

WATER TREATMENT IN INDIA



NATURE OF WATER



Water is a colorless, tasteless, and odorless solvent that can dissolve most minerals, chemicals and biological impurities. The quality of water is largely influenced by such compounds and their concentration in water, which originate either from natural sources or from waste deposits. Such compounds, if inorganic in nature, originate from weathering and leaching of rocks, soils, and sediments, etc and if organic in nature, originate from decaying plants and animal matters and from agricultural runoffs, etc.¹

According to the Water (Prevention and Control of Pollution) Act, 1974, water is polluted, if it is contaminated, or its physical, chemical or biological properties are altered, or any sewage or trade effluent or any other liquid, gaseous or solid substance is discharged into water, which may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms.

REGULATORY BODIES

As per the Constitution of India, water supply and solid waste management, etc is a State Subject. Therefore, it is the responsibility of the State Government and Urban Local Bodies (ULBs) to implement, operate and maintain water supply and sanitation systems and also arrange finances for the same.²

The Central Pollution Control Board (CPCB) of India in collaboration with concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCCs) has established a

¹http://cpcb.nic.in/upload/NewItems/NewItem_103_statusofwaterqualitypackage.pdf, last visited on 18.04.2017

²http://moud.gov.in/pdf/584e49ad3390bGuidelines_DWM_0.pdf, last visited on 18.04.2017

nationwide network of water quality monitoring which is conducted on a monthly or quarterly basis in surface waters and on half yearly basis in case of ground water.³

WASTE WATER MANAGEMENT

The contaminated water contains a number of chemicals and effluents which renders it unfit for human consumption. A number of water treatment plants across the country have utilized various technologies to render such water safe for human consumption and other purposes.



The management of waste water may be done using either conventional centralized systems or decentralized systems.

- A. The centralized system of waste water management is usually planned, designed and operated by Government agencies. It will collect and treat large volumes of waste water for an entire community.
- B. Whereas, the decentralized system of waste water management will treat the waste water of individual houses, clusters of homes, isolated communities, industries, or institutional facilities close to their origin.⁴

WASTE WATER TREATMENT PROCESS

I. Conventional methods of treating waste water⁵

The CPCB has studied the functioning of water treatment plants, the prevailing raw water quality and water treatment technology, etc across the country. As per its findings, the following process has been followed by these plants for treating waste water:

³http://cpcb.nic.in/upload/NewItems/NewItem_103_statusofwaterqualitypackage.pdf, last visited on 18.04.2017

⁴Supra note 2

⁵Supra note 3



(i) Aeration

Aeration involves bringing air or other gases in contact with water to:

- a. convert volatile substances from liquid to gaseous state and
- b. dissolve beneficial gases into the water.

The volatile substances may include volatile organic compounds, and various aromatic compounds responsible for tastes and odors. Whereas, the gases that may be dissolved into water may include oxygen and carbon dioxide.

For conducting this process, the aerators that may be, commonly, used are gravity aerators, spray aerators, diffusers and mechanical aerators.

(ii) Coagulation and Flocculation

The process of coagulation and flocculation may be broadly described as a chemical/physical process of blending or mixing a coagulating chemical into a stream and then gently stirring the blended mixture.

a. Coagulation-

Herein, a coagulant (say, alum) is thoroughly mixed with raw water which causes neutralization of charge of particles. The coagulant chemicals, inorganic and/or organic in nature, when added to water at an optimum dose (normally in the range of 1 to 100 mg/l), cause destabilization.

b. Flocculation-

After coagulation, the water is then flocculated, i.e. it is gently stirred to enhance the contact of destabilized particles and to build floc particles of optimum size, density, and strength to be subsequently removed by settling or filtration.

(iii) Sedimentation and filtration

The flocculated water is then taken to sedimentation tanks / clarifiers for removal of flocs and thereafter to filters where the remaining turbidity is removed.

(iv) Backwashing of filters

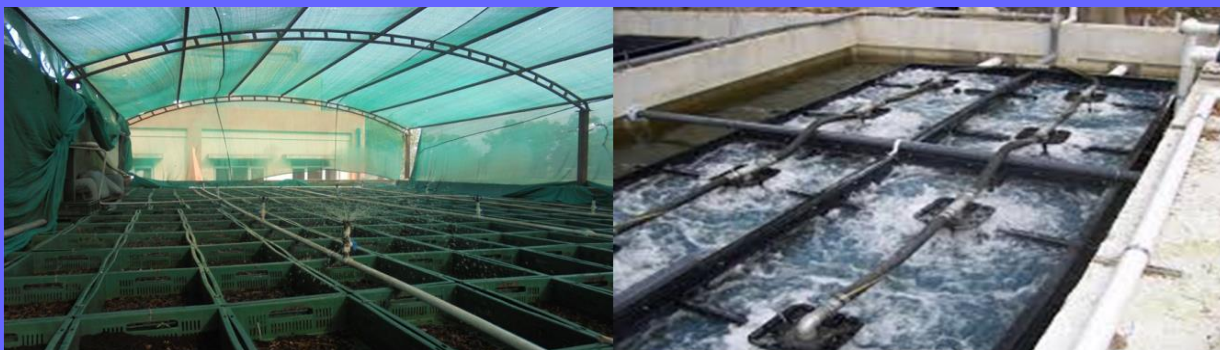
As the amount of solids retained in a filter increases, bed porosity decreases. Before they start breaking through the filter, backwashing is required to clean the bed.

(v) Disinfection

Disinfection of potable water system is the specialized treatment for destruction or removal of organisms in water which are capable of causing disease. For such disinfection, the chemical that has been predominantly used is chlorine. This chlorination system consists of six separate subsystems:

- a. chlorine supply;
- b. storage and handling;
- c. safety provisions;
- d. chlorine feed and application;
- e. diffusion, mixing and contact; and
- f. the control system.

II. Use of bio-technologies for waste water treatment



According to the CPCB, for treatment of waste water, use of biological methods can be a more cost-effective option than use of conventional treatment systems. The bio-technology is less expensive,

easy to operate and does not produce secondary pollutants. A few instances of bio-technologies used for treatment of wastes have been described below:

i) Anaerobic technology-

The application of anaerobic technology avoids heavy machinery and reduces the land requirement for the waste water treatment plant. The anaerobic process includes the use of the acclimatized microbes for transforming complex macromolecules of organic matter present in waste water into biogas. Also, the stabilized sludge from anaerobic process may be free from strong or foul odors. The output that it produces, i.e. biogas and digester-sludge can be utilized as an alternate source of energy and as a fertilizer respectively.⁶

ii) Duckweed based waste water treatment-

For the purpose of setting up a low cost waste water treatment technology which will also utilize the nutrients in waste water, the CPCB has sponsored a project on duckweed based waste water treatment to M/s Sulabh International, a social service organization. This project was conducted for three years in Delhi and in Halisahar, West Bengal. Duckweed is a small free-floating and fast growth aquatic plant which is mostly found in ponds and ditches. It has great ability to reduce the suspended solids, bacterial and other pathogens from waste water. As per its findings, this system can be used for small towns or in rural/semi rural areas, where land is available and harvested duckweed can be used for different economic uses including pisciculture.⁷

iii) Enzymatic treatment-

Oxidative enzymes such as peroxidase are used for removal of toxic organic and recalcitrant compounds from drinking water sources as well as from industrial effluents.⁸

iv) Bio-filters-

The environmentally sustainable and economically viable bio-filters technology uses earthworms and beneficial microbes to break down organic waste present in the waste water and also converts the energy, carbon and other elements of the waste to bio-nutritional products such as humus and bio-fertilizer.⁹

⁶ http://www.cpcb.nic.in/upload/Publications/Publication_437_sec14_6.pdf, last visited on 18.04.2017

⁷ http://www.cpcb.nic.in/upload/Publications/Publication_436_sec14_7.pdf, last visited on 18.04.2017

⁸ http://www.cpcb.nic.in/upload/Publications/Publication_431_sec14_12.pdf, last visited on 18.04.2017

⁹ <http://timesofindia.indiatimes.com/city/mangaluru/Bio-filter-an-environmentally-sustainable-technology-for-waste-water-treatment-Expert/articleshow/39103468.cms>, last visited on 18.04.2017

ENTRY OF FOREIGN COMPANIES IN THIS SECTOR



A few companies that have entered the sector of water treatment in India are as follows:

- (1) Remondis AG & Co KG, a Germany-based water and waste management company, had entered India by acquiring of Shrushti Consultants, an Indian company that provides water supply and treatment plants to industry. Through this deal, Remondis acquired 11 management contracts for water treatment plants in Maharashtra - nine for industrial clients and two for municipal water supply, waste water collection and disposal.¹⁰
- (2) M/s. Degremont S.A., France has been allowed 100% foreign direct investment (FDI) by the Ministry of Commerce & Industry, on the recommendations of the Foreign Investment Promotion Board (FIPB), for providing engineering technology and consultancy services in the areas of designing, building, operation; and maintenance of water treatment plants etc.¹¹

A number of public-private partnerships projects have been executed for improvement of water supply in urban and rural areas, construction and operation of water treatment plants, etc. Therefore, the Government has also encouraged private sector participation and FDI from foreign companies to develop this sector.¹²

¹⁰https://kpmg.de/docs/inside_01.pdf, last visited on 18.04.2017

¹¹<http://dipp.nic.in/English/policy/pr271200.htm>, last visited on 18.04.2017

¹²[http://moud.gov.in/upload/uploadfiles/files/Trends%20in%20PSP%20in%20Indian%20water%20sector%20\(Detailed\)013.pdf](http://moud.gov.in/upload/uploadfiles/files/Trends%20in%20PSP%20in%20Indian%20water%20sector%20(Detailed)013.pdf), last visited on 18.04.2017

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