Effectiveness of Applying Sewage Sludge to Inhibit PCDD/F Formation in Thermal Treatment of Fly Ash

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Due to rapid development of industry and high population density, Taiwan has adopted incineration as the mainstream technology for the treatment of municipal and industrial waste. Although incineration can greatly reduce the landfill space, the impact of incineration products (such as bottom slag, fly ash) and related pollution on the environment cannot be ignored. Fly ash contains significant amount of dioxin, chloride, and heavy metals, so more attention should be paid to its treatment. In order to treat the fly ash and reduce the environmental impact, several technologies such as sintering, high-temperature verification, solidification with cement and chelating agent and wet-type treatment have been developed. According to the statistics released by the Taiwan Environmental Protection Administration, nearly 200,000 tons of fly ash are generated from 24 large-scale municipal waste incinerators (MWIs) annually in Taiwan and currently fly ash is mainly treated by solidification with cement/water for final disposal. Although this method has the advantages of low cost and simple operation, the mass increases by 40-50% after solidification process and the space needed for landfill is significantly increased. In addition, treatment of sewage sludge is also a big challenge in Taiwan. Sewage sludge contains various harmful substances such as heavy metals, organic pollutants and bacteria, posing potential hazards to human health and environment and requires proper treatment. Sewage sludge also contains sulfur and nitrogen (0.35 ± 0.01 wt% and 4.25 ± 0.06 wt% in dry basis, respectively) which can potentially suppress dioxin formation during the pyrolysis of fly ash. Therefore, this study aims to integrate water washing with low-temperature pyrolysis for co-processing of fly ash and sewage sludge to improve the destruction efficiency of PCDD/Fs in fly ash generated from MWIs. The results showed that the chloride content of fly ash was reduced from 16.48 ± 0.78 wt% to 10.45 ± 0.56 wt% after water washing. Experimental results obtained from the pyrolysis of fly ash with dry sewage sludge at 350℃ for 5 minutes indicate that PCDD/F reduction efficiency based on mass concentration is over 99% and the reduction efficiency based on TEQ concentration is over 96%. These efficiencies were obtained when the mass ratio of washed fly ash (WFA) to dry sewage sludge (DSS) was controlled at 1.0 and the TEQ concentration was greatly reduced from 9.16 ± 0.01 ng I-TEQ/g-WFA to 0.11 ng I-TEQ/g-WFA with 5 minutes of reaction. Moreover, as

the reaction time was extended to 10 minutes, the PCDD/F TEQ concentration was further reduced to 0.01 ng I-TEQ/g-WFA to meet the European End of Waste criteria (20 pg TEQ/g). This study demonstrates that pyrolysis of washed fly ash with dry sewage sludge can greatly reduce the dioxin content in fly ash. If the technology is applied to the field, it can be a good option to achieve the objectives of pollution reduction and resource reuse at the same time. Detailed results and the mechanisms leading to PCDD/F destruction during the pyrolysis of fly ash with dry sewage sludge will be provided in this presentation.

Keywords: Dioxin, Fly ash, Thermal pyrolysis, Inhibitors, Dechlorination