Journal of Civil Engineering and Environmental Technology
p-ISSN: 2349-8404; e-ISSN: 2349-879X; Volume 2, Issue 16; October-December, 2015 pp. 80-83

http://www.krishisanskriti.org/Publication.html

Construction: "Recycling of Waste Water Impact of Pollutants and Techniques in Purification Process"

Satish Joshi[1] and K, Gajanan[2]

[1,2]Kavikuluguru Institute of Technology & Science, Ramtek
E-mail: [1]satishjoshi_2007@rediffmail.com, [2]gajanan_2k@yahoo.com

Abstract—*Water is a critical resource in the lives of people who both benefit from its use and who are harmed by its misuse and unpredictability (flooding, droughts, salinity, acidity, and degraded quality). Water is a finite and vulnerable resource. Consequently, consumption of polluted water puts lives and livelihoods at risk because water has no substitute. There are many ways in which water intended for human consumption can get polluted. These include wastes from industries like mining and construction, food processing, radioactive wastes from power generating industries, domestic and agricultural wastes and by various microbiological agents. Nowadays, water is being purified by various methods but research is being conducted to look for more reliable and cheaper methods that can purify water at an affordable cost. Various techniques have been developed like utilizing rechargeable polymer beads, aerobic granular sludge technology, resin based treatment and two pronged water treatment technology.*

1. 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).

Water moves continually through a cycle of evaporation or transpiration (evapotranspiration), precipitation, and runoff, usually reaching the sea. Winds carry water vapor over land at the same rate as runoff into the sea. Pure uncontaminated water does not occur in nature. Water pollution is any undesirable change in the state of water, contaminated with harmful substances. It is the second most important environmental issue next to air pollution.

Any change in the physical, chemical and biological properties of water that has a harmful effect on living things is termed as 'water pollution' (WHO 1997). As a result of the unwanted human activities, water pollution is a growing hazard in many developing countries. A more serious aspect of water-pollution is that which is caused by human activity, and industrialization (Park 2009). There are also various micro-biological agents that include bacteria, viruses and protozoa which can also cause water pollution and may cause various water-borne diseases.

2. HUMAN ACTIVITIES RESPONSIBLE FOR WATER POLLUTION

Virtually all human activities produce some kind of environmental disturbance that contaminate surrounding waters. Eating (body wastes), gardening (pesticide and sediment runoff) 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 (Mc Kinney and Schoch 2003).

a. Industrial

b. Agricultural and

c. Domestic wastes

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. Polluted water also contains viruses, bacteria, intestinal parasites and other harmful microorganisms, which can cause 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 less than 5 years 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 1billion people lack access to safe and improved water supply. More than 50 countries still report cholera to WHO 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.

a. 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 (i)manufacturing (ii) power-generating (iii) mining and construction, and (iv) food processing industries (Mc Kinney 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 (Mc Kinney Power generating industries are the major contributors of heat and radioactivity. Nearly all power plants, whatever the fuel, are major sources of thermal (heat) pollution.

Radioactivity from nuclear power plants can pollute waters in a variety of ways, including discharge of mildly radioactive waste water and ground water pollution by buried radioactive waste (Mc Kinney and Schoch 2003). Radioactivity may be found in ground waters as well as surface waters. In ground waters it may be due to radioactive material present in underground rocks, while in surface waters it may have been passed on with effluents from uranium mining and enrichment plants (Rao 2001).

b. Agricultural Wastes

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 (Mc Kinney 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). The use of nitrogen fertilizers can be a problem in areas where agriculture is becoming increasingly intensified. These fertilizers increase the concentration of nitrates in groundwater, leading to high nitrate levels 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 (Yasso et al. 2001).

c. Domestic Wastes

These are those that are produced by households. Most domestic waste is from sewage or septic tank 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 fertilizers used extensively in household lawns and gardens (Mc Kinney and Schoch 2003). Today, many people dump their garbage into streams, lakes, rivers, and seas, thus making water bodies the final resting place of cans, bottles, plastics, and other household products (Groundwater 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 106 Ramandeep Singh Gambhir, Vinod Kapoor, Ashutosh Nirola et al. contained in washing powders affect the health of all forms of life in the water.

New 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 is 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 effort and research. 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 biocide 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 a 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.

Organisms make contact with the display of chlorine, for example, on the surface of the beads, and pick up enough halogen to inactivate them in short order 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 2015. And it could do so without resort to the massive infrastructure investments that are needed to reach this goal using more conventional centralized sanitation and distribution approaches (Dunk et al. 2005).

3. WATER TREATMENT USING THE SEEDS OF THE *MORINGA OLEIFERA* 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 the 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 (Paterniani et al.2010). These studies have confirmed that the seeds are highly effective in removing suspended particles from water with medium to high levels of turbidity (Moringa seeds are less effective at treating water with low levels of turbidity). *Moringa oleifera* seeds 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 characteristics of these components, it is accepted that treatments with Moringa solutions will remove 90-99.9% of the impurities in water (Paterniani et al. 2010). Solutions of Moringa seeds for water treatment may be prepared from seed kernels or from the solid residue left over after oil extraction (presscake). Moringa seeds, seed 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:* Low turbidity NTU (Nephelometric Turbidity Units) <50 1 seed per 4 liters (4.225 qt) water *Medium Turbidity:* NTU 50-150 1 seed per 2liters (2.112 qt) water *High Turbidity:* NTU 150-250 1 seed per 1 liter (1.056 qt) water *Extreme Turbidity:* NTU >250 2 seeds per 1 liter (1.056 qt) water

4. 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 processes occur within these granules (Delft University of Technology 2006). The technology, therefore, offers important advantages when compared to conventional water purification processes. For example, all the processes 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 (Delft University of Technology 2006).

5. RESIN BASED TREATMENT FOR COLOUR AND ORGANIC IMPURITIES REMOVAL

The rapid industrialization during the last few decades 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 operations related to various industrial processes, and is responsible for their pollution (Kumar and Bhatia 2007). Attempts 108 Ramandeep Singh Gambhir, Vinod Kapoor, Ashutosh Nirola et al. 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 have to be removed prior to drinking.

Among the manufacturing operations, the textile dyeing and finishing industries are directly affecting colour; which is the most noticeable characteristic 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. The present method for colour removal uses a green colour basic dye, an anion exchange resin called 'Duolite A 171/SC' and a column made of borosil glass of height 40cm. From the results it was concluded that resin treatment is a better method than conventional biologic process even at much higher filtration rate (Kumar and Bhatia 2007).

6. CONCLUSIONS

1. Water is a renewable natural resource. Due to ever increasing industrialization, urbanization, this precious resource is continuously under stress.
2. 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/ fungicides/ herbicides/insecticides, use of chemical fertilizers instead of organic manures, etc are causing water pollution.
3. Moreover there are numerous water borne diseases like cholera, diarrhea, dysentery etc. which are transmitted by drinking contaminated water. There are various new water N purification techniques which have come up to purify water for example by using rechargeable polymer beads, using the seeds of Moringa oleifera tree, purifying water by using aerobic granular sludge technology etc.
4. 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 everyone will have access to clean and pure water and that too at an affordable cost.

REFERENCES

[1] Charting Our Water Future- Economic Frameworks to Inform Decision-making (pdf) 2009. From<http.www.mckinsey.com> (Retrieved October 29, 2011).

[2] Dunk D, Mickey PE, Williams J 2005. Point-of – use water purification using rechargeable polymer beads. *Water and Wastewater Asia*, 40-43.

[3] Harter T 2003. *Reference: Groundwater Quality and Groundwater Pollution, University of California Division of Agriculture and Natural Resources Publication 8084.*

[4] Home Page of History of Water Filters-Early Water Treatment2009, from<http.www. History of water filters.com/early-water-treatment> (Retrieved March 20, 2009).

[5] Home Page of Mining and Water Pollution 2011. From<http.www.safewater.org> (Retrieved March 4, 2011)

[6] Kulshreshtha SN 1998. A global outlook for water resources, to the year 2025. *Water Resources Management*, 12(3): 167–184.

[7] Kumar P, Bhatia UK 2007. *Proceedings of the National Conference on Civil Engineering: Advancement and Challenges, 9-10 March*.

[8] Mullana: M.M.Engineering College, Mullana. McKinney Michael L, Schoch Robert M, Yonavjak Logan 2007.

[9] *Environmental Science Systems.* Burlington, United States: Jones and Bartlett Learning Inc.

[10] Nevondo TS, Cloete TE 1999. Bacterial and chemical quality of water;in the Dertig village settlement. *Water SA*, 25(2): 215-220.

[11] Obasohan E E, Agbonlahor D E, Obano E E 2010. Water pollution: A review of microbial quality and health concerns of water, sediment and fish in the aquatic system. *African Journal of Biotechnology*, 9(4): 423-427.

[12] Official Home Page, Delft University of Technology, 2006. New Water-Purification Method Promises Radical Improvement. From <http. www. physorg. Com /70621194.html> (Retrieved March 9, 2009).

[13] Official Home Page of UNICEF: Promotion of Household Water Treatment and Safe Storage From< http.www. unicef.org> (Retrieved, February 11, 2011). Official Home Page of WHO Guidelines for Drinking Water Quality 1996.