‘Activated carbon’: effective at locking away mercury

Mercury is often removed from industrial emissions with ‘activated carbon’ which is then disposed of. A recent study assesses the adsorption of mercury by four types of activated carbon and demonstrates that they all provide a permanent means of locking away mercury.

As part of the EU Mercury Strategy¹ emissions of mercury from major industrial sources are subject to the EU legislation on air quality². One of the main strategies for controlling mercury emissions from combustion processes is to inject activated carbon into the gas as it is emitted from the flue.

Activated carbon is powdered and porous (lots of small holes), giving it a large surface area available for adsorption. Once it adsorbs gaseous mercury, it is captured with fly ash and then typically disposed of in ash ponds or landfills. This study assessed the stability of mercury adsorbed by activated carbon.

Two commercial activated carbons were studied, one of which was impregnated with a minimum of 10 per cent gaseous sulphur at low temperature. Two other activated carbons were impregnated with sulphur by reactions with sulphur dioxide at relatively high temperatures.

Each activated carbon was exposed to a level of mercury that was similar to that experienced in flue gas. The stability of the adsorbed mercury was assessed using a standard method called the Toxicity Characteristic Leaching Procedure (TCLP) which simulates the conditions of landfill. The steps of mercury release were also investigated.

For all forms of activated carbon, the TCLP demonstrated that very little mercury is released. This indicates that the adsorption was stable and would provide permanent sequestration after disposal.

The study also found that there are two forms in which mercury is sequestered or stored. In the activated carbon impregnated by sulphur dioxide, at least 75 per cent of mercury is bound in its elemental form, i.e. it remains pure and does not react with other elements. However, for the activated carbon impregnated with gaseous sulphur at low temperatures, the mercury reacts with the sulphur and nearly 60 per cent is bound as mercury sulphide.

The study demonstrates that activated carbon can immobilise mercury via two different mechanisms: binding in its elemental form and binding as a sulfide. While the mechanisms are different, the mercury is highly stable in both cases, and will remain permanently sequestered after disposal.

1. See http://ec.europa.eu/environment/chemicals/mercury
2. See http://ec.europa.eu/environment/air/legis.htm


Contact: j_graydon@utoronto.ca

Theme(s): Chemicals, Waste