Current status and research progress of laboratory wastewater treatment

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Abstract: In recent years, with the deepening development of China's science and technology strategy, a large number of scientific research institutes and laboratories are springing up like bamboo shoots after the rain, which play an important role in the development and innovation of our science and technology. At the same time, the laboratory also produced some laboratory wastewater in the research process. As there is no fixed discharge cycle for these laboratory wastewater, the amount of discharge can not be accurately calculated, and the wastewater composition is complex and the concentration is high, so it is difficult to treat. After investigation, it was found that some laboratories will discharge untreated experimental wastewater directly into the sewer, which greatly increases the difficulty and load of urban sewage treatment, and causes great damage to the ecological environment. Therefore, it is necessary to treat the laboratory wastewater, so as to better practice the sustainable development and the environmental protection policy of our country. In this paper, the present situation of laboratory wastewater treatment was briefly analyzed in the latest, hoping to provide some valuable reference for readers.

Key words: laboratory wastewater; Treatment status; Research progress

Introduction

Laboratory wastewater is mainly the waste produced in the process of experiment and teaching, including disinfection water, cooling water, and even high concentration of experimental reagents, etc. Laboratory wastewater is considered to be the most seriously polluted water. At present, China's laboratory wastewater discharge lacks strict supervision and corresponding discharge standards, and some laboratories will discharge experimental wastewater directly through drainage pipes. Such practice will not only increase the burden of urban sewage treatment, but also bring serious threats to the ecological environment and human health. In this regard, each laboratory should pay attention to and pay attention to the treatment and discharge of wastewater according to the actual situation, according to the characteristics of all kinds of experimental wastewater, establish an economic, scientific and effective wastewater treatment method, treat it, make it meet the discharge standards and then discharge the wastewater, so as to protect the environment.

I. The types of laboratory wastewater

Different types of laboratories or the same laboratory carry out different scientific research projects, and the types of experimental wastewater produced by scientific researchers with the change of innovative thinking are also different. Therefore, the type of laboratory wastewater is mainly judged according to the nature of the pollutants contained in it, which can be roughly divided into organic wastewater, inorganic wastewater, comprehensive wastewater and wastewater containing pathogenic microorganisms and other four categories. Among them, organic wastewater mainly refers to the water containing organic solvents that are difficult to degrade in the general environment. Inorganic wastewater mainly refers to wastewater containing heavy metals, sulfides, cyanide and so on. Wastewater containing pathogenic microorganisms mainly refers to its cell experiment wastewater, microbial experiment wastewater and so on. Comprehensive wastewater mainly refers to the wastewater containing the first two or three kinds of wastewater, and the content is high. At present, most laboratory wastewater belongs to comprehensive wastewater.

II. Laboratory wastewater treatment technology

Nowadays, with the continuous development of science and technology, laboratory wastewater treatment technology is also constantly developing and innovating. After investigation, it is known that the main process of treating laboratory wastewater is physical method, chemical oxidation method, physical chemical method and the combination of the above methods.

1. treatment of laboratory organic wastewater technology

In the experiment, in order to carry out relevant scientific research, a large number of surfactants, fuel solvents and other organic matter are often used, which leads to a large number of organic matter in the laboratory wastewater. In this regard, we can learn from other organic wastewater treatment methods to treat laboratory wastewater, such as physicochemical method and biological method. However, because the laboratory organic wastewater has a strong resistance to degradation and toxicity, the ordinary biological treatment effect is not significant, can not meet the relevant standards. For high-concentration organic wastewater in the laboratory, the organic solvent can be recovered and treated first, and chemical methods can be used to treat it on this basis; Taking the laboratory organic wastewater as the experimental object, the organic solvent in it can be recovered by ordinary distillation, and then Fenton oxidation process is used to treat the wastewater. According to the experimental test, Fenton oxidation method can effectively reduce the concentration of organic matter in wastewater, and is an effective method to treat laboratory organic wastewater. Scholars Dong et al. developed a new approach by using supercritical oxidation technology to treat laboratory organic wastewater. After a large number of experimental studies, the experimental results proved that the treated laboratory wastewater was in line with the Comprehensive Sewage Discharge Standard (GB 8978-1996). However, this chemical method needs to consume huge human and material resources, and the cost is expensive, so it cannot be popularized in a large area. The use

of physical method to treat organic wastewater in the laboratory is relatively simple, the cost is low and is widely used, it is mainly the use of adsorption principle to treat sewage. The commonly used adsorbents are activated carbon, coke, molecular sieve and so on. Scholar Wang Qiang used silica-aluminum phosphate molecular sieve to treat organic wastewater in the laboratory. After treatment, the wastewater met the relevant standards of "Water Quality Standard for Sewage Discharge into Urban Sewers" (CJ 343-2010). In addition, other scholars have also carried out continuous exploration and innovation, scholars Go Zhan et al., through the use of Hainan plant waste made of activated carbon on the laboratory organic wastewater treatment effect of in-depth research, through a large number of experiments proved that they found that the use of bagasse made of activated carbon treatment laboratory organic wastewater capacity is the best.

2. The treatment of laboratory inorganic wastewater

(1) Laboratory wastewater containing heavy metal ions

Laboratory because of different research projects, there are obvious differences in the production of laboratory wastewater, some laboratories because of scientific research, resulting in a large number of metal ions in the wastewater, this experimental wastewater if not timely treatment, will cause serious damage to the environment. In order to treat this laboratory wastewater, under normal circumstances, chemical precipitation method, ion exchange method and electrochemical treatment method can be used. Scholar Wang Huanying used ion exchange method to recover heavy metal ions in laboratory wastewater, the removal rate of zinc and lead is very high, and the treatment effect is very obvious. For the laboratory wastewater containing lead and mercury, chemical precipitation method can be used to treat the wastewater with sulfide, make it react, transform into sodium sulfide, and then precipitate. This method has remarkable effect, simple operation and low cost, but there are certain problems in the dosage control. If the dosage is sufficient, it may cause a waste of resources. The treatment effect of metal ions will be greatly reduced.

(2) Treatment of cyanide-containing laboratory wastewater technology

At present, the treatment technology of laboratory cyanide-containing wastewater is not mature and perfect, but it can learn from the existing cyanide-containing wastewater treatment technology. For example, by using ozone oxidation method, electrolysis method and high temperature decomposition method, the cyanide-containing wastewater is treated. Among them, the electrolysis method is more expensive, and the ozone method consumes more energy. Although these methods have achieved certain results in the treatment of cyanamide wastewater, the consumption is too large, and some gains are not worth the loss. Therefore, for the laboratory wastewater with low cyanide concentration, chlor-alkali method can be used for treatment, this method is mainly under alkaline conditions, the use of liquid chlorine, bleaching powder and other chlorine oxidizing agents, the CN- oxidation decomposition, so that it is converted into co2 and N2 Guangzhou Institute of non-ferrous metals is the use of sodium hypochlorite + activated carbon combined process to treat chlorine-containing laboratory wastewater. The treated wastewater is in line with the "sanitary standards for Drinking Water" (GB5749-2006) standards, and the effect is remarkable.

(3) Treat wastewater containing acid and alkali

In the laboratory, acid and alkali reagents are the most frequently used, but also the most common laboratory reagent, therefore, there are also a large number of acid and alkali wastewater in the laboratory, if it can not be effectively treated and recycled, it will cause serious clothing to drainage pipes and buildings, change the pH value of the water body, and cause great damage to the environment. Resulting in the reduction and destruction of water resources. When the acid-base wastewater contains H- and OH+, the principle of acid-base neutralization can be used to treat the wastewater so that its pH value reaches the allowable discharge standard.

3. Experimental wastewater containing pathogenic microorganisms

In the microbiology laboratory, often because of the experimental research on viruses, bacteria, fungi, etc., resulting in a large number of experimental wastewater containing pathogenic microorganisms, in these wastewater, the survival of microorganisms, the degree of harm, the mode of transmission, living conditions are different, once untreated wastewater discharge, will have a huge impact. Therefore, the experimental wastewater containing pathogenic microorganisms must be treated and in line with the relevant national discharge standards before it can be discharged. There are many ways to inactivate harmful microorganisms, through the analysis and research of these microorganisms, the most effective and simplest way to inactivate high temperature and high pressure. Therefore, for the experimental wastewater containing pathogenic microorganisms, it can be collected, and then through high temperature and high pressure, it is inactivated, and then discharged after reaching the sewage discharge standards.

4. Comprehensive wastewater treatment technology

At present, most laboratories to carry out experimental research produced by the wastewater are comprehensive wastewater, which contains a variety of toxic and harmful substances, the composition is very complex, containing a variety of acids, bases, heavy metals, if still use a single treatment technology for its treatment, will not be able to achieve good treatment results, can not be discharged. In this regard, the combined treatment technology can be applied in the comprehensive wastewater treatment plant to improve the wastewater treatment effect. Scholar Zhao Li used two-stage flocculation-activated carbon adsorption method to treat the comprehensive wastewater in the laboratory. The wastewater not only contains a lot of heavy metal ions, but also sulfide and aniline. The treatment results show that the method can effectively treat the heavy metal and sulfide in the wastewater, and reduce the chroma and turbidity of the wastewater. In addition, the suffering environmental Science Institute for a research unit in the laboratory wastewater experiments, through the use of "coagulation precipitation - contact oxidation filtration constructed wetland" comprehensive treatment technology, the effect is remarkable, the treated wastewater in line with the "water pollution discharge limits" (DB44/26--2001) in the relevant requirements and standards. In this regard, the combined process technology can be used to treat the integrated wastewater.

III. The existing problems and solutions

1. Existing problems

(1) Staff's awareness of environmental protection is weak

Through the author's practice investigation, it is found that some experimental researchers attach great importance to the experimental process and results, but do not pay attention to the damage that may be caused to the environment during the experimental process. The environmental awareness is relatively weak, and the laboratory wastewater treatment is ignored.

(2) Lack of effective supervision

At present, the funding of many scientific research institutions is not enough, and researchers do not want to spend a large amount of money on wastewater treatment, but hope to use it in scientific research. In addition, the supervision of scientific research institutions is not strict, and even some regions do not supervise and manage the discharge of scientific research wastewater.

(3) There is no sound laboratory management system

The production of laboratory wastewater is not regular and quantitative, often small and scattered, and there is no clear collection requirement for by-products produced in the experiment process.

2. Preventive measures

First of all, education and publicity should be carried out for scientific researchers to strengthen their awareness of environmental protection, so that they realize that when conducting scientific research, it is not only necessary to conduct comprehensive analysis and research on scientific experiments, but also to cause negative effects on the experiments. As far as possible, the use of experimental drugs should be reduced, and the recyclable drugs should be recycled. At the same time, it is necessary to establish and improve the laboratory wastewater discharge standards and supervision system, and strictly implement, so that the experimental wastewater can be discharged after meeting the discharge standards; It is necessary to improve the laboratory management system, collect the wastewater generated by the experiment, and then discharge it after treatment. Due to the small amount of laboratory wastewater, irregular, scattered and other characteristics, it can be treated with integrated equipment. In addition, you can also use the water quality online detector in the laboratory wastewater treatment process, through this way, to understand the water quality, and on this basis to carry out targeted wastewater treatment, so as to effectively improve the wastewater treatment effect.

Concluding Remarks

In short, in the new period, the problem of laboratory wastewater must pay attention and concern, because the concentration of laboratory wastewater is high, containing a large number of toxic and harmful substances, therefore, it is necessary to choose the appropriate sewage treatment process to treat it, so that it meets the relevant discharge standards, and then discharge. However, due to the small amount of laboratory sewage, dispersion and other characteristics, can use simple operation, lower cost, higher efficiency of the treatment method, integrated sewage treatment equipment will become the main trend of laboratory sewage treatment.

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