Science Exploration

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INTRODUCTION

TO

WATER TREATMENT PLANTS

Visit to

Nimeta Water Treatment Plant, Vadodara

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INTRODUCTION TO WATER TREATMENT PLANTS

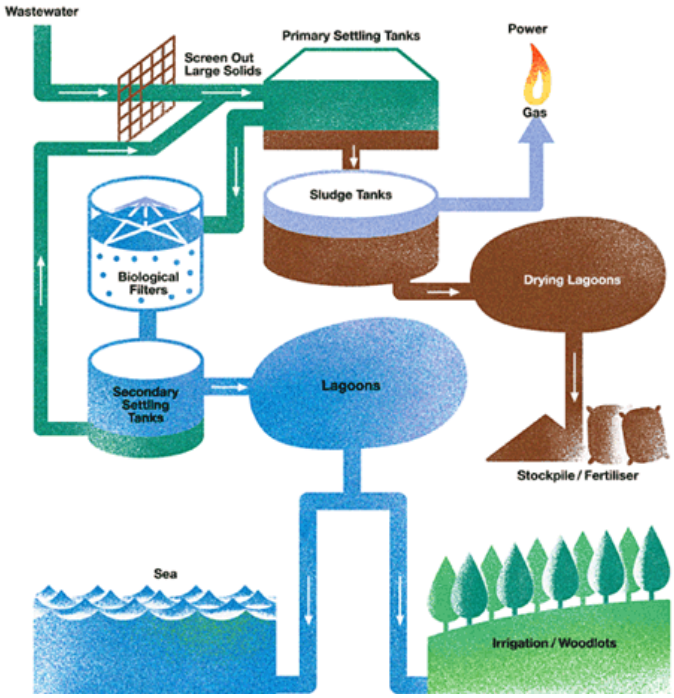
1. Water Treatment Plants are installations where waste or dirty water is converted into better quality water through various physical and chemical processes. Wastewater treatment processes are designed to achieve improvements in the quality of the wastewater. The various treatment processes may reduce:

(a) Suspended solids (physical particles that can clog rivers or channels as they settle under gravity)

(b) Biodegradable organics (e.g. BOD) which can serve as “food” for microorganisms in the receiving body.

(c) Pathogenic Bacteria and other disease causing organisms.

(d) Nutrients, including nitrates and phosphates.



WATER TREATMENT PROCESSES

2. Widely used terminology refers to three levels of wastewater treatment:

   (a) Primary,

   (b) Secondary, and

   (c) Tertiary (or advanced).

3. **Primary (mechanical) treatment** is designed to remove gross, suspended and floating solids from raw sewage. It includes screening to trap solid objects and sedimentation by gravity to remove suspended solids. This level is sometimes referred to as “mechanical treatment”, although chemicals are often used to accelerate the sedimentation process. Primary treatment can reduce the BOD of the incoming wastewater by 20-30% and the total suspended solids by some 50-60%. Primary treatment is usually the first stage of wastewater treatment. Many advanced wastewater treatment plants in industrialized countries have started with primary treatment, and have then added other treatment stages as wastewater load has grown, as the need for treatment has increased, and as resources have become available.

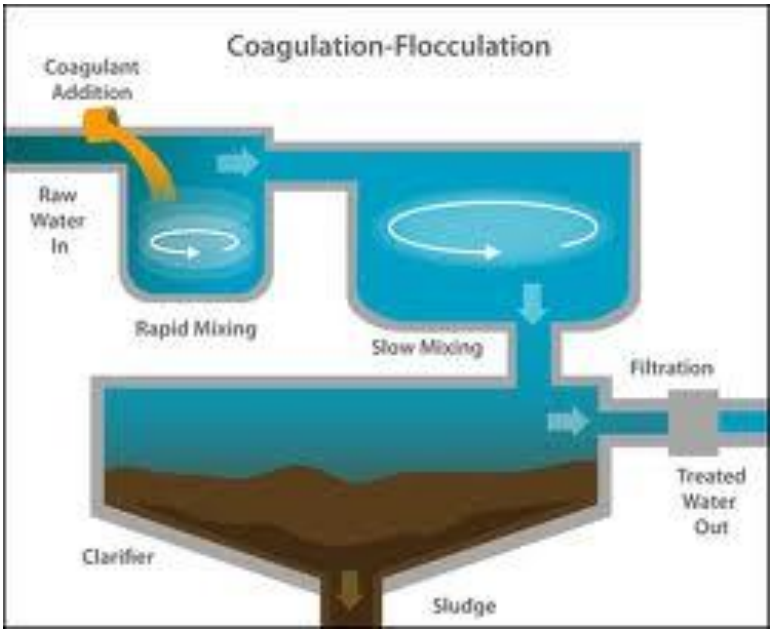
4. **Secondary (biological) treatment** removes the dissolved organic matter that escapes primary treatment. This is achieved by microbes consuming the organic matter as food, and converting it to carbon dioxide, water, and energy for their own growth and reproduction. The biological process is then followed

by additional settling tanks (“secondary sedimentation", see photo) to remove more of the suspended solids. About 85% of the suspended solids and BOD can be removed by a well running plant with secondary treatment. Secondary treatment technologies include the basic activated sludge process, the variants of pond and constructed wetland systems, trickling filters and other forms of treatment which use biological activity to break down organic matter.

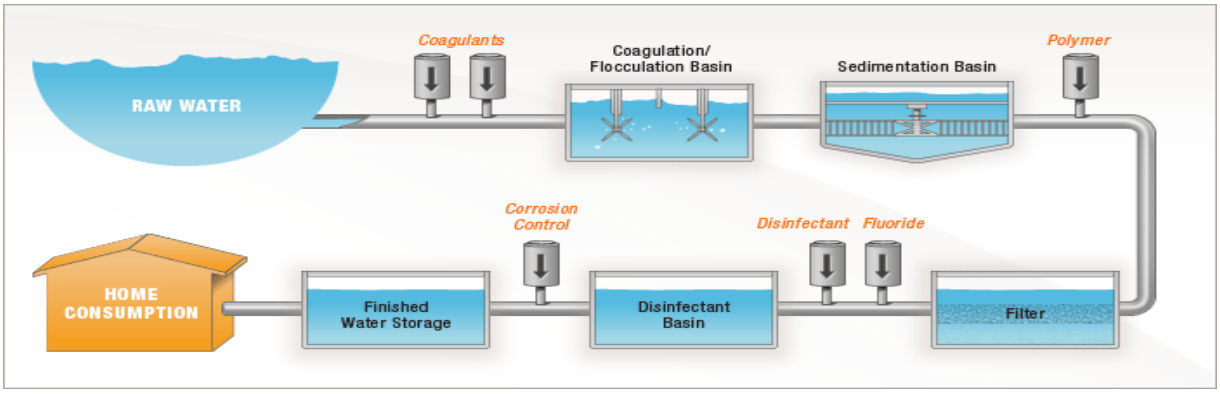
5. **Tertiary treatment** is simply additional treatment beyond secondary! Tertiary treatment can remove more than 99 percent of all the impurities from sewage, producing an effluent of almost drinking-water quality. The related technology can be very expensive, requiring a high level of technical know-how and well trained treatment plant operators, a steady energy supply, and chemicals and specific equipment which may not be readily available. An example of a typical tertiary treatment process is the modification of a conventional secondary treatment plant to remove additional phosphorus and nitrogen.

STEPS OF WATER PURIFICATION

6. **Coagulation :** Natural and wastewater containing small particulates which are suspended in water forming a colloid. These particles carry the same charges, and repulsion prevents them from combining into larger particulates to settle. Thus, some chemical and physical techniques are applied to help them settle. The phenomenon is known as **coagulation**. A well known method is the addition of electrolyte. Charged particulates combine with ions neutralizing the charges. The neutral particulates combine to form larger particles, and finally settle down. Another method is to use high-molecular-weight material to attract or trap the particulates and settle down together. Such a process is called **flocculation**. Starch and multiply charged ions are often used. Historically, dirty water is cleaned by treating with alum, $Al_2(SO_4)_3.12\ H_2O$, and lime, $Ca(OH)$. Coagulation is a major application of lime in the treatment of wastewater.



7. **Sedimentation**: Let the water sit around to let the floculated or coagulated particles to settle out. It works best with relatively dense particles (e.g. silt and minerals), while flotation works better for lighter particles (e.g. algae, color). A settling tank should be big enough so that it takes a long time (ideally 4 hours +) to get through. Inlets and outlets are designed so the water moves slowly in the tank. Long and narrow channels are installed to let the water to snake its way through the tank. The settled particles, sludge, must occasionally be removed from the tanks. The water is next ready to be filtered. Sedimentation is used in pre-treatment and wastewater treatment.



8. **Filtration** is the process of removing solids from a fluid by passing it through a porous medium. Coarse, medium, and fine porous media have been used depending on the requirement. The filter media are artificial membranes, nets, sand filter, and high technological filter systems. The choice of filters depends on the required filtering speed and the cleanness requirement. The flow required for filtration can be achieved using gravity or pressure. In

pressure filtration, one side of the filter medium is at higher pressure than that of the other so that the filter plane has a pressure drop. Some portion of this filter type must be enclosed in a container. The process of removing the clogged portion of the filter bed by reversing the flow through the bed and washing out the solid is called back washing. During this process, the solid must be removed out of the system, but otherwise the filters must be either replaced or taken out of service to be cleaned.

9. **Disinfection,** typically with chlorine, can be the final step before discharge of the effluent. However, some environmental authorities are concerned that chlorine residuals in the effluent can be a problem in their own right, and have moved away from this process. Disinfection is frequently built

into treatment plant design, but not effectively practiced, because of the high cost of chlorine, or the reduced effectiveness of ultraviolet radiation where the water is not sufficiently clear or free of particles.

10. **Aeration :** Bringing air into intimate contact with water for the purpose of exchanging certain components between the two phases is called aeration. Oxygenation is one of the purposes of aeration. Others are removal of volatile organic substances, hydrogen sulfide, ammonia, and volatile organic compounds. A gas or substance dissolved in water may further react with water. Such a reaction is called hydration.

BIBLIOGRAPHY

1. Research Paper “An indepth study of Waste Water Treatment processes” by Ms. Susmita Nandi, M.Sc under Vidyasagar Univerisity 2012 et.al.

2. Reference from www.denverwater.org

3. Reference from www.dec.ny.gov

4. Reference from www.sawater.com.au

5. Reference from www.pubwv.com

6. Reference from www. birminghamwaterworks.com