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Water Treatment Plants: Making water fit for use

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It should be emphasized that all the positive effects of a water-treatment system could be jeopardized if the water is not drawn, stored and transported carefully and hygienically. These water need to be treated to produce safe and potable drinking water, writes **Rishabh Sethi, Executive Director, SPML Infra Ltd.**

Water is a prime natural resource, a basic human need and a precious national asset. Planning, development and management of water resources need to be governed as per national perspectives. Access to safe drinking water continues to be a problem in some areas. Availability of water in different regions and different community in the same region is imbalanced and has the potential of causing social unrest. Groundwater, though part of hydrological cycle and a community resource, is still perceived as an individual property and is exploited inequitably and without any consideration to its sustainability leading to its overexploitation.

In the last one decade, the world has become more urban and has more than half population living in urban areas, a drastic shift from earlier. Over 90 per cent of urban growth is now occurring in the developing world; adding an estimated 70 million new residents to urban areas each year. There will be more than two billion urban residents in the next 20 years. The urban populations are expected to double during this period in Africa and South Asia.

Much of this urban growth is occurring in medium and small sized cities, with about 53 per cent of the world's urban population residing in cities with population of 5 lakh or less. This demographic change raises important issues about the water availability and process of treatment.

Water contamination

Water to be supplied for public use must be potable i.e. satisfactory for drinking purposes complete with its chemical, physical and biological characteristics. Drinking water should, preferably, be obtained from sources free from pollution. The raw water normally available from surface water sources is, however, not directly suitable for drinking purposes.

Water can be contaminated by the following agents:

- Pathogens - disease-causing organisms that include bacteria, amoebas and viruses, as well as the eggs and larvae of parasitic worms.
- Harmful chemicals from human activities (industrial wastes, pesticides, fertilizers).
- Chemicals and minerals from the natural environment, such as arsenic, common salt and fluorides.

Some non-harmful contaminants may influence the taste, smell, colour or temperature of water, and make it polluted. Water from surface sources is often contaminated by microbes, whereas groundwater is supposed to be safer, but even groundwater is now contaminated by harmful chemicals from human activities or from the natural environment. Rainwater captured by a rooftop harvesting system or with small catchment dams is relatively safe, provided that the first water is allowed to flow to waste when the rainy season starts. The amount of water to be treated should also be assessed. This can be estimated by assuming that each person will need a minimum of 20-50 litres of water a day for drinking, cooking, laundry and personal hygiene.

It should be emphasized that all the positive effects of a water-treatment system could be jeopardized if the water is not drawn, stored and transported carefully and hygienically. These water need to be treated to produce safe and potable drinking water. Some of the common treatment processes used in the past includes Plain Sedimentation, Slow Sand Filtration and Rapid Sand Filtration. Pressure filters and diatomaceous filters have been used though very rarely. Roughing filters are used, under certain circumstances, as pretreatment units for the conventional filters.

Water treatment is most common in cities before it could be supplied to the residents. The objective of all water treatment process is to remove existing pollutants in the water, or reduce the concentration of such contaminants so the water becomes fit for its desired end-use, drinking. The processes involved in treating water for drinking purpose may be solids separation using physical processes such as settling and filtration, and chemical processes such as disinfection and coagulation. The treatment processes may need pretreatment like pre-chlorination and aeration prior to conventional treatment.

Water treatment methods

The common water treatment processes are:

- Filtration
- Rapid granular media
- Slow sand and other b i o - logical filters
- Membrane filters: micro, ultra, nano and reverse osmosis
- Disinfection
- Physical: UV radiation, heat, membrane filters
- Chemical: Chlorine, ozone, chlorine dioxide, iodine, other antimicrobial chemicals
- Other physical-chemical removal processes
- Chemical coagulation, precipitation and complexation
- Adsorption: e.g. activated carbon, bone char etc.

- Storage & Distribution

The water-treatment methods described above can reduce the number of pathogens in water, but do not always eliminate them completely. And although boiling and solar disinfection are effective, the methods are impractical with large volumes of water. In contrast, chemical disinfection inactivates pathogenic organisms and the method can be used with large volumes of water. Chlorine compounds usually destroy pathogens after 30 minutes of contact time, and free residual chlorine (0.2-0.5 mg per litre of treated water) can be maintained in the water supply to provide ongoing disinfection.

Several chlorine compounds, such as sodium hypochlorite and calcium hypochlorite, can be used domestically, but the active chlorine concentrations of such sources can be different and this should be taken into account when calculating the amount of chlorine to add to the water. The amount of chlorine that will be needed to kill the pathogens will be affected by the quality of the untreated water and by the strength of the chlorine compound used. If the water is excessively turbid, it should be filtered or allowed to settle before chlorinating it.

Main components

The main components of a typical water treatment plant:

- Raw water pre-settling
- Settling tank
- Inlet chamber
- Parshall flume
- Flash mixture
- Clariflocculators
- Chemical dosing viz. chlorination
- Filtration
- Clear water reservoir
- Pump house for distribution

With the deteriorating quality and quantity of water, communities and industries are facing a difficult task in managing their resources. Municipal bodies in several parts of India are asking industry to treat wastewater and use it for their processes, rather than drawing from the scarce resources that need to support for drinking water.

SPML Infra Ltd being a leader in water and wastewater treatments is helping municipalities to provide access to safe, clean potable water supply to their residents. SPML has gained a strong foothold in the domain of design and construction of water treatment plants and constructed a number of treatment plants across India. SPML provides solutions for proper treatment and disposal of municipal wastewater and sewage to ensure that the generated wastewater does not harm our delicate ecosystem and is recycled for further usage.

Some of the signature water treatment plants constructed and maintained by SPML:

- 119-mld Pokaran Water Treatment Plant will provide clear water to 580 villages and three towns of Pokaran, Balotra and Siwana in Rajasthan.
- 146.75-mld WTP in Sawai Madhopur would treat the raw water of Chambal River to specified quality standards that will help to supply drinking water to the residents of Sawai Madhopur, Karauli and nearby four towns and 926 villages.
- 100-mld WTP in Goa is to augment the existing water supply system.
- 57-mld WTP in Shimoga is to augment the water supply scheme of Shimoga in Karnataka.
- 72-mld WTP helped in generating power for Bakreshwar Thermal Power Plant in West Bengal.
- 60-mld Water Treatment Plant in Davanagere, Karnataka, to help water supply to the town.
- 68-mld WTP for providing drinking water supply to Hubli-Dharwad twin city in Karnataka.
- 38-mld WTP with water sourcing from Krishna River for improvement of water supply scheme to Bijapur in Karnataka.
- 20-mld WTP for water supply scheme for Jorhat in Assam.
- 19.5-mld Integrated WTP for water supply in Ramganjmandi, Rajasthan.
- 15-mld Water Treatment Plant at Chamrajnagar, Karnataka.