

# New Activated Carbon Adsorption Device

## “JFE-Gas-Clean-DX”<sup>†</sup>

### 1. Introduction

Dioxins (DXNs) discharged from various types of industrial furnaces such as waste incinerators and electric furnaces have become a social problem in recent years, and countermeasures have been demanded. Among methods of reducing DXNs in waste incinerator exhaust gas, the most widely used at present is powdered activated carbon injection, but activated carbon adsorption devices are being adopted to meet stricter emissions standards. However, the conventional activated carbon adsorption device is large in scale, and because the device contains a large quantity of combustible activated carbon, ignition prevention measures are necessary. For these reasons, application has been limited to only some waste incinerators.

Aiming at further popularization of activated carbon adsorption devices, JFE Engineering developed a compact activated carbon adsorption device called the “JFE-Gas-Clean-DX” with the goal of satisfying both compact size and a high elimination factor for trace amounts of harmful materials such as DXNs, volatile organic compounds (VOC), etc.

### 2. Features of JFE-Gas-Clean-DX

**Figure 1** shows the appearance of the device. The device adsorbs and eliminates trace amounts of toxic materials in exhaust gas by enabling efficient contact between the exhaust gas and the filled activated carbon. A cartridge structure is used for the activated carbon filled part, as this structure enables easy removal/installation of cartridges in the device housing. In the area of contact between the exhaust gas and the activated carbon in the cartridge, the flow of exhaust gas is properly divided in a crossing flow structure, maintaining a high DXNs elimination factor, yet reduces contact resistance with the exhaust gas (i.e., pressure loss) to  $\leq 1$  kPa (100 mmAq).

In activated carbon adsorption devices, which are filled with a large quantity of granulated activated car-

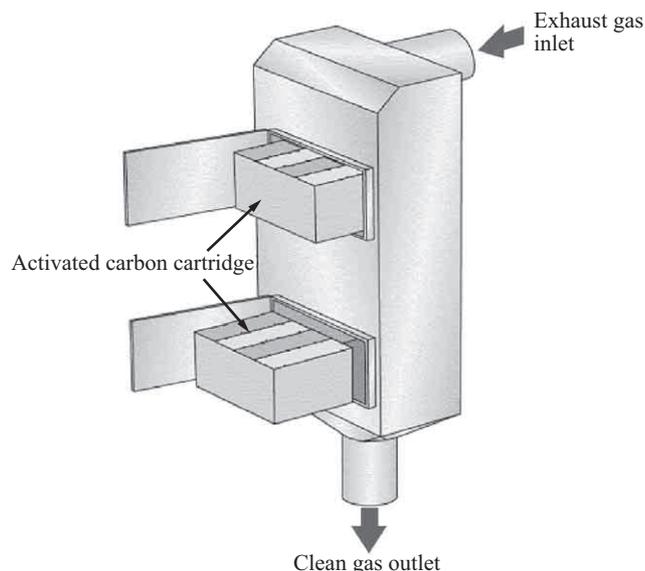


Fig.1 JFE-Gas-Clean-DX

bon, there is a possibility of local high temperature spots generation by contact with the exhaust gas, which might lead to an ignition of activated carbon. For this reason, strict control of the gas temperature and installation of a chokedamp fire extinction device for use in emergencies is necessary. To solve this problem, JFE Engineering developed a new type of activated carbon which has high heat conductivity and a low heat storage capacity while also maintaining adsorptivity. As a result, the applicable exhaust gas temperature range was expanded to approximately 200°C, and it was possible to eliminate auxiliary equipment such as the fire extinction device.

Thus, by developing an original activated carbon cartridge and a new type of high performance activated carbon, it was possible to realize both compact size in the equipment and a high DXNs elimination factor. The advantages of this device are summarized below:

- (1) DXNs concentration can be reduced to 0.01 ng-TEQ/m<sup>3</sup>N or lower.
- (2) Installation space is approximately 1/5 or less than that with conventional activated carbon adsorption devices (comparison by JFE Engineering), and an integrated structure with a bag filter is also possible.
- (3) Auxiliary equipment such as a fire extinction device for emergency use is not necessary.
- (4) Because a fixed bed activated carbon cartridge struc-

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ture is used, the device has no moving elements, and therefore does not require daily operation or maintenance work.

- (5) Because the ignition temperature of the activated carbon is high, operation at high exhaust gas temperatures is possible (maximum exhaust gas temperature: approx. 200°C).
- (6) Filling with chokedamp gas for fire prevention during equipment stop is not necessary.
- (7) The life of the activated carbon during equipment stop is long (approximately 1 year), and the activated carbon exchange frequency is low.

### 3. Results of Demonstration Test

With the cooperation of Hino Motors, Ltd. in all aspects, a practical-scale test device (gas treatment capacity: 22 900 m<sup>3</sup>N/h) was installed in Hamura Clean Center, Hino Motors, Ltd. (continuous fluidized bed incinerator for incineration treatment of waste generated by Hino Motors, Ltd.), and a long-term demonstration test was performed. With an inlet DXNs concentration of 9.6 pg (0.009 6 ng)-TEQ/m<sup>3</sup>N, the device outlet DXNs concentration was 0.50 pg (0.000 50 ng)-TEQ/m<sup>3</sup>N, thus achieving an ultra-low concentration which satisfied the

air standard.

### 4. Conclusion

The JFE-Gas-Clean-DX activated carbon adsorption device adsorbs/eliminates trace amounts of harmful materials in exhaust gas by efficiently utilizing the intrinsic adsorption function of activated carbon. Therefore, the device is not limited to dioxins, but is also applicable to adsorption/elimination of volatile organic compounds (VOC), which were placed under legal emission regulations in Japan in 2006. Because the structure of the device is simple and pressure loss is low, as mentioned above, retrofitting in existing systems is simple and the load on the exhaust gas fan is low. Based on these various advantages, JFE Engineering aims at further popularization of the new device.

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