urbanization, this precious resource is continuously under stress. There are multiple dimensions to water quality and its deterioration. Water pollution is rendering much of the available water unsafe for consumption. The pressure of increasing population, loss of forest cover, untreated effluent discharge from industries and municipalities, use of non-biodegradable pesticides/ insecticides, use of chemical fertilizers instead of organic manures, etc are causing water borne diseases like cholera, diarrhea, dysentery etc. there are various new water purification technique which have come up to purify water for example by using rechargeable polymer beads, using the seeds of moringaoleifera tree, purifying water by using aerobic granular sludge technology etc. Research is being conducted all over the world to develop more and more techniques which can generate pure water at low cost. All these techniques are being developed to ensure that in near future every-one will have access to clean and pure water and that too at an affordable cost.

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