Application and Research of High Salt Organic Liquid Wastes Incineration Equipment and Technology

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Abstract. High-salt organic liquid wastes treating were worldwide problem. It perplexes many chemical industries such as medicine, pesticide, metallurgy, papermaking, printing and dyeing. A new high temperature incineration technology is introduced. This is especially suitable for the treatment of organic waste liquid. At the same time, it is divided into a variety of segmentation technology routes. According to the type and amount of salt or different process routes, incineration technology can effectively transform organic waste liquid into harmless substances. At the same time, the process also recovers salt resources and generates steam, and the gas emission reaches the standard. In this paper, we will compare the different treatment methods for route selection. Through the summary of process optimization, it can provide strong support for innovation decision-making and application planning of liquid waste incineration technology.

In different industrial fields, industrial wastewater treatment is a global problem, which has high content of salt liquid and saturated salt [1]. In the process of disposal, a lot of manpower and scientific research funds have been invested. However, the effect is very small. Meanwhile, China's State Environmental Protection Administration says liquid waste emissions and related pollution are increasing year by year [2]. In 2011, China's sewage discharge reached 65.92 billion tons, as shown in the table below. In the 2.39 billion tons of industrial wastewater discharge, the chemical industry organic wastewater with strong toxicity has attracted much attention [3]. At the same time, in the 12th Five Year Plan for the development of national strategic emerging industries, the State Council also focused on the research of these disposal paths and recycling core technologies. They fully agree to promote cleaner production and low-carbon technologies for new equipment and products.

1. Domestic and abroad technology summary

At present, high salt waste incineration technology is divided into "wet" and "dry". In the "wet process" high salt organic wastewater incineration (1100°C), the high temperature flue gas directly enters below 100°C from 1100°C quench. Salt crystals in flue gas are dissolved in water due to the formation of salt solution. The high-temperature flue gas enters the waste heat recovery device after dry treatment. Through the salt collection system, the particulate salt in the flue gas is cooled and collected into solid salt.

| Emission Year | Wastewater (Gigaton) | Industrial Wastewater (Gigaton) | High-salt Liquid Waste (Gigaton) | Duty Ratio (%) |
|---------------|-----------------------|---------------------------------|---------------------------------|---------------|
| 2007          | 55.68                 | 24.66                           | 11.08                           | 44.3          |
| 2008          | 57.17                 | 24.17                           | 10.56                           | 42.3          |

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In developed countries, since the 1850s, this technology has begun to study the thermal oxidation systems of the United States, John Zink Inc and PCC, mainly using the salt waste liquid from liquid jet furnace and waste heat boiler. After the improvement, the particle pollution is eliminated and the heat transfer coefficient of the heating surface is reduced. The principle is that alkaline earth is related to the flue gas temperature which is cooled to or lowers than the melting point of the low melting point salt solution. At the same time, Japan has developed a submerged combustion technology for TSKE [4]. It is mainly used for the treatment of waste liquid chlorine. The high temperature gas above 1100℃ can effectively avoid the generation of dioxins under 1100℃ [5]. In France, Vihelm Company invented waste treatment developed by evaporation process of high temperature oxidation system. Similar to Japan, production of dioxins and nitrogen oxides is extremely low [6].

| Year | USA | JPN | EUR | CHN |
|------|-----|-----|-----|-----|
| 2009 | 58.97 | 23.45 | 9.78 | 39.8 |
| 2010 | 61.73 | 23.75 | 9.89 | 38.5 |
| 2011 | 65.92 | 23.09 | 8.87 | 35 |

Table 2. The summary for technologies of domestic and foreign products

| Countries | USA | JPN | EUR | CHN |
|-----------|-----|-----|-----|-----|
| Wet Process¹ | Submerged Combustion | Vaporization+High temperature oxidation | Incinerator+Filter+Quenching |
| Wet Process² | Liquid injection furnace+Waste heat boiler routings | | |
| Dry Process | | | Incinerator + Heat recovery +Gas purification |

¹²Notes: the main equipment of wet processing in 1 and 2 were different.

At present, the research on high temperature combustion and high salt organic wastewater treatment technology is mostly concentrated in scientific research institutes. But the engineering application is less. In the laboratories of Zhejiang University, Harbin radicalism Research Institute, Chinese Academy of Sciences and other universities, fluidized bed incineration technology is widely used to treat salty wastewater [7]. How to avoid low melting point coking of materials in molten salt bed is studied. At the market level, high temperature incineration is the main method to treat high salt organic wastewater. The technology is high temperature combustion technology, which is developed from dry process. At present, there is related equipment production in China; its performance is not inferior to foreign products. See Table 2 for product technology at home and abroad.

2. Similarities and differences

2.1 The advantages and disadvantages of "Wet method".

The Using adiabatic incinerator can save more energy than "dry method". At the same time, if the salt containing wastewater is not used as the main raw material device, it will lead to the problem of secondary wastewater treatment.

Due to the high temperature, and flue gas without waste heat recovery, "wet" industrial water consumption is large and intense. After rapid cooling, the flue gas increased nearly one time. After absorbing the system, the equipment will be increased accordingly. It may lead to an increase in unit investment.

If the waste water containing high calorific value salt can keep stable combustion as a single type of salt, the long-term stable operation of the unit can be guaranteed by "wet method". At the same time, it reduces the consumption of public facilities and the maintenance cost of complete equipment. Their route can be summarized in Figure 1.
2.2 The advantages and disadvantages of "Dry method".

The "dry method" is used to recover the residual heat of flue gas, and the economic operation of the analysis device is better.

The "dry method" adopts membrane water-cooled wall. When the treatment capacity is equal, the fuel consumption of the specific humidity method is $1/3 \sim 1$ times, and the overall investment of the equipment can be 1 times larger than that of the humidity method. It also covers an area of $1/3 \sim 1/2$ times larger than the humidity ratio method.

There are many kinds or complex components of salty wastewater. These conditions may lead to difficulties in "dry" recycling. At the same time, it will carry small pollution particles on the heating surface of flue gas, increasing the difficulty of long-term stable operation of the unit [8]. According to the engineering experience, the ash cleaning cycle of the incineration boiler corresponding to 50kg/h salt is about 3-6 months. After the ash cleaning measures are added to the system online, the ash cleaning cycle in the furnace can be extended to 8-10 months. Their route can be summarized in Figure 2.

3. Conclusion

For high temperature and high salt waste liquid, what kind of technical route should be adopted for incineration process treatment is a problem. Carry out comprehensive evaluation according to the actual situation of the project. Including rationality, main process characteristics, the actual needs of the owner...
and the project investment can determine the technical route. However, for the type of waste liquid containing salt and salt, if its treatment capacity is more than 200kg / h, in order to ensure the long-term stable operation of salt, the "wet" device can be used more.

Acknowledgments
This work was supported by the Research of “Study on Key Technologies of Heterotopic Thermal Desorption of Organic Contaminated Soil” (TKS190410).

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