

## Waste water treatment: An overview

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### EDITORIAL

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 acceptable impact on the environment, or reused for various purposes (called water reclamation). The treatment process takes place in a wastewater treatment plant (WWTP), also referred to as a Water Resource Recovery Facility (WRRF) or a Sewage Treatment Plant (STP) in the case of domestic wastewater. Pollutants in wastewater are removed, converted or broken down during the treatment process.

The treatment of wastewater is part of the overarching field of sanitation. Sanitation also includes the management of human waste and solid waste as well as stormwater (drainage) management. The main by-product from wastewater treatment plants is sewage sludge which is usually treated in the same or another wastewater treatment plant. Biogas can be another by-product if anaerobic treatment processes are used.

The processes involved in waste-water treatment include physical processes such as settlement or flotation and biological processes such as aerated lagoons, activated sludge or bio-films in trickling filters. Other physical methods such as filtration through sieves may be used in specialised circumstances such as de-watering waste-water sludge.

To be effective, sewage must be conveyed to a treatment plant by appropriate pipes and infrastructure and the process itself must be subject to regulation and controls. Some wastewaters require specialized treatment methods. At the simplest level, treatment of sewage and most wastewaters is carried out through separation of solids from liquids, usually by sedimentation. By progressively converting dissolved material into solids, usually a biological floc, which is then settled out, an effluent stream of increasing purity is produced.

Phase separation transfers impurities into a non-aqueous phase. Phase separation may occur at intermediate points in a treatment sequence to remove solids generated during oxidation or polishing. Grease and oil may be recovered for fuel or saponification. Solids often require dewatering of

sludge in a wastewater treatment plant. Disposal options for dried solids vary with the type and concentration of impurities removed from water.

Solids such as stones, grit, and sand may be removed from wastewater by gravity when density differences are sufficient to overcome dispersion by turbulence. This is typically achieved using a grit channel designed to produce an optimum flow rate that allows grit to settle and other less-dense solids to be carried forward to the next treatment stage. Gravity separation of solids is the primary treatment of sewage, where the unit process is called "primary settling tanks" or "primary sedimentation tanks." It is also widely used for the treatment of other types of wastewater. Solids that are denser than water will accumulate at the bottom of quiescent settling basins. More complex clarifiers also have skimmers to simultaneously remove floating grease such as soap scum and solids such as feathers, wood chips, or condoms. Containers like the API oil-water separator are specifically designed to separate non-polar liquids.

Oxidation reduces the biochemical oxygen demand of wastewater, and may reduce the toxicity of some impurities. Secondary treatment converts organic compounds into carbon dioxide, water, and biosolids. Chemical oxidation is widely used for disinfection.

Secondary treatment by biochemical oxidation of dissolved and colloidal organic compounds is widely used in sewage treatment and is applicable to some agricultural and industrial wastewaters. Biological oxidation will preferentially remove organic compounds useful as a food supply for the treatment ecosystem. Concentration of some less digestible compounds may be reduced by co-metabolism. Removal efficiency is limited by the minimum food concentration required to sustain the treatment ecosystem.

Polishing refers to treatments made following the above methods. These treatments may also be used independently for some industrial wastewater. Chemical reduction or pH adjustment minimizes chemical reactivity of wastewater following chemical oxidation. Carbon filtering removes remaining contaminants and impurities by chemical absorption onto activated carbon. Filtration through sand (calcium carbonate) or fabric filters is the most common method used in municipal wastewater treatment.

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