The research about the removal of antibiotic pollutants in water pollution by adsorption materials and photocatalytic materials.

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Abstract. In recent years, antibiotics a kind of efficient chemical synthetic are widely used in medicine, agriculture, and animal husbandry, etc. It can strengthen the prevention of human diseases and animal diseases, and promote the growth of animals in animal husbandry and aquaculture. But it is important to note that antibiotics have become a new source of pollution, and the abuse of antibiotics has become more and more serious about the human environment. Because of its heavy dosage, it can induce the production of resistant strains, which pose a significant threat to human health and ecological environment. At present, the technology of conventional sewage treatment plants is not sufficient to remove the effects of antibiotics and drug-resistant genes, and even sewage treatment plants become an important source of antibiotic water pollution. Therefore, in order to effectively improve the pertinence of the treatment technology in antibiotics and drug resistance, we focused more on the study of antibiotic treatment and purification analysis. This paper is a review of the complex pollution status and treatment methods caused by various antibiotics in water pollution, as well as the prospect of future research.

1. Introduction
Antibiotic is a kind of chemical compound that are resistant to microbial activity. As a kind of broad spectrum antimicrobial agents, they are widely applied to treat various human diseases and animal diseases. At the same time, antibiotics can be used as food additives in animal breeding to promote the growth and development of animals. Since penicillin was utilized extensively by humans, the studies and use of antibiotics have become more popular. The use of antibiotics has brought considerable benefits to the production of medical and animal husbandry. But the misuse of antibiotics has also given birth to a series of serious environmental problems. The majority of antibiotic drugs ingested by
humans and animals cannot be completely absorbed and then discharged into sewage treatment plants or directly into the environment. The pollution status, transfer and risk assessment of the new environmental pollutants have become the new focus of attention \cite{1}.

With the improvement of analytical instruments and analytical methods, more and more antibiotics are found in rivers in different countries and regions. Table 1 lists the recent reports of antibiotics in China.

Table.1 The concentrations of antibiotics in domestic river and marine sediments.

| Place       | Antibiotic | Sediment concentration (ng/g) | Place       | Antibiotic     | Sediment concentration (ng/g) |
|-------------|------------|-------------------------------|-------------|----------------|-------------------------------|
| Yellow River| Noroxin    | 7.76                          | Daya Bay    | Sulfadiazine   | 2.7–6.1                       |
|             | Ofloxacin  | 3.49                          |             | Sulfadiazine   | 5.3–7.4                       |
|             | Erythromycin| 8.11                          | Norfloxacin | 1140           |
|             | Tetracycline| 135                           | Ciprofloxacin| 46             |
|             | Ofloxacin  | 5770                          | Ofloxacin   | 362            |
|             | Ciprofloxacin| 1290                         | Sulfamethazine| 5.94       |
| Hai River   | Sulfadiazine| 653                           | Ofloxacin   | 7.86           |
|             | Erythromycin| 298                           | Sulfadiazine| 1.4            |
|             | ROX        | 67.2                          | Sulfamethazine| 6.92       |
|             | Terramycin | 3.24–83.9                     |             |                |
|             | Sulfadiazine| 4.42–154                      |             |                |
|             | Sulfamethazine| 1.2–99.9                     | ROX         | 302            |
|             | Norfloxacin | 2.96–72.6                     | Erythromycin| 3.04           |
|             | Tetracycline| 19.2–1120                     | Terramycin  | 653            |
|             | Ofloxacin  | 11.4–1560                     | Norfloxacin | 177            |
|             | Ciprofloxacin| 9.02–143                      | Erythromycin| 40.3           |
|             | Erythromycin| 1.26–62.7                     | Sulfadiazine| 29.6           |
|             | ROX        | 0.99–106                      | Liao River  |                |
|             | Roxithromycin| 0.99–106                    |             |                |

2. Materials and methods
At present, main treatment technologies of antibiotics include biodegradation, physical adsorption, chemical oxidation and so on. These technologies have some limitations. \cite{2,3}. The water pollution caused by antibiotics is the most serious problem at present. The authors checked out this and briefly described the treatment methods studied. The pollution caused by antibiotics in the environment results in a mixture of pollution and persistent pollution. Depending on the characteristics of this pollution, the authors chose to use biomass material adsorption and photosynthetic technology to treat polluted water bodies (adsorption materials and high-efficiency active conversion materials \cite{4}).

2.1. Physical adsorption
In industries, adsorption method is widely used for processing wastewater containing organic pollutants (pops). We put the adsorbent material in the polluted water, a wide variety of pollutant diffusion in the target pollutants or near a adsorbent and gradually accumulated in the surface of the
adsorbent adsorption, eventually adsorbent will break water pollutants. This method is not destructive to antibiotics, since it simply separates the pollutants and does not alter the nature of the pollutants themselves. Therefore, during the adsorption process \cite{5}, the adsorbent does not degrade the single pollutant or complex pollutant, and it would not raise the risk of secondary pollution due to the incomplete degradation. The adsorption process is simple, cost saving, safe, controllable, and efficient for the removal of antibiotics. Moreover, it has huge advantages in all kinds of research and applications\cite{6}.

The effect of adsorption depends on the surface state and internal structure of the adsorbent, while the molecular structure of the adsorbent and the properties of the functional group also affect it. Therefore, the key of this adsorption technology is to choose the adsorption material with extraordinary efficiency. First, biomass materials have low cost and no toxicity, and it has excellent biocompatibility and does not cause secondary pollution to water sources. We modified it chemically, and introducing magnetic ministerial that can be separated and recycled so that its adsorption capacity and recycling function can be enhanced \cite{7-9,11}. Magnetic nanometer material is a type of composite material with atomic shell structure such as MNPs, which has the advantages like large surface area, high magnetic strength and stable chemical properties. Thanks to these advantages, the material has great potential in wastewater treatment, and it will not produce secondary pollution. It is characterized by sharp adsorption efficiency, short adsorption time and reusable capacity. It has superior ability to remove antibiotics, heavy metal ions and biotoxins in sewage. Therefore, we combine magnetic nano-materials with biomass materials to form a more durable composite material, which can effectively absorb complex antibiotic pollutants in wastewater.\cite{10,16}.

2.2. \textit{Photocatalytic technology}

At the same time, we should also consider that adsorption is only a crude removal of antibiotic pollutants in water. It does not completely change the chemical composition of the pollutants, nor does it have a deep purification of the water. There are obvious deficiencies in this single mode of governance, and it is sometimes difficult to complete the purification of polluted water body alone \cite{11}. In order to maximize the treatment of antibiotic pollution, this combination technique has gained widespread attention. We regard biomass material and membrane filtration technology as pretreatment technology for treating wastewater, and then combine them with physicochemical reaction, photocatalysis and other technologies to finally achieve optimal treatment of wastewater \cite{12}.

The advanced oxidation technology can remove antibiotics in a short period of time and remove other refractory organic compounds. According to this, we consider using highly efficient composite photosynthetic materials to thoroughly purify the polluted water \cite{13}. Because of the low cost of photographic technology and its no secondary pollution, this technology can be used to deal with all kinds of complex polluted wastewater which are not difficult to prepare and have no excellent stability such as the "screw ZnI2sn4", the CdS and WO3, etc.. This is likewise the key to maximizing the removal of antibiotic contaminants. Through the analysis of antibiotic pollution and the selection of wastewater treatment methods, we can make future experiments on appropriate polluted water to search the national water treatment measures and methods\cite{14}.

3. \textbf{Results and Conclusions}

The combination of compound adsorption material with the natural minerals, has enhanced the mechanical properties and stability of biomass Chitosan, and also maintained its rich functional genes and biocompatibility. We used the coupling of magnetic materials with inorganic ministerial, both of which can efficiently remove the antibiotic substances in the sewage environment and improve the ability of effective recycling. The main problem of photosynthetic technology is to use suitable materials to modify and load the efficient catalyst, thus effectively improving the degradation efficiency and the recovery ability of the catalyst\cite{15,17}. In the future, we will develop a suitable photosynthetic reactor to make photosynthetic technology more promising in the treatment of antibiotic wastewater and bring in solar energy utilization\cite{18}.
At present, in terms of water environment, we have insufficient research on the compound toxicity of antibiotics, and we cannot simulate the actual environment better. In the future, we should learn more about the complex toxicity of multivariate antibiotics and understand their risks to environmental organisms. Therefore, we can provide a realistic basis for the related departments to build the treatment plant to antibiotic compound pollution.

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