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Review on Techniques Used for Wastewater Treatment

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Abstract

There is a great need for wastewater treatment for all sources of water pollution and an obvious potential for natural treatment systems. In this paper, we looked into the problem of growing quantity of wastewater irrespective of the limited drinking water supply. The water once utilized for domestic or industrial applications is then obtained as the released water from the waste, which cannot be reused until not being recycled or reprocessed thoroughly using reliable wastewater treatment techniques. In the paper, a review on various wastewater treatment techniques used and their development are presented.

Keywords: wastewater, pollution, treatment, filtration, industrial applications, natural, oxidation, UV radiation

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INTRODUCTION

Numerous efforts are made to treat wastewater in order to solve the major problem of water deficiency mainly for industrial applications. Researchers stick to the conventional rule of using the natural treatment systems that evidently considered being quite efficient technologies. There are many fine examples of the use of natural treatment systems for purification of many types of wastewater, sludge handling and use of purified water for irrigation. Indeed, the natural treatment systems for wastewater treatment have to compete with technical solutions, namely with so called conventional treatment systems such as activated sludge process.

Natural technologies are the most than for large producer frequently used for wastewater treatment and water management ranging from individual houses, recreational and the other facilities to the settlements up to 2,000 inhabitants (p. e.), smaller industrial plants, and farms. Their use is also the question of the availability of affordable land.

PRETREATMENT TECHNOLOGIES

Besides pollution indicators routinely monitored, raw sewage contains, a number of other substances, such as pieces of rags, fibers, hair, thread, feces, grease, household trash, remnants of fruit and vegetables, plastic, various containers, pieces of wood.

A stream of water at the bottom of the drainage may be, particularly in the rainy season, also entrained with heavier materials such as gravel, pieces of brick, etc. For this reason, the mechanical pretreatment stage is an important part of any treatment plant. It protects the mechanical parts and/or the filter material of distribution layers from damages and clogging. It prevents

clogging of pipes, gutters, vents and protects pumps from damage. It also serves to capture finer particles of sludge, which would unnecessarily affect the performance the biological system of the plant. A properly functioning mechanical pretreatment stage helps achieving good results in the outflow from constructed treatment wetlands.

CONSTRUCTED TREATMENT WETLANDS

These are natural wastewater technologies work as constructed filtration systems planted with wetland vegetation (most often reed, reed canary grass, and cattail) with defined filter material and direction of wastewater flow. The basic principle of this method of cleaning is the flow of wastewater through the filtration system, which is planted with wetland vegetation. Filter material must be permeable enough to avoid clogging and subsequent surface flow. When the wastewater passes through the material, the treatment occurs, carried out by the complex intertwining of chemical, physical and biological processes. The water flows through the filter horizontally or vertically at the constructed wetland wastewater treatment plant.

WASTEWATER STABILIZATION PONDS

Stabilization ponds are an important part of the natural treatment ways. They are used mainly for sewage water treatment of individual households, groups of houses, municipalities, exceptionally up to 15,000 p. e., hotels, recreation facilities, restaurants, summer camps, small plants, agricultural and industrial wastewater treatment (especially the food industry), treatment of polluted surface water and treated wastewater. The desired treatment effect is achieved by physical, chemical and biological processes occurring in the aquatic environment in the presence of water and wetland biocoenosis (bacteria, phytoplankton, and zooplankton), higher vegetation and organisms.

COMBINED WASTEWATER TREATMENT SYSTEMS

Combined systems for wastewater treatment consist of mechanical pretreatment, constructed wetland (filtration reed-beds) as main facility of the biological treatment and a stabilization pond (one or more) used as a polishing step increasing treatment efficiency especially in removing nitrogen and phosphorus from water. It is also possible to combined reed-beds with soil filters, infiltration drains or irrigation facilities including fast-growing trees irrigation. Another option is a combination of constructed wetland and aquaculture facilities.

DISINFECTION OF TREATED WASTEWATER

The most used technology for disinfection of wastewater treatment plants is applicable to smaller plants, which include natural treatment methods, sodium hypochlorite and calcium and UV radiation. It is also advantageous to use membrane technologies because together with the sanitary provision it removes non-dissolved substances (suspended solids) and creates the prerequisites for both discharges into groundwater but also for further use.

Research On These Devices Identified The Following Shortcomings

- Improper arrangement of inflow and outflow; faulty design, when inflow and outflow from storm water basin are located next to each other, which excludes the possibility of the satisfactory function.
- Removal of sediments from storm water basin is not satisfactorily solved• Often insufficient retention time.

- High Volume Septic Tanks did not acquit themselves well, the accumulated sludge produced in the process is washed away and flows with wastewater to the filters. Sludge is churned and washed away when the flow of wastewater is limited.

It is very demanding to drain the covered high volume septic tanks. It is strongly discouraged to use high volume septic tanks as accumulation, settling tanks.

Ground Settling Tanks fulfil the settlement function; they are proposed to have a prismatic shape, and be sealed. If there is just one tank fulfilling the function of sand trap and settling tank, its maintenance is very difficult without shutting down the entire stage of treatment.

Settling Tanks combined with a separate decay space seem to be inefficient within the indicative tests. They require the special operation mode with frequent draining and a special way of sludge. Otherwise, there is a partial decay of sludge in the sedimentation space, resulting in leakage of gaseous productions of decay, washing away sludge particles and mixing sludge with wastewater. Some cases have been observed where the composition of the effluent wastewater was worse than the composition of wastewater influent.

LITERATURE REVIEW ON DEVELOPMENT OF WASTEWATER TREATMENT TECHNIQUES

Yi Jing Chan et al. in his paper reviewed the various types of high rate anaerobic–aerobic water treatment techniques currently available including high rate bioreactors and integrated anaerobic–aerobic bioreactors. While previously most treatment of wastewaters have been carried out in conventional anaerobic–aerobic treatment plants, in recent years, high rate anaerobic–aerobic bioreactors have been increasingly employed for wastewaters with high chemical oxygen demand (COD).

A.S. Sheoran and V. Sheoran made a critical review of the heavy metal removal mechanism involving various physical, chemical and biological processes, which govern wetland performance. This information is important for the siting and use of wetlands for remediation of heavy metals.

Acid mine drainage (AMD) is one of the most significant environmental challenges facing the mining industry worldwide. Water infiltrating through the metal sulphide minerals, effluents of mineral processing plants and seepage from tailing dams becomes acidic and this acidic nature of the solution allows the metals to be transported in their most soluble form. The conventional treatment technologies used in the treatment of acid mine drainage are expensive both in terms of operating and capital costs.

Parag R. Gogate et al. documented a review of oxidation processes operating at ambient conditions. It has been observed that none of the methods can be used individually in wastewater treatment applications with good economics and high degree of energy efficiency.

Moreover, the knowledge required for the large-scale design and application is perhaps lacking. In the present work, an overview of hybrid methods (the majority are a combination of advanced oxidation processes) has been presented. Hybrid methods viz Ultrasound/H2O2 or ozone, UV/H2O2 or ozone,

Ozone/H2O2, Sono-photochemical oxidation, Photo–Fenton processes, catalytic advanced oxidation processes, use of advanced oxidation processes in conjunction with biological oxidation, SONIWO (sonochemical degradation followed by wet air oxidation), and CAV-OX have been discussed with specific reference to the principles behind the expected synergism, different reactor configurations used and optimum considerations for the operating and geometric parameters.

Duncan J. Barker gave a review concerning the characterization, production, modelling, significance and implications of soluble microbial products (SMP) in wastewater treatment are presented. The precise definition of SMP is open to debate, but is currently regarded as "the pool of organic compounds that are released into solution from substrate metabolism (usually with biomass growth) and biomass decay", although for anaerobic systems volatile fatty acids are not included as SMP.

Some of the SMP have been identified as humic and fulvic acids, polysaccharides, proteins, nucleic acids, organic acids, amino acids, antibiotics, steroids, exocellular enzymes, siderophores, structural components of cells and products of energy metabolism.

OPERATIONAL FEEDBACK

Serious problems impacting the final treating stage of constructed wetland treatment plants are poor-quality, unmaintained sewer network, structurally unsuitable to dysfunctional rain separators and a number of commonly used insufficiently functional equipment of mechanical pretreatment. The requirement of quality and well-maintained sewer network is thus a priority.

Relatively little is done in regards to solving issues in precipitation water management, in most cases it is not satisfactorily solved. Therefore, Supply and Distribution Facilities are determined for supplying water into the constructed wetland wastewater treatment plant and its distribution across the whole width of the wastewater treatment plant.

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