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Latest technologies used for small drinking water system

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Abstract
Water is of fundamental importance for life on earth. The synthesis and structure of cell constituents and transport of nutrients into the cells as well as body metabolism depend on water. The contaminations present in water disturb the spontaneity of the mechanism and result in long/short-term diseases. The probable contaminations and their possible routes are discussed in the present review. Continued research efforts result in some processes/technologies to remove the contaminations from water. The review includes concepts and potentialities of the technologies in a comprehensible form. It also includes some meaningful hybrid technologies and promising awaited technologies in coming years.

Keywords: water contaminants purification hybrid technology

1. Introduction

Availability of fresh water, the nature's gift controls the major part of the world economy. The adequate supplies of water are necessary for agriculture, human consumption, industry as well as recreation. Ironically, sometimes, natural or added contaminations rob us of the gift and making us confront a lot more challenging world. It is a well-known fact that fresh water is an important necessity for our health. With the advancement of technology and industrial growth, fresh water resources all over the world are threatened. One-sixth of the world population suffers from the freshwater unavailability situation (Elimelech 2006). It is seen that developed countries suffer most from chemical discharge problems, whereas developing countries from agricultural sources. Contaminated water causes problems to health and leads to waterborne diseases which can be prevented by taking measures even at the household level. Providing safe water for all is a challenging task. Continued research efforts in this area for more than few decades result in many processes/technologies (Shannon *et al*. 2008).

Water contamination is a common problem to all over the world. These may be geological or anthropogenic (man-made) (Fawell and Nieuwenhuijsen 2003). Higher levels of contaminants in drinking water are seldom to cause acute health effects. Of course it depends on individual susceptibility and mode of contact with the body.

The types and concentrations of natural contaminates depend on the nature of the geological materials through which the groundwater flows and quality of the recharge water. Groundwater moving through sedimentary rocks and soils may pick up a wide range of compounds, such as magnesium, calcium, and chloride, arsenate, fluoride, nitrate, and iron; thus, the effect of these natural contaminations depends on their types and concentrations. The natural occurring elements present at unacceptable levels can contaminate water as well (Liu *et al*. 2005; Charles *et al*. 2005; Rukah and Alsokhny 2004; Mulligan *et al*. 2001; Ghrefat *et al*. 2014; Meenakshi and Maheshwari 2006).

Other contaminants are man-made by-products of industry, and agriculture, including heavy metals like mercury, copper, chromium, lead, and hazardous chemicals, dyes and compounds like insecticides and fertilizers. Improper storing or disposing of household chemicals such as paints, synthetic detergents, solvents, oils, medicines, disinfectants, pool chemicals, pesticides, batteries, gasoline and diesel fuel can lead to ground water contamination (Kass *et al*. 2005; Anwar 2003) According to UN report 2003 (UN WWAP 2003) every day 2 million tons of sewage, industrial and agricultural waste are discharged into the world’s water.

The microbial contaminants include pathogens like bacteria, viruses, and parasites such as microscopic protozoa and worms. These living organisms can be spread by human and animal wastes knowing or unknowingly.

Some contaminants can be easily identified by assessing color, odor, turbidity and the taste of the water. However, most cannot be easily detected and require testing to reveal whether water is contaminated or not. Thus, the contaminants may result in unappealing taste or odor and staining as well as health effects.

Color of the drinking water is a physical characteristic that cannot be noticed unless it is one of high concentration. For example, if ground water containing a high iron concentration, it gives a reddish appearance; similarly, high tannin concentration makes the water look brown. Generally, it is measured by comparing a water sample to a color standard. One color unit has no effect on the water and usually not detectable while 100 color units could be compared to the color of light tea (Ligor and Buszewski 2006). Odor is also an indicator for the presence of some contamination though odor-free water is not necessarily safe for drinking purpose. Also, some contaminant odors are noticeable even when present in extremely small amounts.

On the other hand, the presence of clays, silts or sand, or organic, algae, and leaf particles results in turbidity. The turbidity may shield bacteria, preventing disinfection chemicals from attacking and destroying the cells. The presence of organic materials in conjunction with chlorine can form trihalomethanes and other potentially harmful chemicals. Generally, surface water sources have higher turbidity compared to groundwater sources. The turbidity of a surface water source can vary greatly from 1 to 200 NTU (NTU: nephelometric turbidity unit). The immunity in turbidity level is different from children to adult people.

2. Review of Literature

At present information and literature available on drinking water quality of several canals, ponds, domestic taps, open wells in India is very less. Therefore before choosing any topic for research, one should invariably look into the past work. The sole contention of the literature review is to know what has been done and what has not been done in the area of research. If done, what were the significant findings? And whether these findings apply to the study area or not? To avoid redundancy only salient studies were included. An appreciable number of reports are available for limnobiotic studies of water pollution and their abatement. However, no detail report on the quality of water of Andhra Pradesh in relation to urbanization and industrialization is available. Study of different physico-chemical and microbiological parameters of different ground and surface water yield useful data for understanding the nature of water environment throws a flood of light on the changes brought by the intense human interference. To pollute is to destroy the purity. The word pollution is derived from 'POLLUTERE' which means defilement. Any needless degradation of pure substances leads to pollution. An event that happens to a resource which will make it useless for future use causes pollution. The four types of environmental damages that can occur are: 1. Threats to human health and safely. 2. Damage to economic resources and to material well being. 3. Reduction in the enjoyment of life of a psychological character 4. Damage to non-human environment to nature (Khan, 2001, Saxena, 2002) [3]. Hame, (1978) said environmental pollution is a worldwide phenomenon. The problem is accentuated by rapid industrialization, which is fast transforming air, water and soil into big natural reservoirs by dangerous pollutants. Further, rapid industrialization programms, have resulted in the generation of solid, liquid and gaseous wastes in such a huge quantity that a serious threat is likely to be posed to the quality of the life in the years to come. Heavy metals are widespread pollutants of great environmental concern as they are non-degradable, toxic and persistent with serious ecological ramifications on aquatic ecology (Chopra *et al*., 2009; Jumbe and Nandini, 2009). The urban Aquatic ecosystems are strongly influenced by long-term discharge of untreated domestic and industrial wastewater, storm water runoff and direct solid waste dumping (Sarika *et al*., 2008). All these released pollutants have a great ecological impact on the water quality.

Abiotic environment of freshwater ecosystem affects the biotic component of the ecosystem. If any change occurs in physico-chemical characteristics of water, it causes a direct impact upon the biotic data. Availability of clean and potable water has become a key issue in several developing countries. Burgeoning population and water scarcity is affecting the quality of life significantly; India is no exception to this (Parashar *et al*., 2006). The water runoff on the land picks up more soluble species in areas where the weather is still in its earlier stages (Peter Nell, 2004). The greatest risk to the public is water contaminated with community derived waste and sewage (Bhargava, 2006) [17]. A number of cities throughout the world, especially in India, are now on the threshold of emerging into metropolitan centres as a result of the rapid industrialization and urbanization. In tropical countries, incidents of water pollution generally occur during the rainy season than compared to other seasons probably because of improper drainage, stagnation of sewage and silage resulting in seepage through the soil, thus polluting the groundwater. Contamination of tap water used for drinking purposes by the sewage when, the pipelines pass through drainage canals through leaks and/or joints in the pipes is a serious problem in the towns and cities in developing countries especially, India (Lalitha, 2008).

3. Latest Technologies Used For Small Drinking Water Systems

In the United States, there are 151,119 operational public water systems (PWS). Of these, 97% (146,767) are considered small systems under the Safe Drinking Water Act, meaning they serve 10,000 or fewer people. Although the majority of our PWS are considered small systems, they serve the fewest number of people-approximately 27% (69,070,729) of the population (255,923,859) receiving drinking water from PWS. While many of these active small systems consistently provide safe, reliable drinking water to their customers, many face a number of challenges in their ability to achieve and maintain system sustainability. Some of these small system challenges include lack of expertise to choose, operate, and maintain systems; lack of financial resources; aging infrastructure; limited options for residual disposal; and state primacy agencies with limited resources to support the large number of small systems

Drinking water treatment plants (DWTPs) are increasingly being challenged by changes in the quality of their source waters and by their aging treatment and distribution system infrastructure. Factors such as shrinking water and financial resources, climate change, agricultural runoff, harmful algal blooms (HABs), and industrial land use increase the probability that CECs (chemicals that have not previously been detected in water, or that are being detected at significantly different levels than expected), such as pesticides, pharmaceuticals, personal care products, endocrine disrupting compounds, and algal toxins will remain after treatment, ending up in consumers' drinking water. This is likely to disproportionately affect small drinking water systems due to limited resources and treatment options, among other factors. Identifying and quantifying the source water and treatment challenges for water systems is an important step towards mitigating present and future risks.

4. Reducing Costs and Improving Techniques for Water Monitoring

Newer monitoring technologies, such as improved water quality sensor technology, remote sensing and satellite imagery, hold opportunities to generate substantially more data at lower cost. New sensor technology coupled with improved telemetry and information technology can make data on water quantity and water quality available for a broader range of applications. Sensor and laboratory advances also provide opportunity for reducing the overall cost of water quality monitoring. New tools are being developed to store, communicate, analyze and visualize the vast data streams. Currently, less than 30 percent of the nation's surface water bodies are assessed by EPA, states or tribes, partly because of the high cost of traditional fixed-station water quality monitoring. F Technology Innovation Challenge and Aspiration: Imagine collaborative monitoring efforts that provide low-cost, watershed-scale, real-time data on water quality and quantity that facilitate protection and wise use of our water resources!

5. Improving Performance of Small Drinking Water Systems

Small drinking water systems consistently provide safe, reliable drinking water to their customers; however, many small systems also face a number of challenges: y Over 94 percent of the more than 156,000 public water supply systems are small, each serving fewer than 10,000 people.35 y In its fifth report to Congress in 2011, EPA identified a total infrastructure need of $64.5 billion for small drinking water systems throughout the country.36 y Very small drinking water treatment systems (serving fewer than 500 people) have the highest percentage of health-based violations of all system sizes (74 percent).37 A 2006 report from EPA's Inspector General38 identified these challenges as:

1. Lack of financial resources,
2. Aging infrastructure,
3. Difficulties obtaining financial assistance,
4. Cost of scale,
5. Management limitations,
6. Lack of long-term planning,
7. System operator issues, and
8. Challenges with understanding and/or compliance with regulations.

Reducing Water Impacts from Energy Production Vast amounts of water are used each year for energy production in the United States. A considerable amount of water is used to cool thermoelectric power plants, grow feedstock and produce biofuels, and extract oil, coal and natural gas. Further, the polluted water discharges from energy production poses difficult challenges for effective management. Opportunities exist for innovative solutions to not only alleviate the potential water quality impacts from energy production activities, but also provide for more efficient and cost-effective energy production. For example, beneficial reuse of produced water may be an attractive opportunity for oil and gas production wells located in water-scarce regions, where limited freshwater resources exist and the potential costs for produced water discharge are high.

6. Conclusion

The world is facing turbulent water future. With the growing economy and rising population, the theme of all nations is 'Save water'. Quantity and quality of water should be given equal importance. Awareness related to 'water conservation' and 'safe drinking water' is extremely important, and should be given a good thought to the people.

The technological solution depends on raw water characteristics, affordability and acceptability and level of application. Of course, sustainability depends on an awareness of the related issues. Since there are limitations in every individual treatment technologies and, thus, hybrid technologies are always beneficial; however, availability, selection, optimization, etc. are important for the best performances of the system. Lastly, it must be mentioned through the gambling of research that the future of the water treatment technology is highly prosperous and hope 1 day we will fulfill the demand 'fresh water for everyone'.

7. References

1. Abdul, Jameel A. Evaluation of drinking water quality in Tiruchirapalli, Tamil Nadu; Indian J Environ Hlth. 2002; 44(2):108-112.
2. Achuthan, Nair G, Mohammad AI, Fadiel MM. Physico-Chemical parameters and correlation coefficients of groundwater of North-East Libya. Poll. Res. 2005; 24(1):1-6.
3. Akbar, Ziauddin, Siddiqui NA. Ground water quality of a coastal area-A case study. Ecol. Env and Cons. 2007; 13(3):645-648.
4. Akoteyon IS, Mbata UA, Olalude GA. Investigation of heavy metal contamination in groundwater around landfill site in a typical sub-urban settlement in alimosho, lagos-nigeria; journal of Applied Sciences and Environmental Sanitation. 2011; 6(2):155-163.
5. Almasri ML, Kaluarachchi JJ. Assessment and management of long-term nitrate pollution of groundwater in agriculture-dominated watersheds. Journal of Hydrology. 2004; 295(1-4):225-245.
6. Anand Chetna, Akokar Pratima, Chakrabarti Rina. Bacteriological water quality status ofriver Yamuna in Delhi. J Environ Bio. 2006; 27(1):97-101.
7. Anbuganapathi G, Manimekialai G, Mohan R, Mohansundaram J, Thirunavukkarasu N. Bacterial Contamination of river Cauvery, Namakkal district. A case study. Res. J Chem and Env. 2003; 13(1):41-44.
8. Anita, Pius, Charmaine Jerome. Evaluation of water quality index and its impact on the quality of life in an industrial area in Bangalore, South India. Am. J Sci. Ind. Res. 2010; 1(3):595-603.
9. APHA 20th edition. Standard methods for the examination of water and wastewater. American Public Health Association, Washington, DC, 1998.
10. APHA, Standard Methods for Examination of Water and Wastewater. (16th edition). American Water works Association. And Water Pollution Control Federation. American Public Health Association, 1998, 80-115.
11. APHA, Standard Methods for Examination of Water and Wastewater. (20th edition). American Water works Association. And Water Pollution Control Federation.

American Public Health Association, 2002, 213-256.
12. APHA, Standard methods for the examination of water and wastewater. 21st Edn, Washington DC, USA. Aria K. E. Tris and S. Dewi, Esherichia coli Contami- nation of Babies' Food-Serving Utensils in a District of West Sumatra, Indonesia, WHO South-East Asia Journal of Public Health. 2005-2012; 1(1):20-27.
13. Ashok Kumar Yadav, Parveen Khan, Sanjay K. Water Quality Index Assessment of Groundwater in Todaraisingh Tehsil of Rajasthan State, India-A Greener Approach. E-Journal of Chemistry. 2010; 7(S1):S428-S432.
14. Asogwa SE. The Risk of Lead Poisoning in Battery Chargers and possible hazard of their Occupation on the Environment. Nig. Med. J. 1979; 9(2):189-193.
15. Bably Prasad, Kajal Kumar Mondal. Heavy metals leaching in Indian fly ash. Journal of Environ. Science and Engineering. 2008; 50(2):127-132.
16. Bakare-Odunola MT. Determination of some metallic impurities present in soft drinks marketed in Nigeria. The Nig. J Pharm. 2005; 4(1):51-54.
17. Bhargava Shobhna. Floristic composition and plant distribution along polluted Pau Dhoi and Hindone River water at Saharanpur. Ph. D. Thesis, CCS. University, Meerut, 2006.
18. Bharti N, Katyal D. Water quality indices used for surface water vulnerability assessment. International Journal of Environmental Sciences. 2001; 2(1):154-173.
19. Bhowmick AN, Arijit Deyand, Chakra Borty D. Ground water conamination through landfills in nctdelhi (Abstracts of Proceedings of the National Workshop on Water Quality (including drinking water). During 1 - 2nd February at SES, JNU, and New Delhi-67, 2002.