Impact of Pollutants and New Techniques in Water Purification Process

R.B. Dhake

Deptt. of Chemistry, D.D.N. Bhole college Bhusawal, Dist. Jalgaon (M.S.)

ABSTRACT: Due to industrialization and urbanization disposal of industrial as well as domestic effluents become more and more complex. Hence various techniques were developed for purification of water. Pollution of water streams causes due to by different inorganic, organic and biological contaminates, among which pesticides are very common and introduced due to agriculture source, represents a serious environmental problem. Several usual methods of water treatment exist such as activated carbon adsorption, chemical oxidation, biological treatment, etc. and as such have found certain practical applications. For example, activated carbon adsorption involves phase transfer of pollutants without decomposition into another pollution problem. Chemical oxidation mineralizes all organic substances and is only economically suitable for the removal of pollutants at high concentrations.

KEYWORDS: Natural water, wastewater treatment processes, reuses desalination processes.

INTRODUCTION: Pollutants in wastewater effluent from industrial manufacturers and normal households, and in landfill leachates. They can be found in ground water wells and surface waters. In all cases they have to be removed to protect our water resources or to achieve drinking water quality. Therefore, many processes have been proposed over the years and are currently being employed to destroy these toxins. This paper presents a review of the various methods and treatments used for water and waste water treatment in order to remove the various constituents of the pollution cycle: solids, organic carbon, nutrients, inorganic salts and metals, pathogens. Waste-water generally contains high levels of organic material, numerous pathogenic microorganisms, as well as nutrients and toxic compounds. It thus entails environmental and health hazards and, consequently, must immediately be conveyed away from its generation sources and treated appropriately before final
disposal. The ultimate goal of waste-water management is the protection of the environment in a manner commensurate with public health and socio-economic concerns. Fundamental studies in the fields of chemistry and microbiology and findings from research into process techniques provide the foundations on which new methodologies for planning and laying out wastewater treatment systems are currently built. In the earth’s crust only 0.01% of total water exists as surface fresh water. Thus fresh water contaminated by inorganic and organic substances such as dissolved solids, metals, detergents, pesticides, Fertilizers, industrial toxic effluents, domestic & agricultural waste etc. At several places on earth there is scarcity of ground water. The quality of water in an aquatic environment depends on the physical, chemical & biological interactions of environment surrounding it. (S. S. Turkar et.,al 2011).

HUMAN ACTIVITIES RESPONSIBLE FOR WATER POLLUTION

Virtually all human activities produce some kind of environmental disturbance that contami-nate 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 conveni-ence, 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  
c. Domestic wastes

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 (Ramandeep Singh Gambhir et.,al 2012).

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 and Schoch 2003).

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).

The mining and construction industries are major contributors of sediment and acid drainage. (Mining and Water Pollution 2011).

. The food processing industry is very diverse. Major sectors include fruit and vegetables, dairy,
meats and fish, alcoholic and non-alcoholic beverages, oils, and packaged foods. The most common environmental concerns in the industry are water consumption and wastewater discharge, chemicals used in processing and cleaning, packaging reduction and disposal, and food scraps and refuse (McKinney and Schoch 2003).

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 (McKinney and Schoch 2003).

c. Domestic Wastes: 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 contained in washing powders affect the health of all forms of life in the water.

Micro-organisms Causing Water Pollution: There are various micro-biological agents which can also cause water pollution if drinking water gets contaminated with these agents. The pathogenic agents involved include bacteria, viruses and protozoa which may cause diseases that vary in severity from mild gastroenteritis to severe and sometime fatal diarrhoea, dysentery, hepatitis or typhoid fever (WHO 1996). Most of them are widely distributed throughout the world. Faecal contamination of drinking water is only one of several faeco-oral mechanisms by which they can be transmitted from one person to another or, in some cases, from animals to people.

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 biocidal 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 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 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. 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 2015. And it could do so without resort to the massive infrastructure investments that are needed to reach this goal using more conventional centralization and distribution approaches (Dunk et al. 2005).

2. 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.

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 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 commercialisation 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).

4. Resin Based Treatment for Colour 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 operations 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 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).

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/ fungicides/ herbicides/insecticides, use of chemical fertilizers instead of organic manures, etc are causing water pollution. There are various new water 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. 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.

ACKNOWLEDGEMENTS:
Authors gratefully acknowledge to the Principal Dr. R.P.Phakal, D.D.N.Bhole college, Bhusawal for providing necessary Laboratory facilities.

REFERENCES:
4. Burlington, United States: Jones and Bartlett Learning Inc.


