

The situation of generation, treatment and supervision of common industrial solid wastes in China

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Abstract. From the point of view of location and sources, an analysis is done for the generation, utilization, treatment and storage of common industrial solid wastes in China. Based on the current situations, suggestions are given to the treatment and supervision polices in China for the utilization of common industrial solid wastes.

1. Preface

Industrial solid wastes regard to the solid wastes generated in industrial processes^[1]. Specifically, common industrial solid wastes are those which are out of “the list of dangerous wastes” or those without dangerous characters based on the GB 5085-2007 “distinguishing standard of dangerous wastes”, GB 5086-1997 “Test method standard for leaching toxicity of solid wastes”, and GB/T 15555-1995 “Determination of corrosiveness of solid wastes”.

Common industrial solid wastes contains a lot of toxic ingredients, which will pollute the air, water and soil, and the pollution caused by common industrial solid wastes will last for long time. This will easily pollute and destroy the surroundings persistently. As a result, the possibility of second time and compound contamination is highly increased.

This article is based on the environmental statistical data of China in recent years. The phrase “Common industrial solid wastes” refers to comprehensive utilization, treatment and storage and other methods.

2. Analysis for the current situation of common industrial solid wastes in China

Huge amount of solid wastes are produced now in China, with the specification of concentration. In recent years, the efficiency of resource recycling is higher than before after strong measures are taken in management of industrial pollution and readjustment of industrial structures. At the same time, thanks to weak demand for coal, steel and nonferrous metals, the production of solid wastes of unit industrial added value is in the trend of falling off. However, the total amount of solid wastes is still huge in China^[2-6] (refer to table 1). In 2015, 161598 industrial companies are especially researched, of which 96715 companies emit waste water or waste water contamination, 117201 companies emit waste air or waste air contamination, 106613 companies emit solid wastes, the amount of which is 327000 0000 ton.

Currently, the utilization of solid wastes develops slowly in China, its industry size is still small. Only some middle of small sized companies are participating in the industry, with low added value and weak market competence^[7]. About 40% of the solid wastes are not utilized comprehensively, and huge risks are brought to the environment due to their long time storage.



Table 1 Generation and treatment situation of common industrial solid wastes in China

| year | amount/(10 thousand ton) | Amount of utilization/(10 thousand ton) | Amount of treatment/(10 thousand ton) | Amount of storage /(10 thousand ton) | Amount of discarding/(10 thousand ton) |
|------|--------------------------|---|---------------------------------------|--------------------------------------|--|
| 2011 | 322772.34 | 195214.62 | 70465.34 | 60376.74 | 433.31 |
| 2012 | 329044.26 | 202461.92 | 70744.82 | 59786.32 | 144.21 |
| 2013 | 327701.94 | 205916.33 | 82969.49 | 42634.16 | 129.28 |
| 2014 | 325620.02 | 204330.25 | 80387.54 | 45033.19 | 59.38 |
| 2015 | 327079 | 198807 | 73034 | 58365 | 56 |

3. Sources of the common solid wastes

3.1. Category of solid wastes

Mine tailing, coal ash, coal, smelting waste and clinker are the main five solid wastes. By the 2015 statistical data, in terms of common solid waste of industrial companies especially researched, mine tailing consist 955010000 ton, oal ash 437850000 ton, coal gangue 386920000 ton, smelting waste 339030000 ton, and clinker 317330000ton, which are 30.7%,14.1%,12.4%,10.9% and 10.2% respectively in the total common solid wastes. The total amount of the above 5 items is 2440000000 ton, which is 78.3% in total. There are huge discrepancies of the utilization of different solid wastes, especially the utilization of mine tailing is still very low.

Table 2 The main categories of common industrial solid waste in China

| Waste | Production/(ten thousand ton) | percentage/% | Amount of utilization /(ten thousand ton) | General utilization percentage/% |
|----------------|-------------------------------|--------------|---|----------------------------------|
| mine tailing | 95501 | 30.7 | 27262 | 28.5 |
| coal ash | 43785 | 14.1 | 38117 | 86.4 |
| coal gangue | 38692 | 12.4 | 25766 | 65.5 |
| Smelting waste | 33903 | 10.9 | 31110 | 91.5 |
| clinker | 31733 | 10.2 | 28123 | 88.2 |

3.2. Mine tailing

The two main sources for mine tailing are black metal and nonferrous metal dressing works, the production is 470000000 ton and 350000000 ton respectively, the general utilization rates are 28.6% and 23.8%. The production of mine tailing in 2015 in different industries are as in Table 3.

Table 3 Main industry sources of tailings in China

| Industry | Production of mine tailing /(ten thousand ton)) | percentage /% |
|---------------------------------|---|---------------|
| Black metal dressing works | 47273 | 49.5 |
| Nonferrous metal dressing works | 34571.3 | 36.2 |
| Chemistry | 3820 | 4.0 |
| Smelting of Nonferrous metal | 3056 | 3.2 |
| Smelting of black metal | 2578.5 | 2.7 |
| Non-metal dressing works | 2005.5 | 2.1 |

3.3. Coal ash

In 2015, the main sources for coal ash are power and thermal plant, the production is 3500000000ton, while the general utilization rate is 85.3%. The subsequent industries are nonmetal material production, raw material of chemistry, smelting of nonferrous metal, smelting of black metal, production of which

are 22701000ton, 19847000ton, 1092000ton and 9194000ton, the general utilization rates are 97.6%, 85.2%, 79.6% and 93.8% (Table 4).

Table 4 Main industry sources of coal ash in China

| Industry | Production of coal ash/(ten thousand ton) | percentage /% |
|-------------------------------|---|---------------|
| Power and thermal plant | 35028 | 80.0 |
| Non-metal material production | 2270.1 | 5.2 |
| Raw material of chemistry | 1984.7 | 4.5 |
| Smelting of Nonferrous metal | 1092.0 | 2.5 |
| Smelting of black metal | 919.4 | 2.1 |

3.4.Clinker

In 2015, the main sources for clinker are power and thermal plant, the production is 150000000 ton, the general utilization rate is 86.9%. The second industries are smelting of black metal, production of which 5873000 ton, the general utilization rate is 95.8%, the third industry is raw material of chemistry, production of which 36937000 ton, the general utilization rate is 80.4 % (Table 5).

Table 5 Main industry sources of furnace clinker in China

| Industry | Production of coal ash / (ten thousand ton) | percentage /% |
|-------------------------------|---|---------------|
| power and thermal plant | 15422.2 | 48.6 |
| Smelting of black metal | 5873.8 | 18.5 |
| Raw material of chemistry | 3693.7 | 11.7 |
| Non-metal material production | 1840.5 | 5.8 |
| Smelting of Nonferrous metal | 1269.3 | 4.0 |

4. Current situation of treatment of common industrial solid wastes in China

In the past 5 years, the total amount of utilization of common industrial solid wastes is as high as 1100000000 ton, among which the utilization of plaster as byproduct, coal gangue, coal ash, mine tailing is much higher than before, thanks to the technical progress in the following:

- (1) Active carbon technology from coal ash
- (2) Coal gangue pumping
- (3) Plaster plate production from devulcanized plaster
- (4) Coal gangue self-fluid technology
- (5) Production of oxide of alumina and calcium silicate from coal ash with high percentage of alumina
- (6) Biological diesel technology from waste oil
- (7) Iron retrieving from red mud
- (8) Production of stock for pottery and porcelain

However, comparing with developed countries, there is still a big lag. There are following problems in the utilization of common industrial solid wastes in China:

- (1) The development of the utilization is not balanced in different areas.
The utilization of solid waste in the east area is much higher than in the west, while the production of solid waste is just in the opposite position. This causes the non-balance development of industrial solid waste industries.

- (2) The size of the companies of utilization of the solid waste is too small.

They cannot match with the upstream industry. Thus there is not sufficient support from the upstream industry to foster the development of the size of the utilization companies to be competitive.

There is a lack of such big scale company groups in the industry to connect different areas and be competitive enough to realize scale merit.

(3) The technical level is still low in the utilization.

Although big progress was made in the past few years with certain first class technology, there are still many technical obstacles. There is not enough input in the research, as well as lack in key equipment and techniques with driving effect and high added value. The technical level and equipment capability cannot match with the modern times, and lead to low utilization of solid waste.

(4) The national policies shall be perfected to foster the development of the utilization of solid waste.

There are not mandatory requirements to the producers to utilize the solid waste, as well as no punishment polices. So there is not enough power and pressure for the industry. Besides, there is not enough financial support to the technical research.

5. Conclusion and countermeasure

(1) 600000000 ton of common industrial solid wastes in China are produced yearly, with little treatment of the previous storage, which caused the rapid accumulation of the total amount. Certain polices shall be issued to reduce the production and enhance fully usage or innocent treatment, thus push the development of clean production and recycling economy.

(2) Mine tailing, coal ash, coal gangue, smelting waste and clinker are the main 5 solid wastes, which consist 80% of the total solid waste, whose treatment is different according to their characters. Concentrated treatment measures shall be taken to foster the development of the industry. Environment protection admonitions shall strengthen the research, technical development and education to the public

(3) Mine tailing, coal gangue and coal ash are mainly from Black metal dressing works, Nonferrous metal dressing works, Chemistry, nonmetal dressing works. The high concentration can help the environment supervision administration to break through and thus lead the whole industry.

(4) The general utilization rate is only 60%^[8], although the amount of production of solid waste is over 3×10^9 ton per year in China. The storage of huge amount of solid waste causes pollution to air, soil and underground water. This will affect the improvement of the environment quality and bring long term environment risks. However, there are many useful resources in the solid waste. With the help of innovation of technology, and constant recycling to reduce storage, the benefit of environment, resources and economy can be realized.

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