

Removal of Mercury from Flue Gas using Activated Carbon

Background

Control of emission of mercury and its compounds to the atmosphere from various industrial sources is essential in decreasing the total emission of mercury. Article 8 of the Minamata Convention requires for the control and reduction of mercury and its compounds to the atmosphere through measures to control emission from point sources falling within the source categories listed in Annex D of the convention (Coal-fired Power Plants, Coal-fired Industrial Boilers, Smelting and roasting processes used in the production of non-ferrous metals, Waste Incineration facilities and Cement Clinker production facilities).

For countries that are in a phase of transition to industrialized economy, increase in the number of facilities specified in Annex D of the Minamata Convention can be expected. In order to prevent and alleviate atmospheric pollution from these facilities, application of BAT is deemed to be essential.

Overview of the Technology

Facilities with combustion processes like incinerators, boilers, cement kilns etc. are typically equipped with a combination of various flue gas treatment devices like denitrification devices, Fabric Filters (FF), Dry or Wet Scrubbers, Flue gas Desulphurization (FGDs) units etc.

Although these devices are effective in reducing the emission of mercury to a certain extent, they are designed for the treatment of NO_x, SO_x, PM etc. and not specifically for the removal of mercury from flue gases.

In Japan, after the bitter experience with Minamata disease, an increase in public awareness to mercury has resulted in the development of an effective technology that uses activated carbon to adsorb mercury from flue gas. A high degree of microporosity and specialized processing makes it possible for mercury present in the flue gas to be effectively adsorbed into the activated carbon, thus preventing its emission. Granulated activated carbon can be installed in the form of pellets in an activated carbon tower, and powder activated carbon can be injected into the flue gas (activated carbon sorbent injection). In Japan, various types of gas treatment devices that utilize activated carbon are used in incineration plants to control mercury emissions.

Granular Activated Carbon

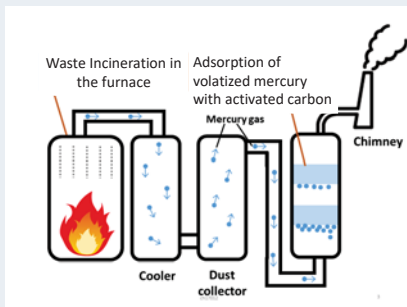


Powder Activated Carbon

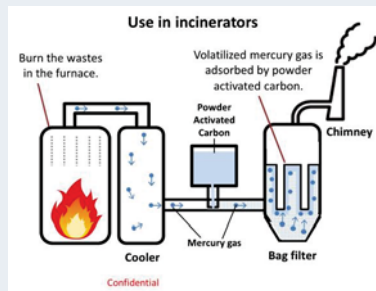


Photos provided by Ajinomoto Fine-Techno Co., Inc.

Mercury removal from a typical incineration plant using Granular activated carbon



Mercury removal from a typical incineration plant using Powder activated carbon



Source: Ajinomoto Fine-Techno Co., Inc.

Advantages/Strengths

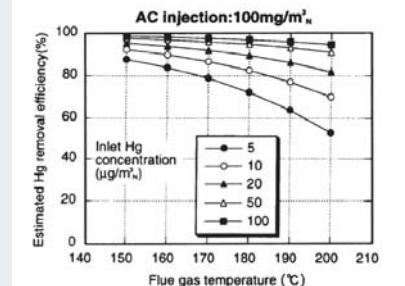
Effective Removal of Mercury

Injection of granulated activated carbon into the flue gas is being used to effectively remove mercury. Although factors like gas temperature, mercury concentration and other flue gas parameters also play a role, it is possible to obtain a high degree of mercury removal performance using activated carbon.

Products with Enhanced Performance

Activated Carbon products that, under specific conditions, have a comparatively higher adsorption potential (up to 1000 times compared to traditionally used ones) have also been developed and can also be used in small flue gas treatment devices. As these products last longer, they do not need to be replaced as often. This helps in reduction of the amount of waste generated, contributing to the reduction of the total operation cost of the flue gas treatment devices. These products also provide improved stability at higher flue gas temperature.

Mercury Removal Efficiency of Activated Carbon Injection in incinerators of municipal solid waste (MSW)



Source: Japan Environmental Facilities Manufacturers Association

Activated Carbon products with enhanced performance

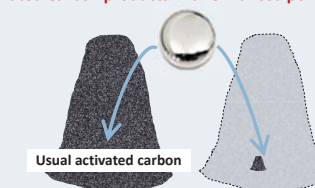


Photo provided by Ajinomoto Fine-Techno Co., Inc.

Applicability

Mercury control needs to be considered as part of a comprehensive pollution control measure that includes other pollutants. From the viewpoint of mercury removal, activated carbon is considered to be one of the most effective methods for the removal of mercury from flue gas and is being successfully used in facilities like incinerators to control emission.

Activated Carbon products come in various forms like granular (crushed type/pellet type), powders which have been engineered into various forms like towers or sorbent powders. Depending upon the requirement, the appropriate product can be chosen and applied.

Further Reading

MOEJ, Technologies for the treatment of flue gas from incinerators (Japanese only)
https://www.env.go.jp/council/07air-noise/y079-03/mat02_7.pdf