COMPARING LEAKAGE RATES OF METHYL BROMIDE AND SULFURYL FLUORIDE DURING FUMIGATIONS IN A FLOUR MILL UNDER NEARLY IDENTICAL SEALING CONDITIONS

Watcharapol Chayaprasert, Dirk E. Maier, and Bhadriraju Subramanyam
Grain Science and Industry Department, Kansas State University, Manhattan, KS 66506

In structural fumigation, half-loss time (HLT) is the most used indicator for comparing fumigant leakage rates. It is well known that HLT is influenced by sealing quality and environmental conditions. However, in typical discussions where gas leakage rates during structural fumigations are compared, environmental conditions generally are not analyzed in details and sealing quality is assumed the same. This gives a false impression that a certain gas fumigant might be contained in a structure better than others. A structural fumigation study was conducted at the Hal Ross Flour Mill (Fig. 1a) of Kansas State University, Manhattan, Kansas in order to compare leakage characteristics of methyl bromide (MB) and sulfuryl fluoride (SF).

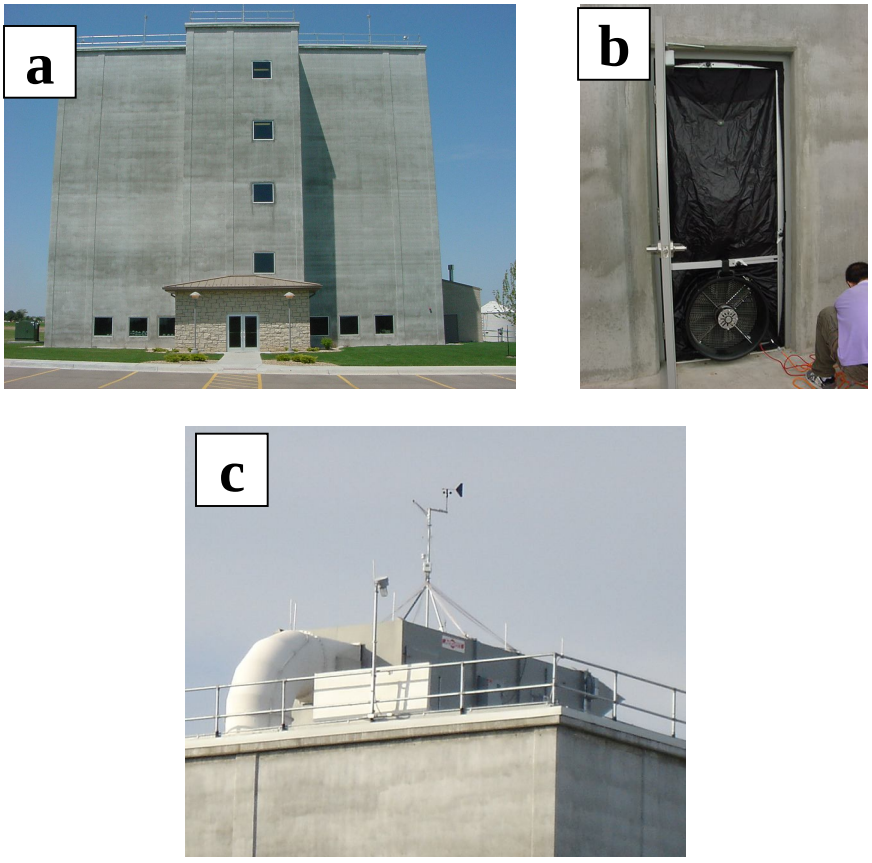

Figure 1.

The mill has five floors with a total volume of approximately 9,628 m^3 (340,000 ft^3). Two sets of one 24-hr MB and one 24-hr SF fumigation experiment were conducted in May and August 2009. In each set, the two fumigations were carried out within a three-week time span. Preparation of all fumigations was done by professional fumigators following the fumigant respective labels. After sealing the mill, for each fumigation, sealing quality was verified by a building pressurization test. The pressurization test was conducted using a specially made blower door fan attached to one of the exist doors (Fig. 1b). The building was subjected to different pressure levels. At each pressure level, the airflow rate through the fan was measured. By plotting the pressure VS flow rate relationship, the leakage characteristics of the building could be determined. Fumigant concentrations were continuously monitored during the entire fumigation period at six locations distributed evenly in each floor of the mill. In addition to monitoring of fumigant gas concentrations, environmental conditions were monitored. A weather station was installed on the roof of the mill (Fig. 1c), monitoring outside barometric pressure, wind speed and direction, temperature, and relative humidity. A temperature/relative humidity logger was placed in each floor of the mill.

The result of this study provided a head-to-head comparison between MB and SF under nearly identical conditions in the same facility. The pressurization test showed that sealing effectiveness can be quantitatively determined ahead of fumigation. It also confirmed the sealing quality of all the experiments to be similar. SF and MB showed similar gas dynamics and thus leakage characteristics. Although the observed HLTs of the fumigations were different, it could be explained by the differences in environmental conditions.