

# Understanding the Emissions from Aerated Composting Piles through Different Sampling Techniques

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## Abstract

The use of measurement protocols for agricultural gaseous emissions results in a wide range of estimates. Composting systems with intermittent forced aeration are complex open sources, for which no one protocol appears to be an appropriate standard. Herein, we tested the effect of mainline sampling protocols for open and enclosed composting with forced aeration, using an experimental composting 'sleeve', an enclosed pile with controlled 'forced aeration' (FA, via perforated pipe inside the pile) and 'surface aeration' (SA, via headspace). Emissions of ammonia (NH<sub>3</sub>), volatile organic compounds (VOCs), and odor were measured in a dynamic flux chamber (FC), a wind tunnel (WT), and direct exhaust ('end-of-the-pipe') and compared over time. A large variability was observed for VOCs, NH<sub>3</sub>, and odor, but emissions were significantly ( $P < 0.05$ ) higher ( $\times 3.2$ ) during FA vs. SA. Emissions reduced significantly ( $\times 2.3$ ) from day 8 to day 16 and then changed insignificantly till day 30. Emissions magnitude trend of WT>FC>exhaust was related to air exchange rates, whereas emissions of VOCs with low Henry's law constants were mostly affected by gas flow conditions. This study demonstrates the effect of protocols on the assessment of emissions under various composting and process conditions. Correction factors are needed to enable comparisons between emissions estimates from compost; yet large data variability makes it challenging. It is recommended that similar considerations are made for other open emissions sources.

**Keywords:** air emissions; flux chamber, livestock manure, sampling methodology, waste management, wind tunnel