

Construction of an eco-friendly water treatments method by utilizing recycled materials- A review.

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Abstract

The most problematic issue of rural areas is the provision of clean water at a relatively low cost and energy rates. Industries discharge chemical effluents that contaminate existing water bodies. Chlorination may be one solution but are not employed in mass as they are less convenient to use. People die out of water borne diseases which in itself act as a source of motivation for resolving and analyzing the problem as soon as possible. In the present article, the demand of water treatment process that is chemical free, inexpensive, and simple to build has been increasing with the rise in population and pollution levels has been reviewed.

Keywords: Water pollution, Eco-friendly treatment.

INTRODUCTION

Energy efficient, low cost and chemical –free method of water purification has become a humanity need. There is acute shortage of drinking water in developing countries. This all due to the water pollution. So, some actions have to be taken in this regard. Today's common method for water purification are energy , chemical, and cost intensive and are used on large amount of water and require electrical power, capital, and resources to run them. That's the reason behind the low popularity in rural areas. Introduction of chemicals leads to the contamination of water. So, in coming future some methods have to find to purify the water and not leading to its contamination.

Water pollution and Water scarcity

In 2004, 1.5 billion people were estimated for lacking access to clean water. Contaminated water includes organic wastes, bacteria, virus and suspending particles. In addition to this another 1.5 billion people approximated for not having proper sanitation facilities. This means that 1 out of 4 people did not have clean water for their daily practices and 1 out of 2 people not having adequate accommodations for bathing or using the bathroom. Since 1998, number had risen roughly 25%. This is all due increase in the population level. It has been estimated that by 2050 population will increase from 3 billion to 6 billion and the per capita water demand will likely to increase twice (Herbert, 2004).

Due to lack of clean drinking water, approx 12 million deaths has takes place. This is due to the water borne illness. It has found that 1.8 million people die a year from diarrheal disease. These deaths could be prevented with improved sanitations and 35% can be prevented by increase in the frequency of hand washing. Diseases like intestinal parasites and diarrhea caused by waterborne bacteria and viruses lead to malnutrition and death for millions of people who consumed drinking water (Herbert, 2004).

Approx 150 gallons of water a day used by Americans and this use not include the agriculture and industrial use. This amount is outrageous in comparison with the African who uses on 7.5 gallon a day. Americans do have indoor plumbing but two-third of the world

population has to fetch the water from outside. Lack of water leads to the poor nutrition because families can't grow vegetables (Herbert, 2004).

Means that make water polluted comprise waste discharges from humans and animals; erosions; natural aging of lake by algal bloom; decay of organic materials; high ion concentrations ; heavy metals; and discharge from various industries. These pollutants not only make water unfit for drinking but also hazardous to our health also (Bohn, *et al.*, 2008).

Water Treatment methods commonly used

Water is generally purified by the filtration and disinfections. Filtration composes of removal of turbidity and suspended particles. Turbidity level must not exceed 5 NTU; methods used for achieving these standards are sedimentations and coagulation. Both this method helps to remove the finer particles from water. In sedimentation process, the particles settle down to bottom and that is subsequently removed whereas in coagulation process clumps the finer particles together by stirring a chemical, such as iron or aluminum salts, into the water. These chemicals help to neutralize the chemical and electrostatic forces that repel particles, and thus lead to the formation of clumps which can be removed by filtration method or they can merely settle down ("water treatment", 2008).

Filtration of polluted water is preceded by sedimentations or coagulations. This is because to avoid the blockage of filter by the large particles. Filtration includes sediments filters, fibrous materials or porous object such as specially designed ceramic bowl. After the removal of suspended particles water is allowed to remove the pathogens. This is achieved by the disinfection method. In this method water is made free from micro organisms. Chlorine and chlorinated compounds are used commonly to purify the water. This method provides the residual disinfections to the water. Additions of chlorine and its compound results the poor taste and odor of the water. Another disadvantage of this is that it reacts with the organic matter to form the carcinogenic DBP ("water treatment", 2008).

Treatment of water in developing Area

There are thousands types of water filter with the ability to purify the water are available in market. Some of them are too expensive and won't meet the specific needs of unindustrialized nations. This filter should not consume lots of non-renewable energy and there should not be any adverse effect on the environment while using it. Creations of this filter should be simple and easily available in the community (McAllister, 2005).

Modern methods are not so common in the rural areas. They purify the water by rudimentary method i.e. solar disinfection using polyethylene terephthalate (PET). In this, water with low turbidity is filled into the clear plastic bottles and put in direct sunlight at least for six hours. If temperature is below 42 degrees Celsius then water has to be kept for two days. In this, UV-A rays of sun kills the diarrhea causing micro organism and serves as the alternative of boiling water. Disadvantage of this method is that it is very tedious process and it is not known that water has spent its sufficient time in the sunlight ("Solar Water Disinfection", 2002)

Some seeds can be used as coagulators such as *Moringa oleifera*. This seeds are a low cost and ecofriendly too. Here seeds which have dried on the trees are only used; the green seeds have no coagulation effect. Seeds used for low turbid water (34-36 NTU) can remove 96% of its turbidity (Alam, Ali, Muyibi, & Salleh, 2010).

Pollution caused by Plastic

The most inexpensive, strong and durable material that can be used for packaging or disposable items is plastics. It has been studied that in 1950, 0.5 tons of plastic were produced, that number had risen to 260 million in 2010. Manufacturing of plastic bags requires extensive energy and raw materials, 8% of total oil is used in the development of plastics (Nicholas and Wabnitz, 2010)

In 1957, plastics bags are used for carrying sandwiches, snacks, etc. After this plastic grocery bag were introduced. These bags were less expensive. This (plastic bottles) are shielded from sunlight in landfills and will not decomposed for thousands of year. They are non biodegradable substance. It may prove harmful to the environment if not recycled properly. Plastic bags are somehow breaking down into smaller particles by the action of light that too contaminate the soil and water. It has been studied that only 7.1% of plastic disposed were recycled in 2008. Two third of waste generated by people is sent for landfill and rest is sent for incineration. In 2008, a survey of landfills found that 82% landfills had a leak. Incinerators cause carbon emission which is more than the emission from coal, oil, or natural gas-fueled power plants. Pollution can be eliminated by reducing the use of plastics ("Waste and recycling facts", 2011).

Standards of drinking water

The parameter which measures the cloudiness of the water, or the amount of suspended particles in the water is Turbidity. Impurities in water may added from industries, high ion concentrations, heavy metals, dead decay bodied, organic matters or particles from the water treatment process including hydroxides and lime softening. It can be quantified by the amount of scattered light resulting from the particles in the water. Tools which are precise are needed to be manufacture in order to measure the extremely high or low turbidity amounts ("Importance of Turbidity",

1999).

Water having high turbidity is not only unfit for drinking but also contain many significant pathogenic contaminations. The organic part of the water serves as the nutrient for those microorganisms. It doesn't have any direct correlation with infection. But it studies show that it is a strong indicator as well as helpful in confirming the removal of pathogens. Phil Consonery is the person who has conducted over 75 evaluations of water treatment plants states that measuring turbidity is quick and inexpensive and it often acts as a good indicator of pathogen. Performance of filter can be evaluated by this method. By measuring the initial and final turbidity we can say how well a system works in removing the suspended particles from different degrees of dirty water. Turbidity levels neither over 1 NTU nor less than 0.3 NTU is required by the US EPA for a direct filtration method system ("Importance of Turbidity"1999).

The bacteria typically found in intestines of human and mammals are coliform bacteria. There number is large in the fecal waste, so therefore used as an indicator for contaminated water. If water is found to be free from coliform then it is accepted that it is pathogens free, free from initial water sources and heavy metals. The standard for which water is tested is being regulated by the US Environmental Protection Agency. As total coliform test indicate the contamination, so it is regarded as standard test for drinking water. Out of total multiples sample of 100ml taken in month, only 5% of multiple sample gives the positive result for maximum coliform levels. Those water system taking 40 or fewer samples per month can have only one positive test for MCL. The most adequate or convenient method for proving the water polluted by microorganism is total coliform test (Berger, Calderon, & Craun, 1997).

CONCLUSION

Today developing countries face scarcity of clean water. The demand for water treatment process that is chemical free inexpensive and simple to build is on rise which runs parallel to the rise in population and pollution levels. Therefore, a need to construct a water treatment device that utilizes recycled materials. In this, device plastic mesh water filter is assembled by puncturing minuscule hole in a grocery bag (High-density polyethylene HDPE) (Kampbell *et al.*, 1998) with sewing needles. Layers of perforated section of bags were attached to the opening of the plastic water bottle that contains fine sand. Water that has been pass through the filter was tested for turbidity and decrement in bacterial population showed satisfying results which paves the way for efficient water treatment that can be utilized by the common mass.

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