METHYL BROMIDE EMISSION CONTROL: Adsorbent Recycling and Bromine Recovery

James. G. Leesch, USDA-ARS
Gerhard F. Knapp, GFK Consulting Ltd.

SUMMARY

A process to control emissions of Methyl Bromide (*MB*) has been tested on a laboratory scale at the USDA-ARS facilities in Fresno. The process consists of trapping the *MB* on activated carbon, desorption of the *MB*, reactivation of the carbon for further use as adsorbent, thermal destruction of the desorbed *MB* for reuse of the bromine in the manufacture of new *MB* and other brominated compounds.

A laboratory apparatus was designed to evaluate the effects of carbon type, temperature, and relative humidity on the loading of *MB* onto activated carbon and to evaluate the effects of volatiles from a commodity on the continued sorptive capacity of the recycled activated carbon. Tests revealed that temperature had the most effect on the loading of *MB* on the activated carbon. The relation was inverse and loading ranged from approximately 6% to 18% (g.*MB*/100g.activated carbon).

The relationship between loading and humidity was a more complicated relationship which was also inverse but changed after the carbon was recycled from the original loading. It was found that the mass transfer reaction in the column could be followed by observing the temperature in the column as the *MB* ladened air passes through the column. The heat of adsorption produced a band of heat that could be followed and which effectively reduced the relative humidity of the air stream. Thus, even when a stream of air with *MB* at high humidity was introduced, the expected loss in capacity due to water was reduced because of the heating of the column by the heat of adsorption.

When carbon was repeatedly used to adsorb and desorb *MB* in an air stream ladened with the volatiles of oranges, no loss of the capacity of the carbon was observed. Some loss of capacity was noted between the first and subsequent uses of the carbon because of a phenomenon that caused the carbon to react differently toward the water content of the stream after the first sorption.

In all our testing the feasibility of using this technique as a method to eliminate or greatly reduce the emission of methyl bromide into the atmosphere after commodity fumigation was encouraging. Now we are in the process of testing the system on a pilot scale in both a 500-ft^3 chamber and in actual fumigations using a slip stream to pass through a carbon bed. Presently a new Cooperative Agreement is being prepared to include Great Lakes Chemical Corporation for testing the system on a pilot scale. By next year we hope to have a prototype unit ready for commercial use along with ways to recycle the carbon and bromine.

DISCUSSION

There are two ways of protecting the stratospheric ozone layer: The first way, which has been selected by some countries because of existing laws and agreements, is to ban all production and use of *MB*. This will guarantee reduced *MB* emissions, but at a considerable economic cost to society. The second way to protect the ozone layer is to allow the continued use of *MB* for commodity fumigations, and to control the *MB* emissions to the atmosphere. There will be a major economic benefit to society by controlling *MB* emissions, rather than by banning *MB*. The ozone layer is protected in either case.

Regulatory personnel (US-EPA, USDA-APHIS, CAL-EPA, CA-DPR, South Coast [Los Angeles] Air Quality Management District) have been kept informally appraised of our efforts. The spent carbon is not a RCRA Hazardous Waste. It may be a CA listed waste, unless we can meet California's "recycling" criteria. We have met with CAL-EPA, CAL-DPA, USDA-APHIS and other agencies who are encouraged by the research results to date and are cooperating to see that pilot tests and on-site slip-stream testing is made possible and the required permits are obtained.

The final step in the verification of the process is to perform emission control at a commercial site. Commercial adsorption vessels are available and can be placed in service on short notice if the appropriate blower and ducting are available.