

ACID GASES, MERCURY, AND DIOXIN FROM MWCs

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Discussion by:

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The authors are promoting the proprietary Sorbalit process for control of various pollutants derived from the combustion of municipal solid waste. The driving force is the current and future regulation of these pollutants, e.g., the New Source Performance Standards which require that MWCs burning more than 250 TPD limit SO₂ to 30 ppm (or 80% removal), limit HCL to 25 ppm (or 95% removal), limit metals to 34 mg/Nm³ (including Hg for which the German standard is 50 ug/Nm³), and limit dioxin to 30 ng/Nm³. A particular advantage of the Sorbalit process is its ability to perform without substantial retrofit of existing air pollution control equipment.

Sorbalit is formulated to promote a particular reaction(s) via adsorption. The calcium reactions remove SO₂ and HCl, and can be obtained from either pebble lime or hydrated lime, dependent on the temperature regime of the flue gas. The carbon reactions remove mercury (Hg) and dioxin and can be obtained from either coal or carbon black. Sulfur reactions can assist in Hg removal, if necessary.

The downstream particulate collection equipment influences the removal efficiency of the trace compounds. Baghouses, which generally emit substantially less particulate (or reacted Sorbalit), will require lower stoichiometry than electrostatic precipitators.

Typical removal capabilities and outlet concentrations are given for SO₂, HCl, PCB, Hg, and dioxin. Mercury removal has been found to be especially sensitive to inlet concentration and temperature of the flue gas.

Substantial text, figures, and tables are devoted to theoretical discussions. These may be of greater interest to a specialist than to general readers. Discussion of test results at several plants with various existing pollution control equip-

ment is quite useful. Perhaps comparison of these actual results with typical values would be even more enlightening. PCB test results are presented but not discussed in the theory section or the title of the paper.

While the title of the paper indicates an "economic" analysis, there is nothing presented therein on which an owner or operator of a MWC could base a cost/benefit analysis of meeting specified emission limits. While it may be comforting to learn that substantial equipment is not required, it would be useful to provide some "economic" parameters for the Sorbalit process.

AUTHORS' REPLY

The authors would like to thank Mr. Henderson for his thorough review and understanding of the adsorption technology. In his review he asks for three points of clarification:

- (1) Can we make comparisons to actual conditions?
- (2) Can we provide a discussion on PCB test results?
- (3) Can we provide some economic parameters?

We will address each of his points as follows:

(a) Typical emissions of uncontrolled emissions from MWCs in the U.S. are:

SO ₂	212 ppmv
HCl	532 ppmv
Hg	600 µg/dscm

The emission of dioxins is more difficult to present on a typical basis. However, from our experience, the uncontrolled emissions from a well designed and operated mass burn facility (prior to a dry scrubber) ranges from 1 to 10 ng/dscm TEQ.

(b) There is very little published data for PCB emissions from MWCs. We believe, however, that the adsorption properties of carbon for PCBs is very similar to dioxins. The data presented in our paper in Table 4 was obtained at a haz-

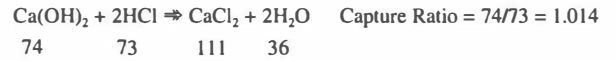
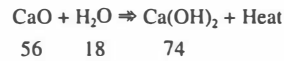
ardous waste facility, and tests were conducted because PCBs were a concern. The data in Table 4 was considered important, since the uncontrolled PCB emissions were high and Sorbalit was able to reduce them to nondetectable limits.

(c) Mr. Henderson correctly points out that one of the major economic advantages is that little or no capital costs are required for most applications of Sorbalit. In addition, there are no up front licensing fees, and in general there is little or no increase in maintenance cost. Our estimate for the up front cost to install a carbon injection system in most plants ranges from \$500,000 to \$2,000,000.

AUTHORS' CLOSURE

Upon a final review of our paper after it was printed, we noted a typographical error which changed the stoichiometric calculations for the use of lime. The following are the corrected calculations and summary that were impacted by this error.

Hydrated Lime



1 lb of CaO yields 1.32 lb of Ca(OH)₂

The stoichiometry of Ca(OH)₂ with acid gases requires:

(a) 1.156 lb of Ca(OH)₂ to capture 1.0 lb of SO₂

(b) 1.014 lb of Ca(OH)₂ to capture 1.0 lb of HCl

The characteristic stoichiometric reaction of Ca(OH)₂ per ton of typical MSW is:

lb Ca(OH)₂/ton MSW

$$\text{SO}_2 = 5.03 \text{ lb SO}_2/\text{ton MSW} \times 1.156 \text{ lb Ca(OH)}_2/\text{lb SO}_2 = 5.815$$

$$\text{HCl} = 7.03 \text{ lb HCl}/\text{ton MSW} \times 1.014 \text{ lb Ca(OH)}_2/\text{lb HCl} = 7.128$$

$$\text{TOTAL} \qquad \qquad \qquad 12.943 \text{ (12.9)}$$

Technology	Hydrated Lime		Quick Lime	
	lb of Sorbalit per ton of MSW	Stoichiometric Ratio	lb of Sorbalit per ton of MSW	Stoichiometric Ratio
Spray dryer/fabric filter	24	1.86	20	1.90
Spray dryer/ESP	40	3.10	35	3.33
Dry injection/fabric filter	50	3.87	n/a	
Conditioned dry injection/fabric filter	24	1.86	n/a	