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Analysis and Control of Pollution Characteristics of Chemical Waste Water

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With the development of modern social science and technology, the role of the chemical industry in social development is increasingly important. The chemical industry has promoted China's economic progress. While the economic benefits are good, it also brings about certain environmental pollution problems. The pollution of chemical wastewater is a major problem in protecting the ecological environment and building a harmonious home. The analysis of the pollution characteristics of chemical wastewater must be carried out in order to effectively adopt effective control strategies. Therefore, this paper discusses the pollution and control of chemical wastewater from two aspects: the analysis of the pollution characteristics of chemical wastewater and the control of chemical wastewater pollution.

1. Introduction

To prevent chemical companies from becoming the worst-hit areas of pollution, pollution control of chemical companies, especially water pollution management, is quite necessary. The water quality of the wastewater discharged by different chemical companies varies a lot, which leads to increasing in the difficulty of handling mixed wastewater discharged by the chemical companies, and the traditional municipal wastewater treatment processes often fails to meet the discharge standards (Sorin et al., 2008). Therefore, it is necessary to understand the pollution characteristics and treatment processes of the wastewater discharged from various chemical companies, and on this basis, a specific treatment method is proposed based on the water quality condition of mixed industrial wastewater. The emission reduction of production process, the recycling of wastewater, and the optimization of wastewater processing system are the basic approaches for the pollution treatment of chemical wastewater, see Figure 1 for details.

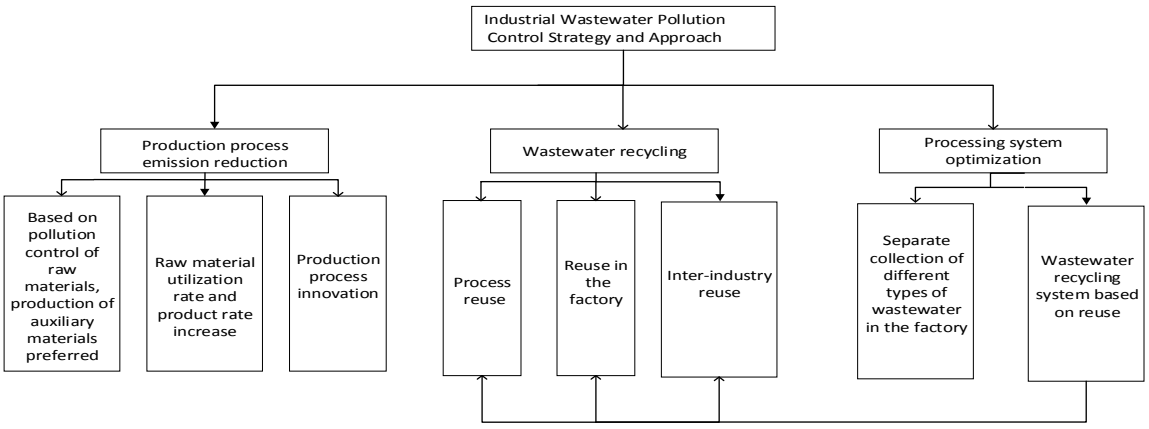

Figure 1: Basic strategies and approaches for pollution control of chemical wastewater

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Among them, the emission reduction of production process should pay attention to the choice of production raw materials and production auxiliary materials. In the raw materials selection phase, it should adopt scientific, reasonable measures so as to reduce the hidden dangers of pollutants. Under the premise of satisfying the production requirements, raw materials with less pollution and good handling properties should be used as much as possible; the optimal operation and management of waste water recycling and wastewater treatment systems are indispensable, and the latter is the precondition and guarantee for the implementation of the former (Cao, 2015). Different recycling methods put different requirements on the treatment water quality and optimal operation of the wastewater treatment system. Therefore, it is necessary to change the treatment mode of industrial wastewater. The implementation of “classified collection and separate treatment” of wastewater can greatly reduce the technical difficulty and operational management difficulty of wastewater treatment, which is also conducive to the implementation of wastewater recycling.

2. Analysis of pollution characteristics in chemical industry

According to the relevant industry classifications in the Industrial Classification for National Economic Activities (GB/T 4754-2017), general investigation data (updated) and environmental statistics data of China's industrial pollution sources are used to statistically analyze the current status of pollution discharge in the chemical industry of our country.

2.1 Classification of chemical wastewater

The main classification of chemical wastewater and its formation process are shown in Figure 2 (Gao et.al, 2017).

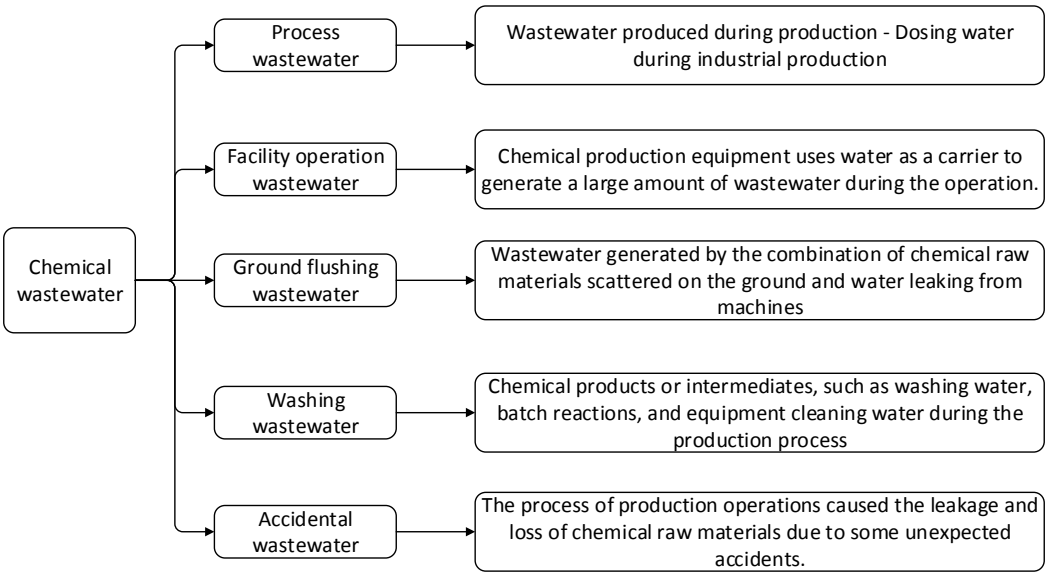

Figure 2: Classification and Formation Process of Chemical Wastewater

2.2 Characteristics of chemical wastewater

Most of the chemical wastewater has the following characteristics: First, complex composition, due to the complexity of modern fine chemical production processes and technologies, there are also more contained chemical compositions; Second, high concentration of pollutants, most wastewater is produced during the production process, it contains a lot of chemical raw materials and by-products; Third, diversified harmful substances, chemical wastewater contains a large amount of organic pollutants, such as dispersants and surfactants, etc.; Fourth, more substances that are difficult to degrade, many chemical elements are difficult to be fully degraded in a short time; Fifth, high colority, which makes the wastewater have a variety of colors and is disgusting (Wang et al., 2017).

2.3 Analysis of contribution of chemical wastewater discharge

In China's chemical industry, the wastewater discharge amount of chemical raw materials and chemical products manufacturing is the largest, accounting for 72% of the total wastewater discharge in the chemical industry; followed by pharmaceutical manufacturing, accounting for 23% of the total wastewater discharge in

the chemical industry; chemical fiber manufacturing and petroleum coking processing industry accounts for 3% and 2%, respectively, as shown in Figure 3.

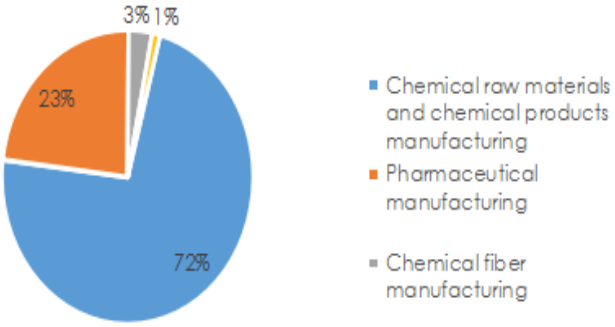

Figure 3: Schematic diagram of wastewater discharge in China's chemical industry

The major pollutants discharged by the wastewater from the chemical industry are COD and ammonia nitrogen, among which the COD discharge contribution of the chemical raw materials and chemical products manufacturing is the largest, followed by the pharmaceutical manufacturing, the petroleum coking and processing industry and the chemical fiber manufacturing industry, contributes for 56%, 38%, 3% and 3%, respectively, see Figure 4.

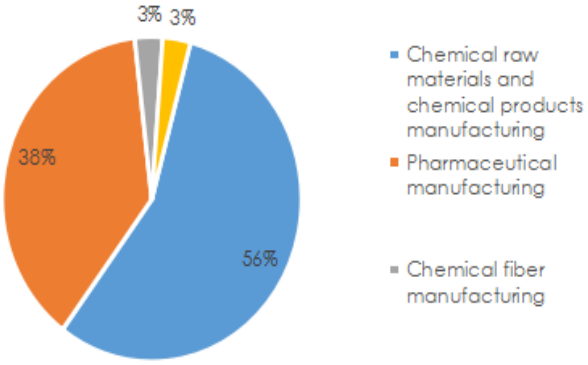

Figure 4: Schematic diagram of COD emission contribution in China's chemical industry

The proportions of ammonia nitrogen emissions contributed by the industry are: chemical raw materials and chemical products manufacturing, petroleum coking and processing, pharmaceutical manufacturing, and chemical fiber manufacturing, accounting for 85%, 8.0%, 7%, and 1% respectively, as shown in Figure 5 (Song, 2016).

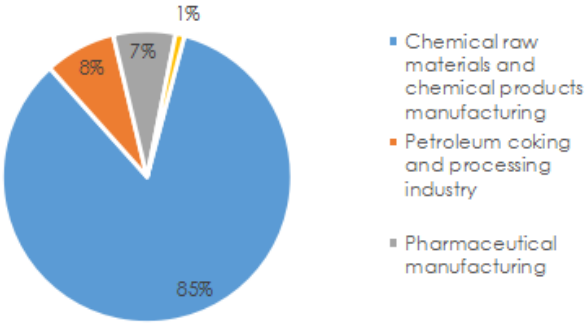

Figure 5: Schematic diagram of ammonia nitrogen emission proportion in China's chemical industry

3. Chemical wastewater control

For the wastewater treatment of chemical industrial parks, since the locations of the chemical industrial parks are different, their main industrial categories also differ. Generally, the wastewater of chemical industrial parks is pretreated in the companies, and then it is centralized-processed after collected. The pretreatment methods are different for chemical wastewater discharged by different companies. Table 1 lists the typical chemical wastewater pretreatment methods (Katsoyiannis et al., 2017). In order to save water resources and reduce the emission of pollutants, so as to achieve the comprehensive deployment and recycling of water resources, chemical wastewater is often further processed after secondary treatment.

Table 1: Pretreatment processes of wasterwater from chemical industrial companies

Chemical wastewater type	Pretreatment method
Pesticide wastewater	Neutralization+condensation+three-effect evaporation
Synthetic ammonia wastewater	Blow off deaminating + oxidation deamination + precipitation to arsenic
Fine chemical wastewater	Catalytic microelectrolysis+flocculation+catalytic oxidation
Coal Chemical Wastewater	Sulfur removal + deamination nitrogen + catalytic oxidation
Polypropylene waste water	Put lime and green earthworms to precipitate to remove sulfite ions in water
Petrochemical wastewater	Grease + air float

At present, the typical treatment mode for wastewater from chemical companies is: pretreatment in the companies—secondary treatment of mixed chemical wastewater—advanced treatment (Cao, 2016). The specific process is shown in Figure 6.

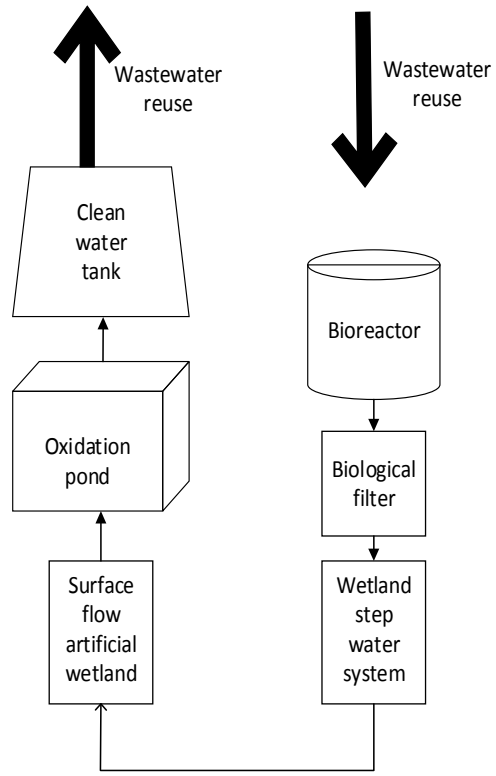

Figure 6: The treatment flow diagram of mixed chemical industrial wastewater

3.1 Main treatment technologies of chemical wastewater

Chemical wastewater contains a lot of impurities and toxic substances, and its treatment technology is very strict. The main technologies of wastewater treatment in China's chemical industry are shown in Table 2 (Ding, 2018).

Table 2: Main Technologies of Wastewater Treatment in China's Chemical Industry

Technical Name	Method
Membrane technology wastewater separation	It is not necessary to use other substances to separate the harmful substances from the water, and the raw materials can be recycled efficiently.
Electrocatalytic wastewater decomposition	The catalytically active electrode reacts to form hydroxyl radicals and gradually converts some of the organic matter in the water into biodegradable organic matter that is converted into carbon dioxide and water through combustion
Ozone wastewater decomposition method	The use of strong oxidants to react with some organic substances in the chemical wastewater can effectively clean up some of the contaminants such as phenol and cyanide in the wastewater and eliminate odors in the water.
Magnetic separation wastewater decomposition method	After decomposing microorganisms in water, the microorganisms are decomposed
Iron Carbon Microelectrolysis	Accumulation of flocs, condensation of substances produced by electrochemical reactions, absorption and filtration of newly formed flocs
Wastewater Treatment Technology	
Immobilized Microbial Wastewater Treatment Technology	Through the natural gel such as calcium alginate, polyacrylamide and polyvinyl alcohol and other related materials to transport refractory organic carrier.

3.2 Chemical wastewater pollution control strategy

Sustainable development is a production requirement for various industries. During the development of the industries, it is not possible to focus solely on the improvement of economic efficiency, it is also necessary to increase the efficiency of the use of resources and reduce the environment pollution as much as possible. Judging from the current pollution characteristics of chemical wastewater, the pollution condition of chemical wastewater is relatively serious. In the developing process of chemical companies, besides paying attention to the economic benefits of companies, the environmental benefits and social benefits cannot be ignored as well, in this case, improving the utilization efficiency of resources in the early stage of production can reduce the content of chemical wastewater, reduce the harmful substances contained in wastewater, so as to control the chemical wastewater from the source (Subramonian et al., 2017). Circular economy is a new type of development mode and development approach proposed during the process of economic development in China. This kind of development mode can improve the efficiency of resource utilization and reduce pollution to the environment. The current situation of chemical wastewater in our country is very serious. In the process of corporate economic development, in addition to paying attention to the economic benefits of chemical production, it is also necessary to focus on the environmental and social benefits of industrial production, and to guide the production process of fine chemicals with the correct development concepts and development ideas (Yu et al., 2017). Through efficient use of resources, the wastewater generated in industrial processes is reduced and the environment is protected. Supervise the chemical wastewater, analyze the discharge status of chemical wastewater according to the supervision results, and take targeted measures to solve the problem and reduce the pollution of chemical wastewater as much as possible (Staicu et al, 2017). Combining the production features of chemical industry, it is necessary to strengthen the treatment of chemical wastewater, meet the requirements of the sustainable development of chemical companies, and allow them to improve economic efficiency without neglecting environmental and social benefits. Combining the pollution characteristics of chemical wastewater with the requirement of production process to improve the treatment technology of chemical wastewater can achieve the best treatment effect, such as the use of chemical transformation and electrochemical technology and biodegradation and strengthening techniques. Among them, electrochemically enhanced aerobic-anaerobic coupling treatment of wastewater uses electrochemical means to promote the degradation of wastewater components based on aerobic-hydrolysis, there are two included processes: electrochemically enhanced aerobic process and electrochemically enhanced anaerobic process. The two processes organically linked with each other, by using the electrochemical microbial reactor platform, it enables aerobic and anaerobic reactions to take place in the anode and cathode pools, respectively (Zhu et al., 2015). According to engineering statistics, the power consumption of chemical wastewater treatment projects accounts for about 60% of the total operating costs, of which the aerobic part consumes more than 80% of the power consumption, technology choice, reactor structure and equipment efficiency have become the dominant factors affecting the operating costs. Using reactors with high oxygen

transfer efficiency such as fluidized beds and choosing oxygen supply equipment with good performance are the main measures to reduce power consumption. The reduction of carbon sources still needs to be addressed through optimization of the process.

4. Conclusions

The implementation of major national water pollution control and treatment technology projects has brought unprecedented opportunities for the research and development of wastewater pollution control technologies in China. At the same time, it also puts forward higher requirements for chemical wastewater treatment research. Identifying the key scientific issues and technical bottlenecks that need to be resolved in the treatment of industrial wastewater pollution, constantly consolidating and correctly grasping the key development directions of chemical wastewater pollution treatment ideas and technologies have important significance for key technology breakthrough of chemical wastewater process and effective control of chemical wastewater pollution. According to the current actual demand of chemical wastewater treatment in China and the existing problems in the wastewater treatment practice and technology research, combining with the latest research progress in chemical wastewater treatment, we should conduct effective control of chemical wastewater pollution from the aspects of chemical wastewater treatment mode, research and development goals, water quality evaluation, control indicators and treatment process design concepts, etc.

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