China Medical Waste Disposal Industry Market Report

February 2021

Content

1. Overview of the development of China's medical waste disposal industry

Medical waste disposal industry in China started in the 1980s.

During the COVID-19 pandemic in 2020, authorities including the National Health Commission issued the **Work Plan for Comprehensive Treatment of Waste from Medical institutions**. The work plan requires each prefecture-level city (293 prefecture-level cities) to build at least one standardized medical waste disposal facility by the end of 2020, and each county (about 2,846 county-level administrative divisions) to build a medical waste collection, transfer and disposal system by the end of June 2022.

The National Hazardous Waste List issued by the China Ministry of Environmental Protection divides medical waste into five categories, including: 1) Infectious waste, which refers to medical waste that carries pathogenic microorganisms and causes the risk of spreading infectious diseases; 2) Pathologic waste refers to wastes such as human wastes or medical laboratory animal carcasses generated during diagnosis and treatment; 3) Damaging waste refers to discarded medical sharps that can stab or cut the human body; 4) Drug waste refers to expired, abandoned drugs that are eliminated, deteriorated or contaminated; 5) Chemical waste refers to discarded chemicals that are toxic, corrosive, flammable, and explosive. Among them, **infectious waste** including items contaminated by patients' blood, body fluids, and excreta, **accounts for the largest proportion, about 85%.**

At present, medical waste disposal enterprises mainly deal with infectious and damaging medical waste. Most drug and chemical medical waste are transferred to hazardous waste disposal enterprises. Pathologic medical waste is not disposed by medical waste disposal enterprises.

.

2. China's disposal technology of medical waste

2.1 Incineration disposal

The incineration technology of medical waste is developed from the incineration technology of domestic waste. However, incineration produces a lot of harmful gases and residues, especially dioxins and furans, which need secondary flue gas treatment. Most of the existing incinerators cannot adapt to the recent and more stringent emission standards, and the cost of replacement is substantial. Modern incinerator equipment has more complex structure and requires more professional team to operate, and thus costs more. As for the incineration technology application, rotary kiln incinerators are generally used for medical waste disposal in cities such as Nanning and Panzhihua.

Wuhan, Hubei - rotary kiln incinerator


Temporary medical waste incinerator used in COVID-19

2.2 High-temperature steam sterilization

High-temperature steam sterilization is the process of putting medical waste in metal pressure vessel (autoclave, with enough pressure strength) and using superheated steam to kill pathogenic microorganisms. Using 2.2 atmospheric pressure and 273 ℉ high temperature and pressure, the technology can achieve more than 6 log10 disinfection and sterilization index. The waste after high temperature steam disinfection can be disposed as domestic waste. The disadvantage is that without crushing process, the waste volume cannot be reduced. Generally, large quantities of drug and chemical wastes cannot be disposed, and the residues still need to be further disposed such as incinerated or safely landfilled. High-temperature steam sterilization is generally used in cities such as Xiaogan and Jingzhou of Hubei Province.


Hunan Changsha medical waste disposal center–
high temperature steam sterilization control system

2.3 Microwave treatment

Microwave is a high frequency electromagnetic wave. When it is used for disinfection, the frequency band is usually 915mfiz or 245omhz. Microwaves can penetrate the object and make the external and internal heating at the same time. Compared with the general heating method, it has **higher speed and high energy efficiency**. Disadvantages includes poor sterilizing ability on low-moisture wastes, potential arc discharge caused by metal wastes, and the microwave radiation that might impact human health. After microwave disposal, the residues also need to be further incinerated or safely landfilled. Microwave treatment is mainly used in cities such as Shijiazhuang in Hebei Province.

2.4 Chemical disinfection

Chemical method is the use of chemicals to kill infectious substances in medical waste, which is divided into dry chemical disinfection and wet chemical disinfection. In general, the method is to break the medical waste, mix evenly with chemical disinfectants (such as lime powder, sodium hypochlorite, calcium hypochlorite, chlorine dioxide, etc.) and let it stand for enough time. However, there is a chance of incomplete disinfection because of a dead zone. The poor working conditions also have great impact on the external environment. However, after disinfection, the residues need to be further landfilled or incinerated.

2.5 Other Technologies

The use of **Pyrolysis method** has good volume reduction capacity, yet poor stability. There is a risk that the residue will not reach the disposal standard. It also has the problem with dioxin emissions. Pyrolysis has been widely used in cities such as Wuhan, Hubei. **Plasma technology** is a type of high-temperature disposal technology, which uses plasma device to generate 10,800℉ temperature in the reaction chamber to decompose waste molecules. Although plasma technology can thoroughly dispose medical waste, it is difficult to be popularized in China due to its high cost and small capacity.

Jiaxing, Zhejiang –
high temperature steam disinfection + microwave disinfection

At present, **incineration or high temperature steam disinfection are widely used in Chinese medical waste disposal enterprises, and the two methods almost share the market fifty-fifty.** Other disposal processes are rarely used in practice. **The Ministry of Ecology and Environment appears to support incineration (rotary kiln) over other methods**. As stated in the Management and Technical Guidelines for Emergency Disposal of Medical Wastes from Pneumonia Infected by COVID-19 (Trial), "high-temperature incineration shall be used for disposal, and non-incineration methods such as high-temperature steam sterilization, microwave sterilization, and chemical sterilization can also be used with ensuring the effectiveness of disposal."

3. China's medical waste industry business model

Medical waste disposal in China is run on a franchise basis. Similar to the User-Pays form under PPP mode, the medical waste disposal enterprises collect fees from the end-users, medical and health institutions. The disposal fees are the operating income of the medical waste disposal center. Some medical waste disposal projects also refer to BOT or ROT contract.

In China, medical waste disposal fee is set under the government guidance. Provincial price authorities formulated principles. Municipal authorities determine the specific pricing standards. At present, the floating range set by the government is relatively small.

The three main pricing methods are: **by bed, by weight and by stepped quota**. At present, the combination of bed pricing and stepped quota pricing is widely used in most cities. For medical-waste-generating units within a city, those with beds are charged by beds. The number of beds is determined by the declared amount and the utilization rate. Other units without beds are charged by stepped quotas. In a few areas, pricing by weight is adopted.

The charging standards vary greatly from place to place. Generally, in economically developed areas the disposal price is lower. The nationwide price range of medical waste disposal priced by bed is 1.5-3.3 yuan (0.23-0.51 USD)/bed/day, concentrated on 2.0-2.5 yuan (0.31-0.38 USD)/bed/day. The price range is higher in cities such as Nanning (3 yuan (0.46 USD)/bed/day) and Changchun (3 yuan (0.46 USD)/bed/day), and is lower in cities such as Shijiazhuang (1.9 yuan (0.29 USD)/bed/day).

4. China's medical waste industry market size

4.1 Current situation of the industry

According to the 2019 National Annual Report on Prevention and Control of Solid Waste Pollution in Large and Medium-Sized Cities issued by the China Ministry of Ecological Environment, the number of medical waste centralized disposal centers with medical waste business license in 2018 is 407. The largest licenses-issued provinces are Guizhou (26), Sichuan (26) and Henan (25). The changes of medical waste disposal facilities over the years are shown in Figure 1.

According to statistics, the disposal capacity of 407 medical waste disposal centers in 2018 is about 980,000 tons. If calculated according to the conservative estimate of 1.4 million tons of medical waste produced in 2018, the disposal capacity of existing medical waste disposal centers accounts for about 70% of the total produced amount.

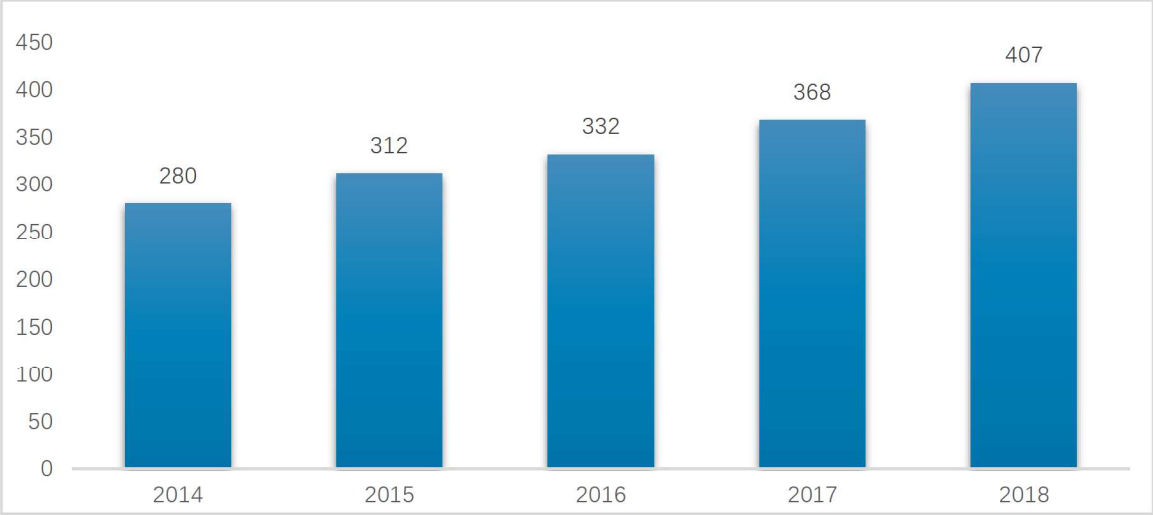


Figure 1 The Number of Medical Waste Disposal Centers in China (2014-2018)

*(**Source:** National Annual Report on Prevention and Control of Solid Waste Pollution in Large and Medium-Sized*

In large and medium-sized cities, the produced amount of medical waste is large and the market for medical waste disposal is almost saturated. According to the 2019 National Annual Report on Prevention and Control of Solid Waste Pollution in Large and Medium-Sized Cities, in 2018, the output of medical waste in 200 large and medium-sized cities in China was 817,000 tons, and the disposal volume was 816,000 tons. Among them, Shanghai is the largest producer with a production amount of 55,000 tons, followed by Beijing, Hangzhou, Guangzhou and Chongqing with a production amount of 40,000 tons, 30,000 tons, 27,000 tons and 24,000 tons respectively. The total amount of medical waste generated by the top 10 cities was 268,000 tons, accounting for 32.9% of the total amount generated by all information-publishing cities. These cities are also the most densely populated urban districts in China.

Among the 200 large and medium-sized cities, 47 key cities and 53 model cities are compulsory information-disclosing cities. From 2009 to 2019, the amount of medical waste produced in these 100 cities with compulsory information disclosure is increasing year by year, and it has been timely and properly disposed of.

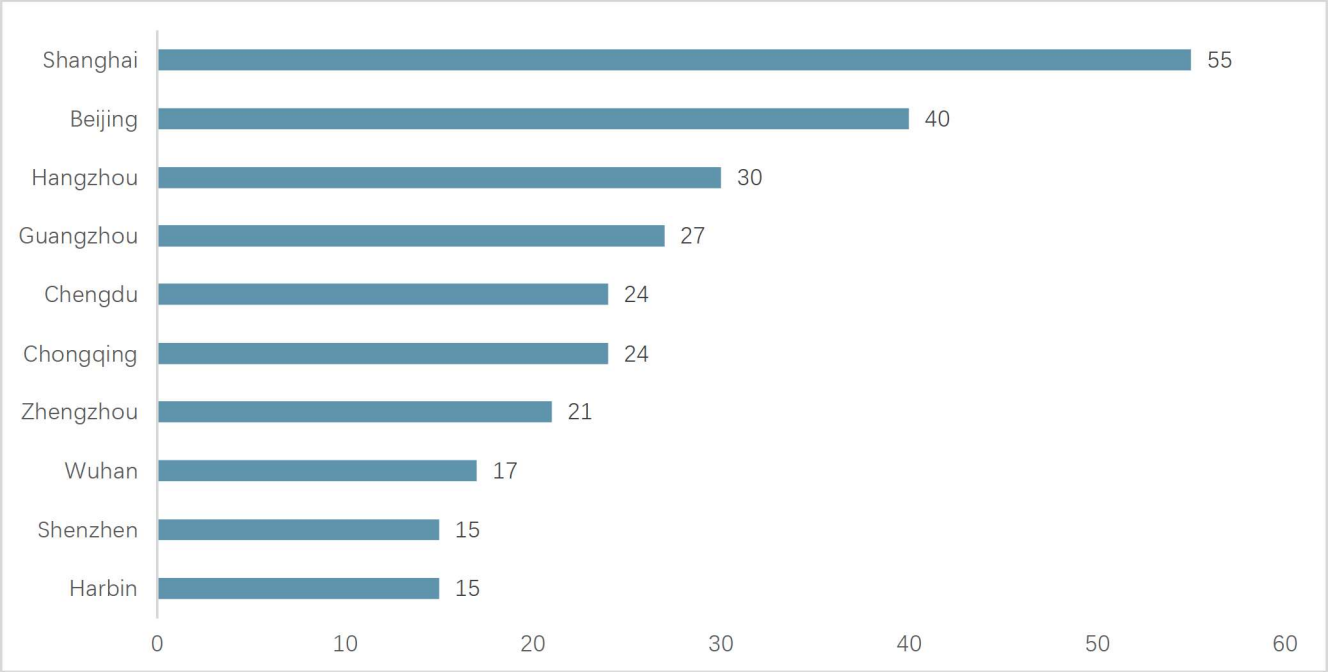
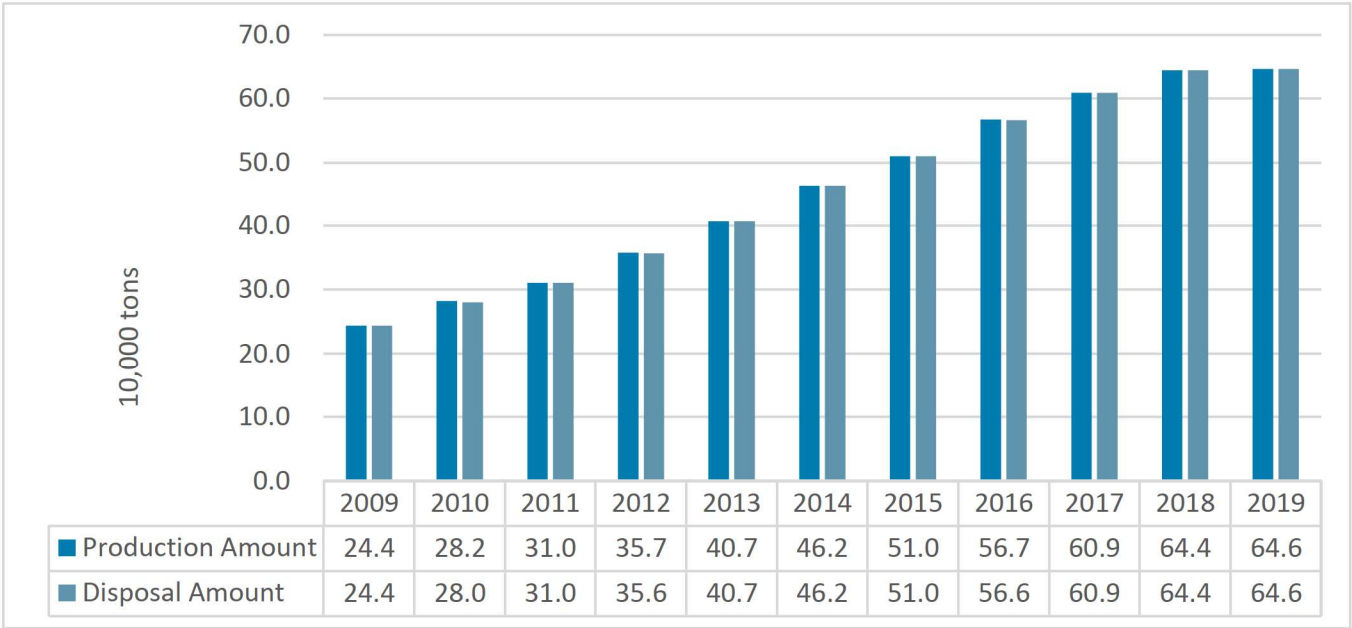


Figure 2 The Medical Waste Production Amount in China's Top 10 Cities in 2018
*(**Source:** National Annual Report on Prevention and Control of Solid Waste Pollution in Large and Medium-Sized Cities)*



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Production Amount	24.4	28.2	31.0	35.7	40.7	46.2	51.0	56.7	60.9	64.4	64.6
Disposal Amount	24.4	28.0	31.0	35.6	40.7	46.2	51.0	56.6	60.9	64.4	64.6

Figure 3 The Amount of Medical Waste Generated and Disposed of in 47 key cities and 53 model cities (2009-2019)
*(**Source:** National Annual Report on Prevention and Control of Solid Waste Pollution in Large and Medium-Sized Cities)*

The medical waste disposal industry has strong regional characteristics. 1) Regional monopolization. Disposal services are usually provided and customized by a certain enterprise for the local medical waste discharge units. 2) Regional barriers. Considering the potential for secondary pollution while transporting medical wastes, the radius of operation and disposal is limited. As a result, there are no actual leading enterprise in the medical waste disposal industry in China. According to the statistical analysis on 52 key cities, by the end of 2019, there were 73 medical waste disposal enterprises in all provincial capitals and major key cities, involving 60 owners.

Overall, the disposal of medical waste in China's large and medium-sized cities has been commercialized and tends to be saturated. The capacity of medical waste disposal in remote areas is relatively weak. Because of the scattered distribution of medical institutions and the small amount of medical waste production, the collection costs in these areas are relatively high. Therefore, medical waste disposal companies are less willing to collect.

4.2 Market potential and profitability analysis

China's medical waste market has a large space, with considerable growth in the future. At present, there is no official statistics on the production of medical waste in China. It is generally believed that the annual production of medical waste in China is about **1.5-2 million tons**. According to the United Nations 2017 World Population Trend Report, China's population is estimated to reach 1.435 billion by 2035, approaching zero population growth. For the number of beds in medical and health institutions, taking the median level of developed countries as reference, it is about 9 beds per thousand population. Based on that, the total number of beds is estimated to reach 13 million in China in the future. At the same time, considering that the annual bed utilization rate is 90%, it is estimated that the annual output of medical waste in China will be no less than 2.1 million tons by 2035, and **the market scale will be more than 10 billion yuan (about USD1.5 billion).**

In terms of income, if the medical waste produced amount is 0.5 kg/bed/day and the unit price of disposal is 2-2.5 yuan (0.31-0.38 USD)/bed/day, the charge of medical waste disposal will be 4,000-5,000 yuan/ton (618-774 USD/ton). Meanwhile, in the long run, the unit price of medical waste disposal is on the rise. Taking Xuzhou City in Jiangsu Province as an example, the municipal government has started the survey for adjustment of unit price of medical waste disposal during the epidemic. Therefore, the unit price of medical waste disposal is estimated to reach 5000 yuan / ton (774 USD/ton) in the future.

In terms of cost, compared with the price of hazardous waste disposal, it is estimated that the cost of medical waste disposal has room for decline. Since the second half of 2018, the price of hazardous waste harmless disposal process, especially incineration, has obviously declined. **The incineration price in some areas has dropped to 4000 yuan / ton ($618 / ton)**. Considering the disposal capacity of hazardous waste disposal market will continue to increase in the short term, a further decline of the unit cost of disposal is excepted.

5. China potential medical waste opportunities

Although medical waste disposal industry in China is relatively mature, the current widely used technologies have their own shortcomings, which make it difficult to meet the new market demand after the epidemic. In addition, the recent policy requires each county (city) (about 2846 county-level administrative divisions) to build a medical waste collection, transportation, and disposal system by June 2022. There is still a large demand in the market. On the technical level, incineration can reduce the volume of waste well, but requires professional management and high operation cost. Dioxin emissions are also a problem. The construction cost of high-temperature steam sterilization method is low, but it cannot reduce the volume of waste. The residue after sterilization needs further subsequent landfill or incineration.

Due to the regional characteristics, the medical waste disposal industry in China' is scattered. The lack of actual leading enterprise also gives opportunities for competitive technologies to enter the market. Under the further tightening of the medical waste disposal policy, the medical waste disposal technology with good volume reducing capacity, high efficiency and low cost will be welcomed by the market. In addition, medical waste disposal technology that is mobile and ready to assemble has become a new demand in the epidemic. .

Reference:

1. China National Health Commission(2020). *Work Plan for Comprehensive Treatment of Waste from Medical institutions.*
2. China Ministry of Environmental Protection（2016）. *National Hazardous Waste List.*
3. China Ministry of Ecology and Environment（2020）. *Management and Technical Guidelines for Emergency Disposal of Medical Wastes from Pneumonia Infected by COVID-19 (Trial).*
4. China Ministry of Ecology and Environment（2020）. *2019 National Annual Report on Prevention and Control of Solid Waste Pollution in Large and Medium-Sized Cities.*
5. The United Nations (2018). 2017 World Population Trend Report.

Contact Info

T: +1(973)396-2680

envguide.info@uceef.org

239 New Road, Bldg. A, Suite 322
Parsippany, NJ 07054 USA