Electroplating Wastewater Treatment Method and Development Trend Analysis

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Abstract. Electroplating wastewater is a highly hazardous industrial wastewater with complex composition. For the treatment of electroplating wastewater, the traditional treatment methods include chemical treatment and membrane treatment. According to the requirements of electroplating wastewater treatment and industrial wastewater treatment in recent years, traditional electroplating wastewater treatment technology is difficult to reach new emission standards. The “zero emission” technology of electroplating wastewater has gradually become a new goal of ecological civilization construction. This article starts discussion from this aspect.

1. Introduction
The electroplating industry is closely related to our lives and is an irreplaceable traditional industry. The conventional treatment processes for electroplating wastewater in China include chemical methods and electrolysis methods. However, the traditional method of treating electroplating wastewater has the problems of high treatment cost, waste of resources and environmental pollution [1]. There are some unavoidable problems in the production process of electroplating. The high water consumption, high processing cost and the pollution of water bodies caused by heavy metal pollutants restrict the development of the industry [2].

In order to solve the problem of heavy pollution in the electroplating industry, China has also introduced many environmental protection policies, and has increased the crackdown on the behaviors that damage the ecological environment, and further changed some heavy metal emission standards. At present, many electroplating companies also hope to improve the production of electroplating wastewater by changing the original process and upgrading the processing equipment to the direction of cleaner production and zero emissions [3].

2. Traditional Electroplating Wastewater Treatment Technology

2.1. Chemical Treatment of Electroplating Wastewater
In the recent decades of development of the electroplating industry, chemical methods have become widely used in many processes because of their mature processes and low investment. The general flow of the chemical precipitation method is shown below:
2. The chemical treatment of electroplating wastewater is essentially a terminal treatment method, but it is only how much the treatment is discharged, and it cannot solve the problem in essence [4].

2.2. Membrane Treatment of Electroplating Wastewater

The membrane separation method is a technique for separating substances by utilizing the selectivity of a polymer [5]. Membrane separation technology is low investment. At the same time, electroplating wastewater and impurities can be well separated and have good economic and environmental benefits. But the use of membrane technology, just recycling the available materials, can not solve the pollution problem in essence. The membrane separation method must be combined with other technologies to truly achieve the best results [6]. The general flow of the membrane treatment method is shown in the following figure:

![Membrane treatment of electroplating wastewater](image)

Figure 2. Membrane treatment of electroplating wastewater [5].

3. “Zero Emissions” of Electroplating Wastewater

Recently, Sino-German Electroplating Wastewater “Zero Emissions” Technology Development Forum held a “zero emission” government direction and corporate solutions in Jieyang, Guangdong. The new era on the requirements of ecological civilization construction, for the entire electroplating wastewater treatment professional Suggestions and references for technical transformation and upgrading [7].

3.1. Status of “Zero Emission” of Electroplating Wastewater

The electroplating process is indispensable because of the wide range of industries involved. However, due to its high energy consumption and high pollution, it is generally processed in the park, and the electroplating wastewater is treated uniformly. Today, and “zero emissions” has gradually become a problem we are very concerned about. In the end, what technology can be used to truly realize the
“zero emission” of electroplating wastewater, and many companies have done a lot of research on this. However, the first thing that needs to be solved to achieve zero discharge is the reuse of wastewater, the recycling of metal salts, etc. From the research results, the problem of limiting “zero emissions” lies in the removal of salt. Only by solving the problem of salt, “zero emission” can be realized in a real sense.

3.2. Electroplating Industry Integration Drives “Zero Emission” Technology Upgrade

Sino-German Metal Eco-city is China’s first “zero-emission” electroplating wastewater treatment project, which is the entry point for achieving “zero emissions”. The Sino-German Metal Eco-City Processing Center, which has just been put into use, has achieved As a result of the vulgarity, first, the recovery rate of wastewater has been greatly improved, and the metal salt after the treatment has also been recycled, and the concept of “zero emission” has also been realized. The solution for “zero emission” of electroplating wastewater and heavy metal recycling is shown in figures 3 and 4.

3.3. Electroplating Wastewater Concentration Treatment Process

The zero-emission treatment process of salt-containing wastewater can be summarized into several typical process units such as pretreatment, membrane concentration, and evaporation crystallization. The membrane concentration unit is mainly used for reducing the wastewater, reducing the processing load of the evaporation crystallization unit, and plays a key role in controlling the cost of zero discharge treatment.

Electrodialysis technology uses DC drive, and the positive and negative ions in the solution move to the positive and negative poles under the drive of direct current. The anion-cation exchange membrane is alternately distributed between the positive and negative poles to form a continuous
arrangement of a concentrated chamber and a light chamber [8]. The removal efficiency of electrodialysis technology is lower than that of reverse dialysis technology. It can only remove the charged impurities, but some uncharged particles cannot be removed [9].

The following sections analyze the economic aspects of several concentration processes, as shown in the following table 1:

| Pretreatment process | Bipolar softening | Soften | Two-pole softening clarification | Bipolar softening |
|----------------------|-------------------|--------|---------------------------------|------------------|
| Concentration process| RO                | SWRO   | FO                              | ED               |
| Concentrate salinity/%| 2-2.5             | -7     | -20                             | 15-17            |
| Influent salt/mg/L   | -10000            | -50000 | 60000-                          | 20000-           |
| Water production     | -200              | -500   | -5000                          | -5000            |
| Operating pressure/MPa| -3                | -6     | 0.2-0.3                        | 0.2-0.3          |
| Tons of water        | Lower             | low    | Very high                      | medium           |
| investment           |                   |        |                                 |                  |

Note:
RO-reverse osmosis;
SWRO-seawater desalination membrane;
ED-electrodialysis;
FO-positive osmosis.

3.4. The Problem of Sustainability of “Zero Emissions”
President Xi said that “green mountains and green mountains are Jinshan Yinshan”, and only by considering environmental protection, can the country’s economy grow steadily. Therefore, the “zero emissions” of various industrial enterprises have become the most eager to solve the problem. Let us discuss the problems of the sustainability of “zero emissions”.

(1) In order to achieve true “zero emissions”, all industries will have huge cost inputs. At this point, the “zero emissions” of electroplating wastewater are the same. This limitation makes many companies reluctant to consider the investment of pre-treatment and end-processing, and to deal with 1m3 water depreciation and interest of more than 20 yuan, and the daily processing capacity of wastewater is 5000 m3, the annual processing cost is 35 million yuan [10].

(2) In fact, there are many projects for zero discharge of electroplating wastewater in China, but most of the projects are unstable. Most of the problems in the operation of the project are concentrated on pretreatment, step by step, salt separation, Evaporation on the crystals [11]. In fact, the fundamental problem is that it is in the pretreatment stage, because the management of the pretreatment stage is not in place, making the wastewater treatment stability not high [12].

4. Conclusion
In China, the treatment of electroplating wastewater is still in the end treatment state. There is no
control from the front end or comprehensive control. The electroplating wastewater should be classified and recycled. Different types of electroplating wastewater should be treated differently [13]. We should take “zero emission” as the highest goal. We must continue to move toward this goal. The current “zero-emission” treatment technology for wastewater is not yet mature, and the operating cost is high. It should be based on emission standards, phased and step by step. Improve the recycling rate of electroplating wastewater [14].

Clean production should also implement the whole process of electroplating wastewater production. It should cope with the relationship between clean production and end treatment, promote and develop closed-circuit circulation non-discharge technology for electroplating wastewater, contain pollutants from the source, and reduce treatment costs [15]. and increase the theoretical research and application of special strains such as salt tolerance, give policy and financial support for the introduction of new technologies, new materials and new equipment, and encourage enterprise innovation [16].

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