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Effect of steam injection into incinerator on thermal destruction of waste refrigerant (HFC-134a)

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The reuse of hydrofluorocarbons (HFCs) with a global warming potential (GWP) of >150 is prohibited in developed countries. Decomposition and subsequent neutralization of the produced hydrogen fluorides is currently widely used for the treatment of high-GWP waste HFCs. However, there is the need to reduce the high auxiliary energy consumption of the utilized incinerator. For this purpose, we developed two versions of a burner for injecting fuel, oxidizer, refrigerant, and steam into the incinerator. The simultaneous supply of the waste HFCs and steam into the incinerator was expected to enhance the destruction of the former, thereby reducing the energy consumption. The following were determined from the results of experiments that were performed to evaluate the effectiveness of the developed type-1 burner. The simultaneous supply of steam and waste HFCs into the incinerator increased the internal temperature of the incinerator when using either version of the type-2 burner. With the simultaneous supply of steam and the HFCs, the internal temperature of the incinerator increases with increasing steam supply, regardless of the version of the burner used. When using the type-2 burner, by which steam is supplied to the incinerator in the same direction as the flame, the NO_x concentration decreases from 71 ppm to 62 ppm with increasing steam feed rate. In the case of using the type-1 burner, there is no decrease in the NO_x concentration. The HFCs decomposition rate is 100% for a HFCs feed rate of up to 2.8 kg/h with no steam supply, while the 100% decomposition is maintained up to HFCs feed rates of 3.0 and 3.4 kg/h when using the types 1 and 2 burners with steam supply. The decomposition rate of the HFCs for the two types of burners are the same for steam feed rates above 0.5 kg/h.

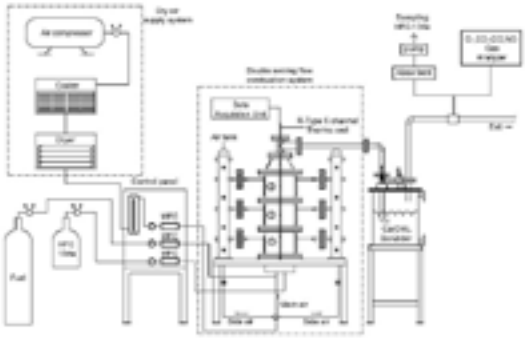

Figure 1: Schematic diagram for the decomposition system of the waste refrigerant

Recent Publications

1. Ohm T I, Myung S Y, Jang W B and Yu S R (2015) A comparison of refrigerant management policies and suggestions for improvement in South Korea. J Mater Cycles Waste Manag 19(2):631–644.
2. Jasinski M, Dors M and Mizeraczyk J (2009) Destruction of freon HFC-134a using a nozzleless microwave plasma source. Plasma Chem Plasma Process 29(5):363–372.
3. Watanabe T and Tsuru T (2008) Water plasma generation under atmospheric pressure for HFC destruction. Thin Solid Films 516(13):4391–4396.
4. Hannus I (1999) Adsorption and transformation of halogenated hydrocarbons over zeolites. Appl Catal. 189:263–276.
5. Wang H P, Liao S H, Lin K S, Huang Y J and Wang H C (1998) Pyrolysis of PU/CFCs wastes. J Hazard Mater 58:221–226.

Biography

Tae-in Ohm has been Professor at the Department of Environmental Engineering, Hanbat National University since 1995. He is interested in designing of incinerator for wastes, municipal solid waste, waste refrigerant, liquid industrial wastes and RDF. Also, he has experience in drying technology of organic waste with high water content.

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