BENCH-SCALE EVALUATION OF LOCALLY- SOURCED ACTIVATED CARBON FOR POSTHARVEST METHYL BROMIDE RECAPTURE

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Abstract.

Activated carbons (AC) prepared from plum and peach stone as well as almond and walnut shells have been found to be effective adsorbents for the recapture of methyl bromide (MB) following postharvest fumigations. The most effective preparation of each of the above raw materials were prepared in kilogram quantities, and evaluated under high humidity conditions. The effects of scaling up the production quantities and high humidity testing were determined as well as the storage stability of MB on each carbon type.

Presentation Summary.

The purpose of this work was to test the viability of certain agricultural by-products as raw materials for the preparation of AC to trap MB vapors following post-harvest fumigations. The potential advantages of this approach are:

- More cost-effective method of MB capture
- Local source(s) of AC
- Value-added additional use for agricultural by-products

Previously, different ACs were screened at the laboratory-scale using columns holding ~6 g of AC each. Because the effect of moisture in the MB airstream is more pronounced at lower AC masses, testing was performed with a dry airstream and with AC that was dried before use. However, the "scalability" of MB sorption onto AC is a critical element. We report the effect of scale on the procedural components of AC preparation, the change in AC quality, the flow rates and reaction times, and other practical challenges associated with scaling preparations from the gram to kilogram scale. Additionally, the effect of scale in testing the sorption capacity of AC was examined, particularly with respect to how the diameter and loading of the adsorbent column changes the amount of water vapor (relative humidity) in the sample stream.

The effect of scale on MB sorption efficiency was determined by challenging each AC type on the bench-scale adsorbent column (BSAC), which holds ~ 2kg AC, an ~300x increase over the mass of AC used in screening. Humidified air (~75% R.H.) is mixed with MB to simulate the aeration of a chamber at 64 mg/L MB over 30 min (1 air exchange / 7 min). Doses are repeated until breakthrough is observed, >500 ppm MB exiting the column, with the moisture content of the carbon measured before and after testing. To determine the storage stability of MB on the various types of AC, MB-saturated AC was stored in an air-tight jar and the headspace concentration of MB was monitored through time. Findings are discussed in the context of safe handling procedures for MB-dosed carbon as well as the potential reuse of the MB trapped on the carbon.