MULTIPLE-WAY-SORPTION FILTER FOR THE REMOVAL OF ORGANIC POLLUTANTS FROM EXHAUST GASES OF WASTE INCINERATORS (KRANTZ SYSTEM)

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1. Introduction

Waste incineration contributes considerably to the environmental overloading emission of organic pollutants such as furans, dioxins and PCBs. It is therefore necessary to introduce secondary emission controlling measures concerning the post-incineration side in addition to the primary measures concerning the incineration itself.

H. Krantz GmbH & Co. in cooperation with the Karlsruhe Nuclear Research Center, has developed a concept for the removal of dioxins (PCDD) and furans (PCDF) from the exhaust gases of waste incinerators (Krantz system), based on the adsorption of these pollutants on activated coke [1].

2. System description

The Krantz system makes use of a dry cleaning method according to which the exhaust gas passes through a reactor filled with activated coke, the reactor temperature being approximately 100-120°C.

Following processes take place on the activated coke:

- adsorption of organic pollutants such as dioxins (PCDD), furans (PCDF) and PCBs
- adsorption of inorganic pollutants such as HCl, HF and heavy metals (basically Hg)
- adsorption of SO_2 followed by catalytic reaction with O_2 and H_2O to H_2SO_4: $2\ SO_2\ (ads.) + O_2 + 2H_2O \rightarrow 2\ H_2SO_4\ (ads.)$
- dust (fly ash) filtration on the activated coke bed of the reactor which enables a reduction of the emission of polluting dust components such as Pb and Cd.

Except for the removal of dioxins, furans and PCBs, a complete removal of other pollutants such as SO_2, HCl, HF, heavy metals and dust can be therefore achieved.

A special multiple-way-sorption filter (MWS-filter) functioning as an activated coke reactor is used during the cleaning process. This reactor comprises at least two filter beds, arranged one on top of the other, through which exhaust gas passes successively (Fig. 1). The exhaust gas passes at first through the lower filter bed and

after entering the deflection chamber passes through the next bed(s). After the saturation of the activated coke in the lower bed, the coke is removed and replaced by coke coming from the next upper bed. The last upper bed is supplied with fresh coke.

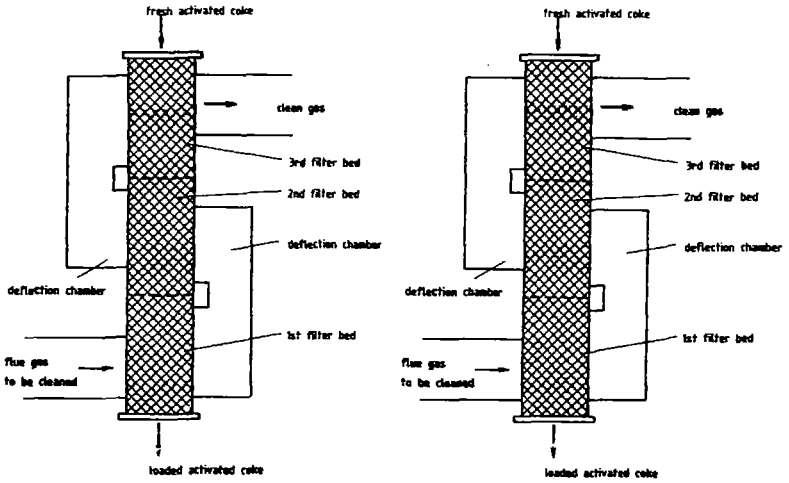

Fig. 1: Sketch showing an activated coke reactor (MWS-filter) with two or three beds

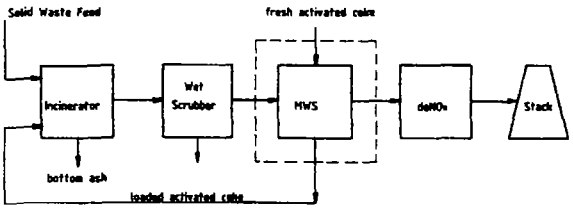

Fig. 2: Arrangement of a MWS-filter within a waste incineration exhaust gas cleaning plant

3. Operating results

Operating tests with an experimental reactor after a municipal waste incinerator have shown that dioxins and furans at a feed concentration of 2,5 - 5 ng TE/m^3, are completely adsorbed within a coke layer of 100 mm thickness [2]. The PCDD- and PCDF-emission value after this layer was under 0,1 ng TE/m^3. Fig. 3 shows the PCDD- and PCDF-distribution in a 100 mm coke layer for a feed concentration of 2,5 ng TE/m^3 after 1600 h. The clean gas concentration was 0,038 ng TE/m^3 (according to BGA).

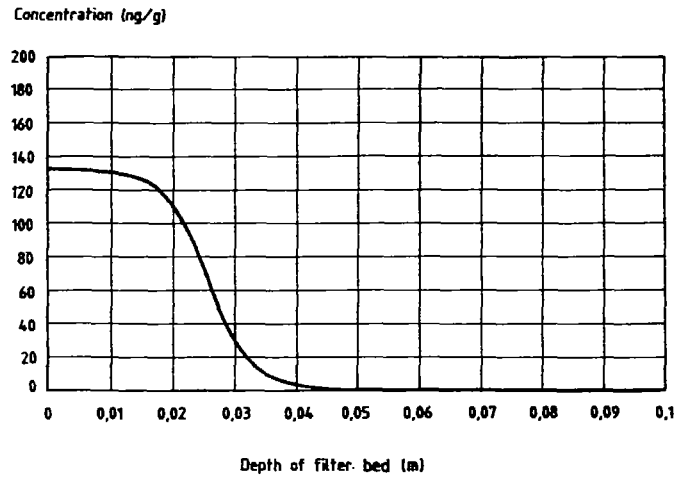

Fig. 3: PCDD- and PCDF-distribution in a 100 mm coke layer

Measurements in a pilot MWS-reactor with two coke beds, after a municipal waste incinerator showed a similar distribution concerning the dioxins and furans after 1350 h (Fig. 4). The normal area velocity of the exhaust gas was 0,1 m/s, and the reactor temperature was 120°C. The results of Fig. 4 show that both dioxins and heavy metals exhibit a low adsorption depth profile in coke compared to SO_2 or HCl. These results confirm other relevant investigations [3]. According to the pollutant distribution in Fig. 4 it is reasonable to remove only the dioxin loaded coke layer for further processing of the loaded coke (decontamination etc.). The separate removal of the dioxin loaded coke can be done with the MWS-filter by means of a special mechanism.

The above operating results show that PCDD-and PCDF-emission values < 0,1 ng TE/m^3 can be achieved with the MWS-filter.

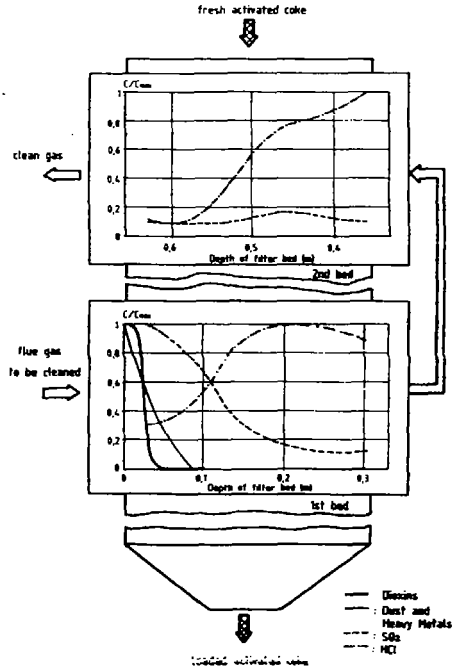

Fig. 4: Adsorption depth profiles of different pollutants in the two coke beds of a MWS-filter

4. Literature

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