Transformation of Living Being Health by Waste Water Treatment

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Abstract

Wastewater management encompasses a broad range of efforts that promote effective and responsible water use, treatment, and disposal and encourage the protection and restoration of our nation's watersheds. Wastewaters generated in areas without access to centralized sewer systems rely on on-site wastewater systems. These typically comprise a septic tank, drain field, and optionally an on-site treatment unit. Widely used terminology refers to three levels of wastewater treatment: primary, secondary, and tertiary (or advanced). Primary (mechanical) treatment is designed to remove gross, suspended and floating solids from raw sewage. Secondary (biological) treatment removes the dissolved organic matter that escapes primary treatment. Tertiary treatment is simply additional treatment beyond secondary. A "decentralized" wastewater treatment program is one that utilizes wastewater management solutions as close to the sources of the wastewater as possible. This is often realized by utilizing a number of on-site or shared systems to treat relatively small volumes of wastewater, generally from individual buildings or groups of buildings, at or near the source. Present paper deals with transformation of living being health by waste water treatment.

KEY WORDS: Sewage, mechanical treatment, secondary sedimentation, biological oxygen demand.

Introduction

Waste water, is any water that has been adversely affected in quality by anthropogenic influence. Municipal wastewater is usually conveyed in a combined sewer or sanitary sewer, and treated at a wastewater treatment plant. Treated wastewater is discharged into receiving water via an effluent sewer. Wastewaters generated in areas without access to centralized sewer systems rely on on-site wastewater systems. These typically comprise a septic tank, drain field, and optionally an on-site treatment unit. Sewage is the subset of wastewater that is contaminated with feces or urine, but is often used to mean any wastewater. Sewage includes domestic, municipal, or industrial liquid waste products disposed of, usually via a pipe or sewer (sanitary or combined), sometimes in a cesspool emptier. Sewerage is the physical infrastructure, including pipes, pumps, screens, channels etc. used to convey sewage from its origin to the point of eventual treatment or disposal. It is found in all types of sewage treatment, with the exception of septic systems, which treat sewage on site. Any oxidizable material present in a natural waterway or in an industrial wastewater will be oxidized both by biochemical (bacterial) or chemical processes. The result is that the oxygen content of the water will be decreased. Basically, the reaction for biochemical oxidation may be written as:

Oxidizable material + bacteria + nutrient + $O_2 \rightarrow CO_2 + H_2O$ + oxidized inorganics such as NO_3^- or SO_4^-

Oxygen consumption by reducing chemicals such as sulfides and nitrites is typified as follows:

$$S^{--} + 2\,O_2 \rightarrow SO_4^{--} \qquad NO_2^- + \tfrac{1}{2}\,O_2 \rightarrow NO_3^-$$

The laboratory test procedures for the determining the above oxygen demands are detailed in many standard texts. American versions include the "Standard Methods for the Examination of Water and Wastewater" [1]. Since disposal of wastewaters from an industrial plant is a difficult and costly problem. Mostly petroleum refineries, chemical and petrochemical plants [2] [3]. Priority Pollutants, these are directly regulated on a basis of toxicity. Government regulation required permits and inspections. All priority pollutants are toxic. They include heavy metals, PCB's and various forms of benzene compounds [4]. Other industrial processes that produce a lot of waste-waters such as paper and pulp production has created environmental concern, leading to development of processes to recycle water use within plants before they have to be cleaned and disposed[5]. The International Water Management Institute has worked in India, Pakistan, Vietnam, Ghana, Ethiopia, Mexico and other countries on various projects aimed at assessing and reducing risks of wastewater irrigation. They advocate a 'multiple-barrier' approach to wastewater use, where farmers are encouraged to adopt various risk-reducing behaviours. These include ceasing irrigation a few days before harvesting to allow pathogens to die off in the sunlight, applying water carefully so it does not contaminate leaves likely to be eaten raw, cleaning vegeTables with disinfectant or allowing fecal sludge used in farming to dry before being used as a human manure [6]. European Union Council Directive 91/271/EEC on Urban Wastewater Treatment was adopted on 21 May 1991 [7] amended by the Commission Directive 98/15/EC [8]. Commission Decision 93/481/EEC defines the information that Member States should provide the Commission on the state of implementation of the Directive [9]. The Clean Water Act is the primary federal law in the United States governing water pollution[10].

Methodology

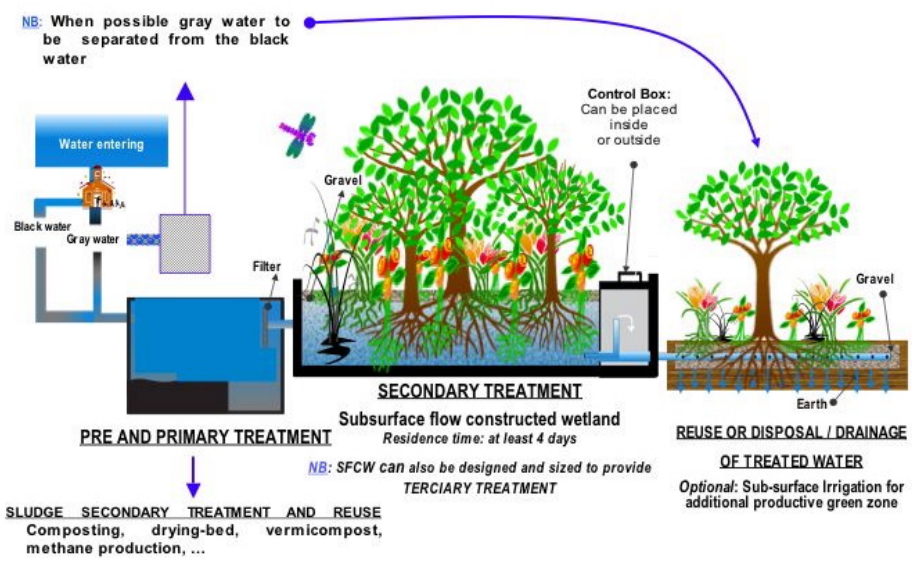
Widely used terminology refers to three levels of wastewater treatment: primary, secondary, and tertiary (or advanced).

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.

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", s) 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.

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.

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.



Observation

Wastewater treatment plants are often unsTable as soon as bacteria growths exhibit some inhibition. Typically, under a constant feed rate, the washout of the reactor (i.e., when biomass is no longer present) becomes an attracting but undesirable equilibrium point. Choosing the dilution rate as the manipulated input is usually a mean for the stabilization about a desired set point, but the most efficient control laws often require a perfect knowledge of the state variables of the system, namely the online measurement of all variable concentrations, which are generally not accessible (for technical or economical reasons). Most often, only few sensors are available.

A popular way to achieve stabilization of a control dynamical system under partial knowledge of the state consists (i) first in designing an "observer" or "software sensor" for the reconstruction of the unobserved variables, and (ii) in a second step, in coupling this estimate with a stabilizing feedback control law, if some "separation principle" is satisfied.

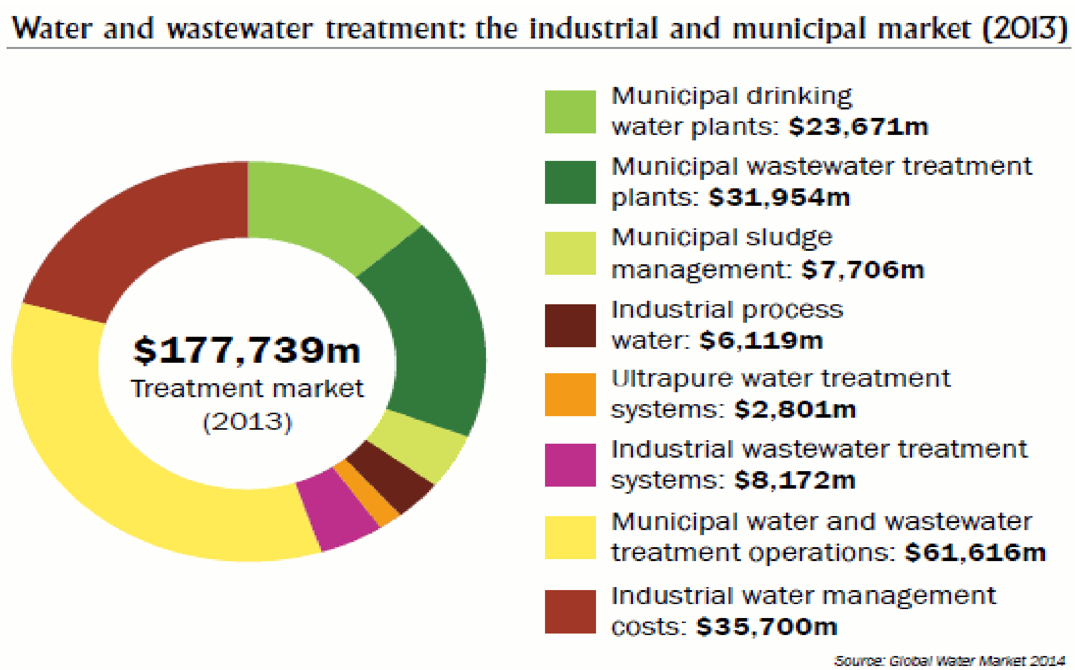
Unfortunately, in industrial operating conditions, one cannot thoroughly trust the models that were developed and identified in well-controlled environments such as in laboratory experiments. Engineers have to deal with several uncertainties on parts of the model, as well as on the output delivered by the sensors. During the startup of the process, the system can be far away from the nominal state, where few empirical data are available. Generally, probabilistic hypotheses cannot be justified regarding the nature of the uncertainty for stochastic models to be considered. On the opposite, reasonable bounds on the unknown parts of the models are available, so that uncertainties can be considered as unknown deterministic inputs. Consequently, robust observers and control laws need to be developed to cope with the particularities of the uncertainty on the models. The search for new configurations of processes as well as for innovative control actions (bioaugmentation for instance) is also an objective we follow.

Result and Discussion

A “decentralized” wastewater treatment program is one that utilizes wastewater management solutions as close to the sources of the wastewater as possible. This is often realized by utilizing a number of on-site or shared systems to treat relatively small volumes of wastewater, generally from individual buildings or groups of buildings, at or near the source. In 1997, U.S. Environmental Protection Agency (EPA) stated that both centralized and decentralized system alternatives would need to be considered when upgrading failing on-site septic systems. The State of Vermont began a process in 1999 to evaluate and revise its overall wastewater review process to make it clearer and to promote “smart growth” or conversely discourage sprawl. The State encourages the review of decentralized approaches in low-density settings in small and rural communities.

The key to the decentralized concept is that it treats both on-site and shared systems as a permanent wastewater treatment solution—as a valuable part of the infrastructure that should be planned for, sited, designed, and installed properly, operated and maintained appropriately, and monitored as required by any relevant permits. The system's owners (whether the Town or individual property owners) should meet compliance requirements and ensure that users of the system are knowledgeable about how their actions can impact the system.

Discussions with the Wastewater Committee have made clear that a primary benefit of this study is the articulation of a wastewater management system that will allow for the alleviation of existing wastewater treatment concerns, and that will allow for some limited level of appropriate development in accordance with local initiatives and the Town's overall Plan.



Conclusion

The following conclusions can be drawn from the study:

- From energy consumption pattern in the campus it is clear that offices consume more than 50% of the total energy. The rest are residential areas 15%, Chiller room 10%, etc.
- Residential areas are the major source of water consumption; with around 50%. The second source is the offices, almost 25% of total water consumption. The rest are chiller room, regional Experimental center, etc.
- On an average, the wastewater generation from AIT is about 1,122 m^3 / day. The water balance indicates a loss of 17.3%.
- The physical characteristics of influent and effluent of wastewater treatment plant indicates that BOD removal

efficiency is only 68-71%. Compared to the Thai standard for wastewater, AITs WWTP sometimes cannot meet the standard.

- Each day AIT generates about 2 tons of domestic waste of which only 4% is recyclable. The remaining 96% is sent directly to the landfill. Seventy five percent of the total recyclable waste is contributed by paper mostly from the offices.
- Solid waste generation is largely from the residential areas; especially the staff areas; about 32% of total solid waste. Student areas generate 27%, 17% from the offices and the rest are AITCC, cafeteria and others. Organic waste is estimated at 60% of total waste.
- Energy, water and solid waste audits were conducted at the representative buildings which consume large amount of energy, water and generate huge amount of solid waste.
- Yard waste is about 0.2 tons per day, some of them are sent to the organic composting site in the AIT campus. The rest is dumped at the dumping site near the School of Management.
- After identifying the potential sources of energy and water consumption and solid waste generation, CP options are proposed, to suggest measures to reduce energy and water consumption and solid waste generation.
- If AIT implemented these CP options, the daily energy consumption will be reduced from 9.65 k Wh / person to 7.65 k Wh / person by 2010. Moreover, the daily water consumption in 2010 will be reduced from 354 L / person to 226 L / person.

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