PCDD/F Behavior in Wet Scrubbing Systems of Waste Incineration Plants

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1.Introduction

In the past, it was reported about PCDD/F formation in wet scrubbing systems of waste incineration plants [1]. Own balancing experiments were performed at the TAMARA waste incineration pilot plant [2], as a result of which the increase in the PCDD/F clean gas concentration and the significant change of the PCDD/F congener profile were attributed to absorption and desorption effects of the scrubber construction material [3].

To confirm these statements, PCDD/F balancing experiments were carried out in a small bypass scrubbing system of TAMARA. Except for the sealing elements (PTFE), all components that are in contact with the medium are made of glass. Thus impacts of absorption and desorption effects of the construction materials on the scrubbing process are minimized.

2.Experimental

The bypass scrubbing system is installed downstream of the fabric deduster of TAMARA. Here, dust concentration amounts to <0.5 mg/Nm^3. Before entering the scrubbing system, the exhaust gas has a temperature of about 160°C. In the experiments performed , a temperature of about 60°C developed in the scrubbing water. This is typical for wet scrubbing systems of municipal waste incineration plants.

The flow sheet of the bypass scrubbing system with the measuring points is represented in Fig. 1. All three scrubbing columns are designed as packed columns with Raschig rings of glass being used as packing. The scrubbers are designed for a mean gas throughput of 15 Nm^3/h (dry). In all columns, the specific amount of scrubbing water L/G was about 12 l/Nm^3.

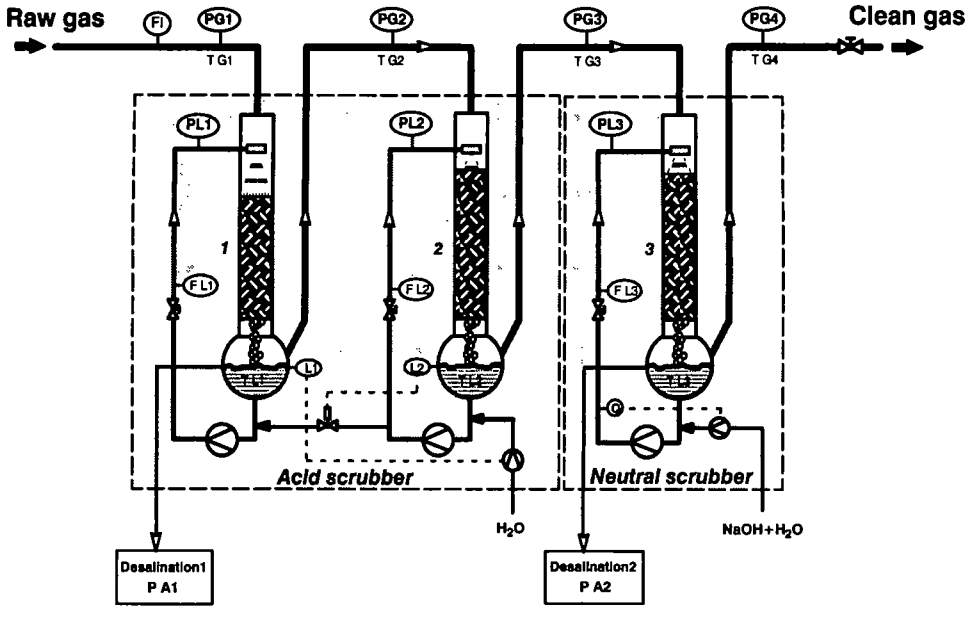

Fig. 1: Flowsheet of the scrubbing system with sampling points

The wet scrubbing system consists of two stages. The acid scrubbing stage serves for HCl separation. SO_2 separation is accomplished by means of the neutral scrubber. The acid scrubbing stage is made up of two individual columns. Scrubbing water passes these columns (1+2) in a counterflow mode in order to obtain concentrated HCl. In the neutral scrubbing stage (3) the pH value of the scrubbing circuit is kept constant by controlled NaOH dosage.

For balancing, samples were taken from the entering and leaving material flows as well as from the bottom of all scrubbing columns. Exhaust gas sampling (PG1–4) took place in accordance with the carbonized lignite method [4]. The scrubbing water samples PA1 and PA2 were collected in glass bottles. The inventories at the bottom of the columns (PL1–3) were determined before and after each experiment by means of sampling.

Three balancing experiments were performed successively. The experiments covered a period of 24 h each.

3.Results

Quality of the gas samplings performed is confirmed by the chlorobenzene concentrations measured at the sampling points. At all gas measuring points, identical values were determined for these practically insoluble compounds in the scrubbing water (Fig.2).

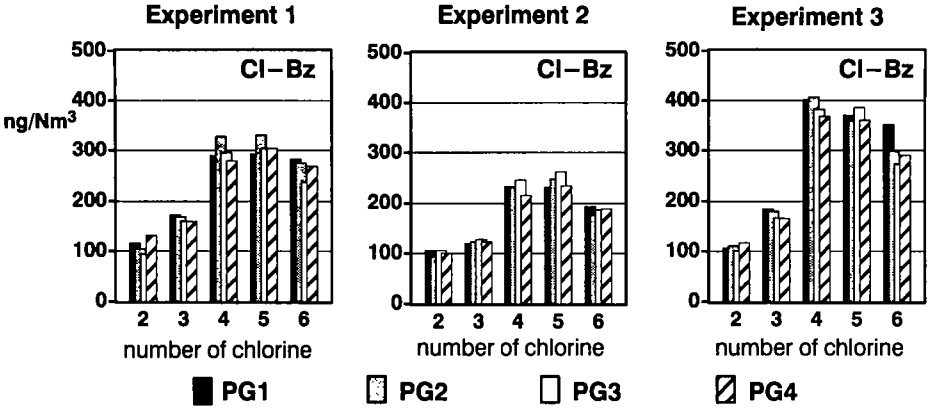

Fig.2: Chlorobenzene concentrations at the gas sampling points

The PCDD/F concentrations measured in the exhaust gas at the gas sampling points are evident from Fig. 3. It can be noticed that the concentrations are identical for the low–chlorinated homologs of PCDD and PCDF. As far as the high–chlorinated PCDD/F and in particular OCDD and OCDF were concerned, the concentration in the exhaust gas was found to decrease significantly downstream of the individual scrubbing columns.

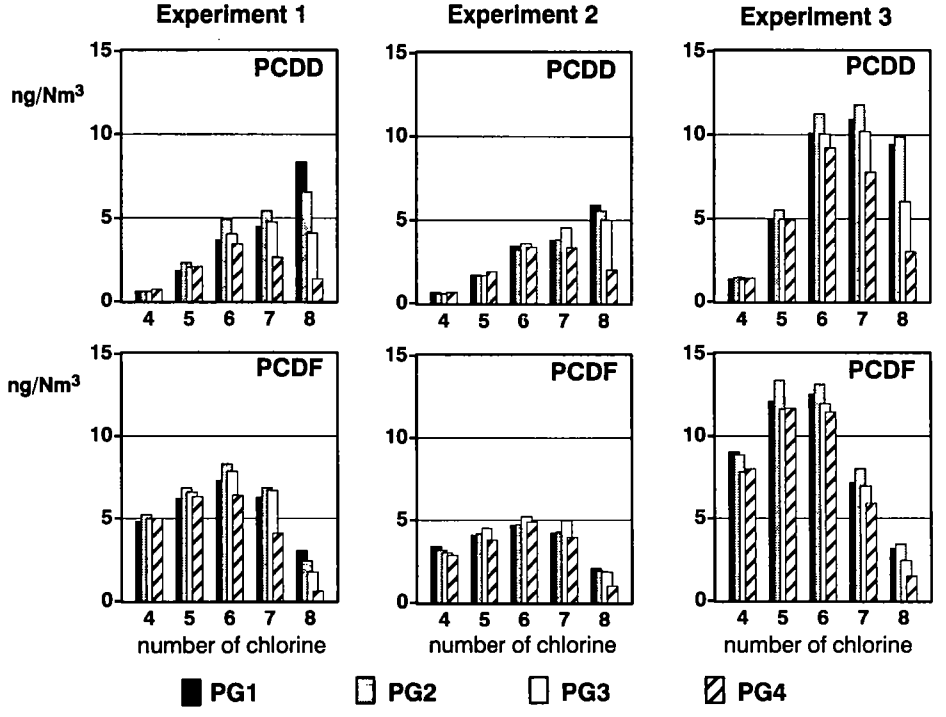

Fig.3: PCDD/F concentrations at the gas sampling points

Due to the small vapor pressure, these congeners are separated in the scrubbing columns. In the scrubbing solutions, hepta– and octa–CDD/F could be detected only.

Total balancing over the entire period (72 h) is represented in Fig. 4. Here, the value measured at the gas inlet is compared with that of the gas outlet and the integral value for scrubbing solutions. The input/output difference for high–chlorinated PCDD/F has to be attributed to adsorption at the glass surfaces and absorption in the PTFE sealing elements [5]. This is confirmed by analyses of individual components.

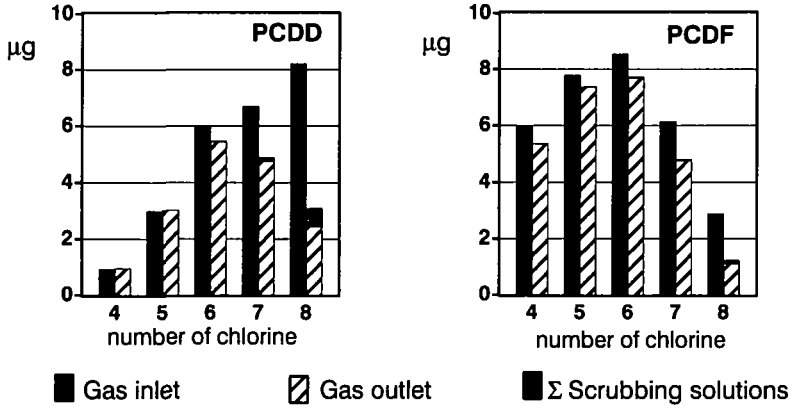

Fig. 4: Total PCDD/F balance (experiments 1+2+3)

4.Conclusions

Even when taking into account the measurement inaccuracies, it is demonstrated by the experiments that a formation of PCDD/F during flue gas scrubbing can be excluded. Nor can a dechlorination of PCDD/F be detected. When studying the PCDD/F behavior in wet scrubbing systems, material influences have to be taken into consideration.

5.References

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