

Wastewater Treatment Plant (Structure and Function)

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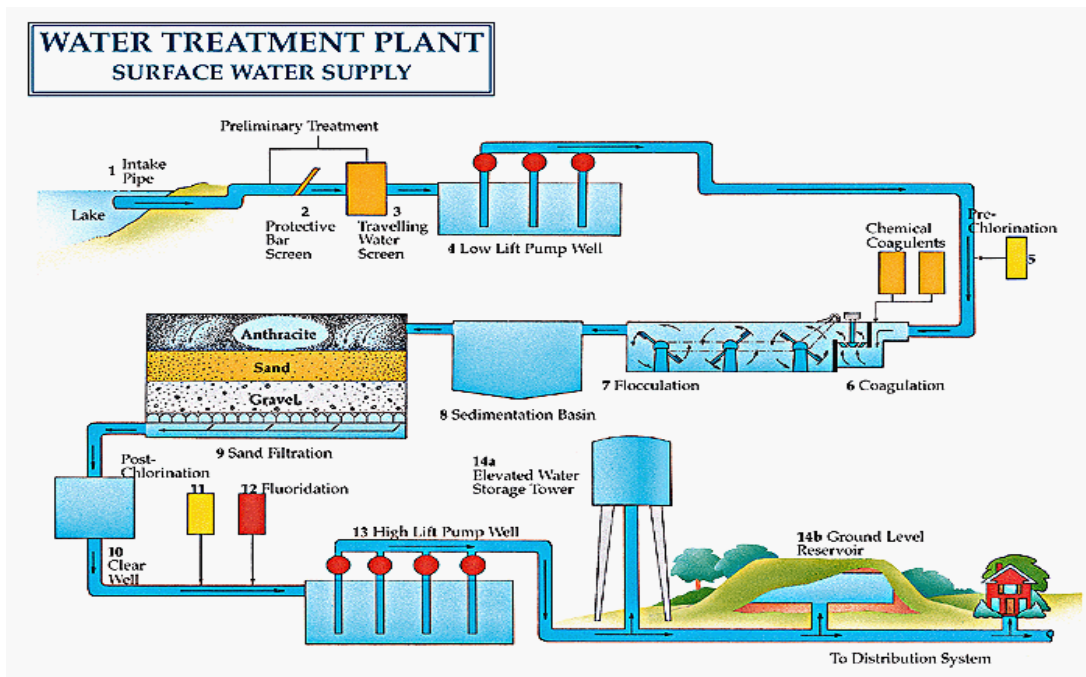
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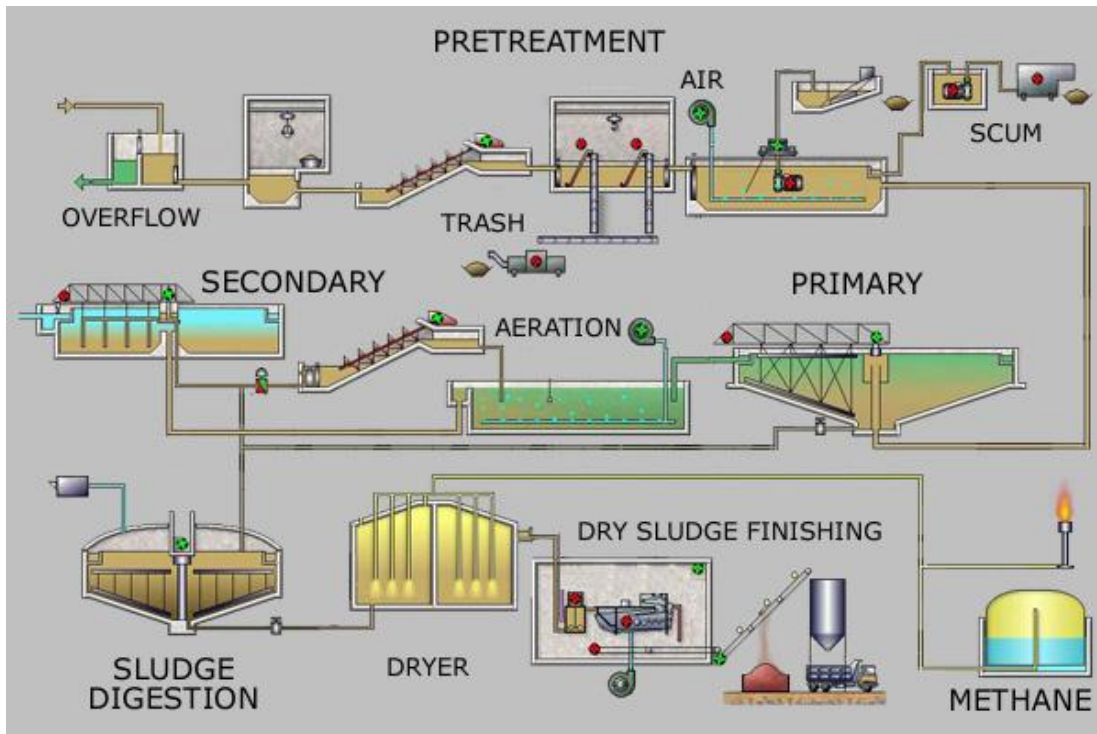
ABSTRACT: Wastewater treatment is a process used to remove contaminants from wastewater or sewage and convert it into an effluent that can be returned to the water cycle with minimum impact on the environment, or directly reused. **Wastewater treatment**, also called **sewage treatment**, the removal of impurities from wastewater, or sewage, before they reach aquifers or natural bodies of water such as rivers, lakes, estuaries, and oceans. Since pure water is not found in nature (i.e., outside chemical laboratories), any distinction between clean water and polluted water depends on the type and concentration of impurities found in the water as well as on its intended use. In broad terms, water is said to be polluted when it contains enough impurities to make it unfit for a particular use, such as drinking, swimming, or fishing. Although water quality is affected by natural conditions, the word pollution usually implies human activity as the source of contamination. Water pollution, therefore, is caused primarily by the drainage of contaminated wastewater into surface water or groundwater, and wastewater treatment is a major element of water pollution control.

I.INTRODUCTION

Wastewater treatment plants are designed to have distinct water treatment process combinations with varied water treatment facilities depending on the influent's water quality and the effluent discharge standard. Conventional wastewater treatment includes pretreatment, primary treatment, and secondary treatment. A series of treatment processes, for example, bar screening, degreasing, air flotation, primary sedimentation, biofilm process/activated sludge process, and secondary sedimentation, are applied. To further improve the effluent quality, tertiary treatment with (sand) filtration, advanced oxidation process, and membrane filtration are used. So far, no treatment method is specially designed to remove MPs, and only a few studies have investigated the detailed removal efficiencies of MPs at different stages of WWTPs.[1]



II.DISCUSSION



One of the most common forms of pollution control in the United States is wastewater treatment. The country has a vast system of collection sewers, pumping stations, and treatment plants. Sewers collect the wastewater from homes, businesses,



and many industries, and deliver it to plants for treatment. Most treatment plants were built to clean wastewater for discharge into streams or other receiving waters, or for reuse. Years ago, when sewage was dumped into waterways, a natural process of purification began. First, the sheer volume of clean water in the stream diluted wastes. Bacteria and other small organisms in the water consumed the sewage and other organic matter, turning it into new bacterial cells; carbon dioxide and other products. Today's higher populations and greater volume of domestic and industrial wastewater require that communities give nature a helping hand. The basic function of wastewater treatment is to speed up the natural processes by which water is purified. There are two basic stages in the treatment of wastes, primary and secondary, which are outlined here. In the primary stage, solids are allowed to settle and removed from wastewater. The secondary stage uses biological processes to further purify wastewater. Sometimes, these stages are combined into one operation. Primary Treatment As sewage enters a plant for treatment, it flows through a screen, which removes large floating objects such as rags and sticks that might clog pipes or damage [2]equipment. After sewage has been screened, it passes into a grit chamber, where cinders, sand, and small stones settle to the bottom. A grit chamber is particularly important in communities with combined sewer systems where sand or gravel may wash into sewers along with storm water. After screening is completed and grit has been removed, sewage still contains organic and inorganic matter along with other suspended solids. These solids are minute particles that can be removed from sewage in a sedimentation tank. When the speed of the flow through one of these tanks is reduced, the suspended solids will gradually sink to the bottom, where they form a mass of solids called raw primary biosolids (formerly sludge). Biosolids are usually removed from tanks by pumping, after which it may be further treated for use as a fertilizer, or disposed of in a land fill or incinerated. Over the years, primary treatment alone has been unable to meet many communities' demands for higher water quality. To meet them, cities and industries normally treat to a secondary treatment level, and in some cases, also use advanced treatment to remove nutrients and other contaminants. Secondary Treatment The secondary stage of treatment removes about 85 percent of the organic matter in sewage by making use of the bacteria in it. The principal secondary treatment techniques used in secondary treatment are the trickling filter and the activated sludge process. After effluent leaves the sedimentation tank in the primary stage it flows or is pumped to a facility using one or the other of these processes. A trickling filter is simply a bed of stones from three to six feet deep through which sewage passes. SECONDARY TREATMENT Activated Biosolids Process More recently, interlocking pieces of corrugated plastic or other synthetic media have also been used in trickling beds. Bacteria gather and multiply on these stones until they can consume most of the organic matter. The cleaner water trickles out through pipes for further treatment. From a trickling filter, the partially treated sewage flows to another sedimentation tank to remove excess bacteria. The trend today is towards the use of the activated sludge process instead of trickling filters. The activated sludge process speeds up the work of the bacteria by bringing air and sludge heavily laden with bacteria into close contact with sewage. [3]After the sewage leaves the settling tank in the primary stage, it is pumped into an aeration tank, where it is mixed with air and sludge loaded with bacteria and allowed to remain for several hours. During this time, the bacteria break down the organic matter into harmless by-products. The sludge, now activated with additional billions of bacteria and other tiny organisms, can be used again by returning it to the aeration tank for mixing with air and new sewage. From the aeration tank, the partially treated sewage flows to another sedimentation tank for removal of excess bacteria. To complete secondary treatment, effluent from the sedimentation tank is usually disinfected with chlorine before being discharged into receiving waters. Chlorine is fed into the water to kill pathogenic bacteria, and to reduce odor. Done properly, chlorination will kill more than 99 percent of the harmful bacteria in an effluent. Some municipalities now manufacture chlorine solution on site to avoid transporting and storing large amounts of chlorine, sometimes in a gaseous form. Many states now require the removal of excess chlorine before discharge to surface waters by a process called dechlorination. Alternatives to chlorine disinfection, such as ultraviolet light or ozone, are also being used in situations where chlorine in treated sewage effluents may be harmful to fish and other aquatic life. Other Treatment Options New pollution problems have placed additional burdens on wastewater treatment systems. [4]Today's pollutants, such as heavy metals, chemical compounds, and toxic substances, are more difficult to remove from water. Rising demands on the water supply only aggravate the problem. The increasing need to reuse water calls for better wastewater treatment. These challenges are being met through better methods of removing pollutants at treatment plants, or through prevention of pollution at the source. Pretreatment of industrial waste, for example, removes many troublesome pollutants at the beginning, not the end, of the pipeline. To return more usable water to receiving lakes and streams, new methods for removing pollutants are being developed. Advanced waste treatment techniques in use or under development range from biological treatment capable of removing nitrogen and phosphorus to physical-chemical separation techniques such as filtration, carbon adsorption, distillation, and reverse osmosis. These wastewater treatment processes, alone or in combination, can achieve almost any degree of pollution control desired. Waste effluents purified by such treatment, can be used for industrial, agricultural, or recreational purposes, or even drinking water supplies.



III.CONCLUSION

Water treatment is any process that improves the quality of water to make it appropriate for a specific end-use. The end use may be drinking, industrial water supply, irrigation, river flow maintenance, water recreation or many other uses, including being safely returned to the environment. Water treatment removes contaminants and undesirable components, or reduces their concentration so that the water becomes fit for its desired end-use. This treatment is crucial to human health and allows humans to benefit from both drinking and irrigation use. Living away from drinking water supplies often requires some form of portable water treatment process. These can vary in complexity from the simple addition of a disinfectant tablet in a hiker's water bottle through to complex multi-stage processes carried by boat or plane to disaster areas.[5]

Constituent	Unit Processes
Turbidity and particles	Coagulation/ flocculation, sedimentation, granular filtration
Major dissolved inorganics	Softening, aeration, membranes
Minor dissolved inorganics	Membranes
Pathogens	Sedimentation, filtration, disinfection
Major dissolved organics	Membranes, adsorption

Many developed countries specify standards to be applied in their own country. In Europe, this includes the European Drinking Water Directive^[4] and in the United States the United States Environmental Protection Agency (EPA) establishes standards as required by the Safe Drinking Water Act. For countries without a legislative or administrative framework for such standards, the World Health Organization publishes guidelines on the standards that should be achieved.^[5] China adopted its own drinking water standard GB3838-2002 (Type II) enacted by Ministry of Environmental Protection in 2002.^[6]

Where drinking water quality standards do exist, most are expressed as guidelines or targets rather than requirements, and very few water standards have any legal basis or, are subject to enforcement.^[7] Two exceptions are the European Drinking Water Directive and the Safe Drinking Water Act in the United States, which require legal compliance with specific standards.

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