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Perspective

Extraction of Various Metals and Toxic Components from Municipal Solid Waste Incineration

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DESCRIPTION

The high calcium content of Municipal Solid Waste Incineration (MSWI) fly ash has made it a potential material to partially replace the calcium flux used in iron ore sintering. The sintering indexes were not negatively affected but enhanced when MSWI fly ash was added, owing to the ultra-fine materials ability to improve granulation and form liquid phase at high temperatures. The increased content of chlorine set in motion by the MSWI fly ash which improved the removal rates of hazardous elements, implying that the residual quantities of K, Na, Pb, and Zn in the finished sinter were not significantly increased because of the quick heating rate and high temperature during the sintering process, 93.03% of the dioxins in the MSWI fly ash were destroyed, both of which are favorable criteria for dioxin degradation. The addition of MSWI fly ash increased the content of SO_2 and dioxins in the flue gas, standardized discharge still be achieved using a traditional activated carbon flue gas purification system. As a result, the iron ore sintering process can be used to utilize resources and dispose of MSWI fly ash in a safe manner.

Due to its significant volume and bulk reduction, Municipal Solid Waste Incineration (MSWI) has confirmed as a functional technology for disposing of Municipal Solid Wastes (MSWs) in many industrialized countries. To deal with the rapid expansion of MSWs, the Chinese government promotes and popularizes this strategy. According to reports, China produced 228 million tons of MSWs in 2018, with fewer than half of those processed *via* incineration. As a result, China's MSWI business remains promising.

Throughout the incineration process, MSWI fly ash, a hazardous waste comprising harmful dioxins and heavy metals are unavoidably generated. MSWI fly ash production is about 5% of MSW production. MSWI fly ash is treated to avoid secondary pollution. As a result, a variety of techniques are developed, the most common are stabilization/solidification and thermal treatment. The potential risk of dioxins is reduced because most of the organic compounds in MSWI fly are degraded under high temperature and heavy metals also solidified.

Sintering and melting are the most common thermal processes for disposing of MSWI fly ash. The temperature ranges covered by these two technologies are 900°C-1100°C and >1100°C respectively. To provide high temperature, stand-alone heating devices (rotary kilns, plasma furnaces,) and accompanying infrastructures are required. Thermal therapy was not generally promoted and used because of high cost of construction, operation, and maintenance. As a result, high temperature process in the modern industry system can co-process MSWI fly ash.

Iron and steel manufacture and cement production are two well-developed high-temperature processes in China; they both have a huge capacity. In 2018, crude steel and cement production were reported to have reached 928 million tons and 2.2 billion tons respectively. The processing power of these two businesses is obviously sufficient, as MSWI fly ash production is just 5.7 million tons in the same year.

Iron-containing solid wastes are formed during the iron and steelmaking processes accounting for around 10% of the crude steel produced. Slags, such as iron slag and steel slag, are commonly utilized in construction and cement manufacture. Dusts, including the sintering dust are collected in electrostatic precipitator, blast furnace dust, etc., are generally recycled to the sintering process when the zinc concentration is below the plant-specific limits. It is worth noting that the sintering dust is a typical ultra-fine powder gathered from the electrostatic precipitator's four electric fields, and its chloride content rises from 10%-30%. Many steel mills recycled sintering dust from the first two electric fields in the sintering process without affecting the quantity or quality of completed sinter. The sintering process has a higher tolerance for chloride than cement manufacturing; sintering dust with high chloride content can be recycled without washing pre-treatment.

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CONCLUSION

The iron ore sintering process was able to dispose and even use the calcium-based MSWI fly ash due to its adaptability to complicated raw materials and the ability to remove sections of dangerous elements in the raw combination. As MSWI fly ash was added although the concentration of SO_2 and NO in the flue gas is increased a little, the granulation performance, sintering indexes, and species of gas pollutant were essentially identical to those of conventional sintering.