Research Status of Tailwater Treatment Technology in Sewage Treatment Plants

Bo Pang

North China University of Science and Technology, Tangshan 063210, China.

Abstract

This template explains and demonstrates how to prepare your camera-ready paper for Trans Tech The tail water of the sewage treatment plant still contains a large amount of pollutants, which are low in content and complex in variety. This paper summarizes the main treatment technologies, such as physical and chemical methods, chemical oxidation methods, biological methods and natural ecological treatment techniques, and analyzes the advantages, disadvantages and development of the methods. In the direction, it is concluded that the electrochemical method is a relatively good treatment method.

Keywords

Tail water treatment, Ecology, Reuse.

1. Introduction

In recent years, the problem of eutrophication of water has become more and more serious. To solve it completely, we must start from the source of pollution. The pollution mainly comes from the untreated direct discharge of enterprises, along the water source pollution and the tail water discharge of the sewage treatment plant. With the supervision and management of the government in recent years, the enterprise sewage direct discharge and non-point source pollution have been effectively controlled, but the secondary tail water volume Greatly, because there is still a lot of pollutants in the tail water, concentrated discharge will pollute the receiving water. Therefore, it is necessary to further deepen the secondary tail water to alleviate the problem of eutrophication of the receiving water.

2. Physical chemistry

2.1 Coagulation sedimentation method.

The coagulation sedimentation method is a method in which a coagulant is added to the sewage to flocculate and separate the suspended state and the colloidal substance in the water. The process has the advantages of stable effluent quality and mature technology, and has been widely concerned. When Ma treated the secondary effluent by coagulation sedimentation, the results also showed that the removal effect of ammonia nitrogen and total nitrogen was not good[1]. The coagulation sedimentation method has a good removal effect on suspended solids and phosphorus in the treatment of secondary effluent, but has limited ability to treat dissolved organic matter.

2.2 Activated carbon adsorption method.

The activated carbon adsorption method mainly utilizes the porosity, hydrophobicity and the characteristics of adsorbing organic substances in water to remove odor, certain organic substances and inorganic substances in water. Activated carbon adsorption has been used in industrial wastewater treatment of dyes, oils and mercury-containing chromium since the 1970s. This method has the advantages of high stability, reusability and no secondary pollution. Feng compared the removal rate of ammonia in the secondary effluent with different adsorbent dosages. It was found that when the dosage was small at 15~30mg/L, the removal effect of activated carbon was better than that of zeolite. The larger the dosage, the better the removal effect of ammonia nitrogen. When added to a certain extent, the adsorption will be weakened[2]. However, there are some problems in the activated carbon adsorption method, such as post-saturation treatment and post-disposal treatment.

2.3 Membrane treatment technology.

Membrane treatment technology is a method that utilizes membrane selectivity to separate solute or solvent. It can be divided into microfiltration membrane, nanofiltration membrane, ultrafiltration membrane and reverse osmosis membrane. It has stable effluent quality, stable operation and no need to add other Substance and other advantages. However, although the membrane treatment technology can restore the membrane flux through backwashing, the irreversible pollution is increasing, the membrane is easy to be contaminated and the membrane module cost is high, which hinders the widespread promotion of the membrane treatment technology.

3. Chemical Law

3.1 Ozone oxidation method.

Ozone is a strong oxidant that can oxidize inorganic and organic substances in water, and has the advantages of fast reaction speed and no secondary pollution. When using Ni/Al2O3 catalytic ozone technology to treat secondary tail water, it was found that ammonia nitrogen and nitrate nitrogen increased by 46.8% and 31.2%, respectively, compared with ozone technology alone. Ozone oxidation has the disadvantages of relatively low removal efficiency, high investment and operating costs.

3.2 Fenton oxidation.

Fenton oxidation method is extremely oxidizing under the condition of Fe2+ and H2O2 coexistence. Therefore, the reaction involving Fe2+ and H2O2 reagents is called Fenton oxidation method, which can treat most refractory organics, low cost and fast reaction speed. Etc. Luo proposed a method of Fenton oxidation and aerated biological filter combination to deeply treat the secondary effluent. Firstly, Fenton oxidation was used to pretreat to reduce some organic matter and chromaticity in the water. Subsequently, the aerated biological filter was used to remove most of the organic matter. The COD and chroma removal rates were 85% and 99%, respectively, but the denitrification effect was not good. Fenton oxidation can only be reacted under acidic conditions, and Fe2+ should be added continuously during the reaction, and the application range is small [3].

3.3 Electrochemical method.

Electrochemical methods use the potential difference to generate electron directed transfer and control the degradation or conversion of pollutants. It is a method of mutual conversion of electrical energy and chemical energy. According to the environmental interface of the pollutants on the surface of the electrode or the reaction of the solution, it is divided into electro flocculation, electro-oxidation, electro-reduction and electro-adsorption. It has the advantages of simple operation, no sludge generation and strong controllability. used the electrocoagulation-microfiltration process to treat the secondary effluent. The average removal rate of ammonia nitrogen was 14% when the microfiltration membrane was used directly, and the average removal rate of ammonia nitrogen during the combined treatment of electrocoagulation and microfiltration 68%, experiments show that the electrocoagulation process as a pretreatment process can greatly improve the removal of ammonia nitrogen.

4. Biological Law

4.1 Biological aerated filter.

Aerated biological filter (BAF) is a method that utilizes filler and biofilm as the main medium, and has the functions of physical filtration, etc., and has the advantages of high treatment efficiency, small floor space and low maintenance cost. Han compared the double-layer aerated biofilter and the single-layer lava-based BAF in terms of ammonia nitrogen and organic removal, and discussed maintenance strategies. The former was found to better cope with higher ammonia loads and by measuring dissolved oxygen and pH. The value, when the feed ammonia concentration is reduced, desorption will occur, there is no significant difference between the two to remove organic matter, in terms of economics, double-layer BAF shows more economic control. However, the aerated biological filter

also has problems such as high pretreatment requirements, insufficient denitrification carbon source and limited anoxic regions, which need to be further solved.

4.2 Biological activated carbon filter.

The biological activated carbon filter is a new technology that was developed in the 1970s by using activated carbon as a carrier to form a biofilm on its surface and combining the adsorption of activated carbon with biological treatment. It has a large hydraulic load and good effluent quality. Etc. Wang studied and analyzed the removal effect of biological activated carbon filter on the organic matter in the secondary effluent. After the stable operation of the BAC column, the removal rate of DOC was 25%, and the removal rate of TN was 11%. When the EBCT was extended, DOC The removal rate is increased by 1.26 times, the total nitrogen removal rate is increased by 2 times, and the removal effect is remarkably enhanced. However, the biological activated carbon filter has high temperature requirements, and the removal effect at low temperatures is affected to some extent[4].

5. Natural ecological treatment technology

5.1 Constructed wetlands.

Constructed wetland is an integrated ecosystem that simulates nature. It puts sewage and sludge on artificially constructed wetlands and flows them in a certain direction. It has the advantages of convenient maintenance and management, good treatment effect and low cost. The constructed wetland mainly removes nitrogen from the sewage by nitrification and denitrification of microorganisms. other methods use VFCW (vertical flow constructed wetland) and HFCW (horizontal flow constructed wetland) system to treat the secondary tail water. The experimental nitrate nitrogen effluent content is low and stable, and the system provides a suitable nitrification environment, ammonia nitrogen. The removal effect is better, the system can effectively remove pollutants, and the effluent quality meets the water quality requirements of Class III of GB3938-2002 Surface Water Environmental Quality Standard. However, due to the large area of artificial wetland, the shortcomings of plant species and long operating cycle, there are significant limitations in the actual operation of sewage treatment plants.

5.2 Stabilization pond.

Stabilization pond is a general term for structures that use the natural purification ability of biological groups to treat sewage. It has the characteristics of low operating cost, no need for sludge and easy operation. studied the effect of CAST-stable pond combination on the treatment of secondary effluent in winter and summer. It was found that the removal effect of total nitrogen, ammonia nitrogen, total phosphorus, COD and SS was better than that in winter, and the water body could be reduced under both conditions. The nutrient load is large, but the stable pond has a large area and the removal effect is relatively low, which is easy to produce odor and affect the surrounding environment.

6. Conclusion

The above several methods have their own technical characteristics. Physical methods are easy to operate, but most of them are concentrated or transferred, which cannot be removed fundamentally, and the effluent water quality is poor. Fenton oxidation and ozone oxidation are costly. Biological methods are susceptible to the nature of the organism itself, and it takes a long time to culture and acclimate the microorganisms, and biological nitrogen removal is greatly affected by temperature. Natural ecological treatment techniques often have a large footprint and a long operating cycle. The combination of various methods, although complementary, is not easy to operate, and the cost is high. Because the electrochemistry has the advantages of instant opening and stopping, no secondary pollution, high efficiency and low cost, and small footprint, it is the best treatment method.

References

[1] Y. Sun: Town Wastewater Treatment Plant tail water discharge water environmental impact and countermeasures (resource conservation and environmental protection) 2019,p.70-75.

[2] Y. Ma: Treatment effect of coagulation and sedimentation on secondary effluent from sewage treatment plant (Water Purification Technology) 2015, p. 88-91.

[3] Z. Luo: Study on Advanced Treatment of Secondary Effluent of Printing and Dyeing Wastewater by Fenton Oxidation-BAF Combined Process(Guangdong Chemical Industry) 2017, 44(15) ,p. 209-211.

[4] L.Y.Wang: Study on the advanced treatment efficiency of biological activated carbon filtration for secondary effluent of sewage（Environmental Pollution & Control）2015,p.31-38.