



159159

Method for Removing Organic Pollutants in Fly Ash

Background of the Invention

Field of the Invention

5 The present invention relates to a method for minimizing the concentration of toxic organic pollutants in fly ash of a combustion plant, more particularly a waste incinerator unit, in which at least some fly ash generated in the incinerator is returned to a combustion process.

10

 Toxic organic pollutants in fly ash are, particularly, polychlorinated dibenzodioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), precursor compounds of PCDDs and PCDFs, i.e. monochlorobenzene, polychlorinated biphenyls
15 (PCBs), and other compounds of comparable structure or effect. These organic pollutants are described and quantified frequently in literature and emission regulations by an internationally adopted toxicity equivalent stated in ng per kg fly ash (ng I-TEQ/kg). The I-TEQ is the
20 equivalent toxicity (international toxicity equivalent) of the sum of a large number of organic pollutants relative to Seveso dioxin (2,3,7,8-tetrachlorodibenzodioxin).

 From EP 0 862 019 A1, returning at least some fly ash
25 coming from a combustion plant to a high-temperature region



G00002

of the combustion plant to induce vitrification and sintering of the ash is known. The products obtained by this method may be added to grate ash again or utilized separately. As a result, the residual quantity of fly ash
5 can be reduced. The fly ash is removed by cleaning a boiler or by stripping from a filter unit, and it is then supplied again to a furnace above a fuel bed when a grate-based combustion system is used. This method does not take into account the presence of toxic compounds such as dioxins and
10 their precursors.

From DE 33 20 466 C3, returning fly ash back into a combustion chamber of the combustion plant is known. The fly ash is chemically treated outside of the combustion
15 chamber before being returned, the aim of which is to reduce pollutants. Thus, a low-pollution fraction of fly ash is returned and incorporated into bottom ash in a high-temperature process.

20 Summary of the Invention

An object of the present invention is to provide a method for removing organic pollutants in fly ash, in which the return of fly ash to a combustion process is regulated so that the largest possible fraction of precursors or other
25 organic pollutants is destroyed and thereby minimizing the

quantity of toxic organic compounds leaving a combustion plant together with the fly ash.

To achieve the above object, the present invention is
5 characterized in that the return of fly ash occurs as a function of specific combustion conditions in which organic pollutants such as PCDDs or PCDFs or precursor compounds (precursors of PCDDs or PCDFs) are produced at a high level.

10 Brief Description of the Drawing

A method for removing organic pollutants in fly ash in accordance with the present invention will now be described with reference to the embodiments shown in the accompanying drawing.

15 Fig. 1 is a flowchart for illustrating briefly and exemplarily a method for removing organic pollutants in fly ash in accordance with the present invention.

Detailed Description of the Preferred Embodiments

20 According to the method for removing organic pollutants in fly ash in accordance with the present invention, when precursor compounds or other toxic organic pollutants to be minimized as much as possible are present in increased quantities due to specific combustion
25 conditions, the fly ash is removed. This is an important

feature of the present invention because the precursor compounds on contact surfaces, which are on the downstream side of a steam generating unit (boiler) and are at a certain temperature, for example, 200 to 400°C, remain stuck
5 there and are transformed into dioxins and/or furans especially in the presence of copper, soot, and chlorine. The transformation reaction can occur within a few minutes to a few hours, the exact time depending on the prevailing temperature conditions and the concentration of substances,
10 such as copper, chlorine, and soot, acting as catalysts and reaction partners.

Advantageously, the return of fly ash occurs as a function of the measured quantities influenced by a
15 combustion process, the measured quantities being determined in the flue gas of a combustion plant.

Most simply, the concentration of carbon monoxide or oxygen in the flue gas, the excess air from combustion, or
20 the temperature in a combustion chamber can serve as the measured quantities.

In a modern waste incinerator unit, the concentration of carbon monoxide during normal combustion operation is
25 approximately 5 to 20 mg/m³, whereas a CO content of 100

mg/m³ or higher would be considered to be a specific combustion condition and would activate intervention in the sense of the present invention.

5 Furthermore, it is advantageous to use the oxygen content in the flue gas as one of the measured quantities, and particularly so when in waste incinerator unit the oxygen content falls below 5% by vol. O₂ or the excess air rate falls down below 1.4 when excess air is measured. In
10 the same way, the temperature in the combustion chamber of the combustion plant can be used as one of the measured quantities when it falls below 800°C as measured at a height of approximately 6 to 10 meters above a main combustion zone.

15 Advantageously, as another embodiment of the present invention, the return of fly ash can be activated as a function of organic pollutants determined in the flue gas of the combustion plant, in particular, PCDDs and/or PCDFs or their precursors.

20

 Advantageously, the measured quantities are determined through an online analysis of flue gas.

 In particular, the return of fly ash occurs as a
25 function of a predetermined I-TEQ threshold value. The

threshold value defining the specific combustion conditions can be set so as to be between 0.1 and 5 ng I-TEQ/m³ in flue gas.

5 This measurement preferentially covers both gaseous and particle-bound organic pollutants and takes place at the top of the boiler or in the untreated gas on the upstream side of a flue gas treatment unit. Suitable analytical methods for this are described in literature such as
10 Resonance Enhanced Multiple Photon Ionisation and Time of Flight Mass Spectrometry (REMPI-TOFMS), which make possible direct online analysis of, e.g., monochlorobenzene. Values from experience show that monochlorobenzene correlates very well with the I-TEQ in flue gas. Therefore, such an online
15 measuring device can also be called a TEQ sensor. According to the present invention, however, sensors for other molecules or classes of molecules can be used if the signal from these sensors correlates characteristically with the content of toxic organic pollutants in flue gas.

20

 In a further preferred embodiment of the present invention, the return of fly ash occurs during a specific period of time after the specific combustion conditions have been observed. Values gained from experience play a special
25 role here. For example, the return of fly ash occurs during

a period of time of 10 minutes to 6 hours after the specific combustion conditions have been observed. The duration of fly ash return can be determined as a function of the level of the measured quantities. Herein, the measured quantities
5 are ones influenced by the combustion process, being the concentration of carbon monoxide or oxygen in the flue gas, the concentration of excess air from combustion, the temperature in the combustion chamber, or the concentration of organic pollutants in the flue gas, in particular, PCDDs
10 and/or PCDFs or their precursors.

If, for the purpose of determining the specific combustion conditions, an analytical instrument is used which facilitates rapid determination of the measured value
15 (as in the case for the aforementioned measuring techniques and measured quantities), then it is expedient, in a further preferred embodiment of the present invention, to specify the duration of fly ash return as a function of the level of the measured value. Accordingly, if the predefined
20 threshold is substantially exceeded, the duration of return will be longer than the case where it is exceeded just slightly.

In order to ensure reliable disposal or decomposition
25 of toxic organic compounds or precursors, in a further

preferred embodiment of the present invention, the fly ash is returned to the main region of the combustion plant where temperature is high.

5 When a grate-based system is used in the combustion plant, the fly ash can advantageously be returned to the fuel bed in the main combustion zone.

10 If, in a further preferred embodiment, the return of fly ash occurs after the specific combustion conditions are observed or during or after boiler cleaning, the aforementioned adverse consequence, namely that the fly ash during this operation period remains stuck to the boiler tubes and that the precursors contained in the fly ash react
15 with it to form dioxins, may be avoided. Thus, not only the fly ash but also the palletized ash gained is subject to the return process.

20 The boiler is cleaned by rapping, brushing, or soot blowing.

 It is recommended that the fly ash which accumulates in the flue gas treatment unit on the downstream side of the steam generating unit be returned together with the fly ash
25 returned as described above. This measure is implemented

when the specific combustion conditions have been observed.

The return of fly ash recovered from the filters on the downstream side of the steam generating unit (boiler) can also occur according to the present invention if the specific combustion conditions are observed.

Although, naturally, operators of combustion plants always strive to re-eliminate the specific combustion conditions as quickly as possible through suitable measures, this is not done automatically by, e.g., combustion control.

In the event that disruptions to combustion sequence do not occur, and hence no specific combustion conditions are observed, boiler cleaning is carried out at the normal frequency. In this regard, the interval between two cleaning phases is often set at around 4 hours. The fly ash generated thereby is disposed of by the normal disposal route.

20

Next, one embodiment of a method in accordance with the present invention will be described briefly and exemplarily with reference to a flowchart of Figure 1.

In this embodiment, combustion is carried out (Step 100), and online gas measurement of, e.g., toxic organic

pollutants or carbon monoxide is made (Step 102).

Alternatively, a typical temperature of flue gas is measured (the same step 102). Then, it is judged whether or not the specific conditions under which fly ash is to be returned

5 are met (Step 104). If the specific combustion conditions are observed during this process through an increase in concentration of organic pollutants or carbon monoxide or through a marked deviation in temperature from the set point, the boiler is cleaned by rapping, brushing, or soot blowing
10 at the time of the previously specified increase or temperature deviation (Step 106). Then, the fly ash obtained by the cleaning is returned to the combustion plant (combustion furnace, combustion chamber) (Step 108). If no malfunction is reported, that is, the specific combustion
15 conditions are not met, normal boiler cleaning takes place at normal intervals (Step 110). The obtained fly ash is conveyed to the outside of process for the purpose of disposal (Steps 112 and 114).

20 As is apparent from the above description, according to the present invention, there is provided a method for removing organic pollutants in fly ash, in which the return of fly ash to a combustion process is regulated so that the largest possible fraction of precursors or other organic
25 pollutants is destroyed and therefore the quantity of toxic

organic compounds leaving a combustion plant together with the fly ash is minimized.

Although the present invention has been described
5 with reference to the embodiments, it is not limited to them. All modifications, changes, and additions that are easily made by a person skilled in the art are embraced in the technical scope of the present invention.

Claims

1. A method for removing organic pollutants in fly ash of a combustion plant, in which at least some fly ash generated
5 in a combustion furnace is returned to a combustion process at intervals, characterized in that the fly ash is returned while the organic pollutants are monitored as a function of specific combustion conditions.
2. The method for removing organic pollutants in fly ash
10 according to claim 1, characterized in that the return of the fly ash occurs as a function of measured quantities influenced by the combustion process that are determined in flue gas of the combustion plant.
3. The method for removing organic pollutants in fly ash
15 according to claim 2, characterized in that the concentration of carbon monoxide or oxygen in the flue gas, the excess air from combustion, or the temperature in the combustion chamber of the waste incinerator unit serve as the measured quantities.
- 20 4. The method for removing organic pollutants in fly ash according to claim 1, characterized in that the return of the fly ash occurs as a function of the organic pollutants determined in the flue gas of the combustion plant, in particular, PCDDs and/or PCDFs or their precursors.
- 25 5. The method for removing organic pollutants in fly ash

according to any one of claims 1 to 4, characterized in that the measured quantities are determined through an online analysis of the flue gas.

6. The method for removing organic pollutants in fly ash according to claim 4, characterized in that the return of the fly ash occurs as a function of a predetermined I-TEQ threshold value.

7. The method for removing organic pollutants in fly ash according to claim 6, characterized in that the I-TEQ threshold value is chosen from between 0.1 and 5 ng I-TEQ/m³ in flue gas.

8. The method for removing organic pollutants in fly ash according to any one of claims 1 to 7, characterized in that the return of the fly ash occurs during a specifiable period of time after the specific combustion conditions have been observed.

9. The method for removing organic pollutants in fly ash according to claim 5, characterized in that the return of the fly ash occurs during a period of time of 10 minutes to 6 hours after the specific combustion conditions have been observed.

10. The method for removing organic pollutants in fly ash according to any one of claims 1 to 9, characterized in that the return duration of the fly ash is specified as a function of the level of the measured quantities measured

according to claim 2 or 4.

11. The method for removing organic pollutants in fly ash according to any one of claims 1 to 10, characterized in that fly ash in the main temperature region is returned to
5 the combustion plant.

12. The method for removing organic pollutants in fly ash according to claim 11, characterized in that the fly ash is returned to the fuel bed in the main combustion zone when a grate-based system is used in the combustion plant.

10 13. The method for removing organic pollutants in fly ash according to any one of claims 1 to 12, characterized in that the return of the fly ash occurs after the specific combustion conditions have been observed.

14. The method for removing organic pollutants in fly ash
15 according to any one of claims 1 to 12, characterized in that the return of the fly ash occurs during or after boiler cleaning.

15. The method for removing organic pollutants in fly ash according to claim 14, characterized in that the boiler
20 cleaning is performed by rapping, brushing, or soot blowing.

16. The method for removing organic pollutants in fly ash according to any one of claims 13 to 15, characterized in that, together with the fly ash obtained according to claims 13 to 15, fly ash accumulating in a flue gas treatment unit
25 on the downstream side of the steam generating unit is

returned.