Reducing H_2S Exposure Through a Water Spray Method and Monitoring

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Summary

The performance of commercial hydrogen sulphide (H2S) monitoring devices was verified by comparing readings with a reference analytical method using a gas chromatograph (GC). A spray treatment method was also evaluated for reducing worker exposure to H2S. Spraying with water was effective in reducing the levels of H2S released from agitated manure. An additive mixed with spray water did not help in reducing H2S levels.

Introduction

Various H2S control methods have been investigated at PSCI; one approach examined was the spraying of water-based liquid on the manure surface during agitation. Because H2S is water soluble, the rationale for this method was to try to put back into solution the H2S gas released during agitation, thereby reducing the airborne H2S concentration. Additionally, a commercially-available H2S monitoring instrument used in the preliminary studies on liquid spray effectiveness showed inconsistent readings when subjected to various conditions during spray application.

Experimental Procedures

The general experimental approach was to apply the spray treatment in an enclosed manure chamber while simultaneously collecting data using the H2S monitors (Draeger PacIII) and gas samples for analysis using the GC system. The performance of the H2S monitors was verified by comparing the readings from the monitor with readings from a GC-based reference analytical method. The effectiveness of the spray treatment was evaluated by comparing the H2S levels in the enclosed chamber during tests without spray (Control) and with the application of spray (Treatment). Treatment tests were conducted using water only, and with the chemical additive mixed with water at varying dilution levels.

Results and Discussion

Summarized in Table 1 are the H2S readings in bagged gas samples using the GC system and the H2S monitor. A paired t-test comparison showed no significant difference ($p>0.05$) between the GC values and the H2S monitor readings over the 0-1000 ppm range of the monitor.

Results from three trials showed that spraying with water only caused a slight initial increase in H2S levels (at t = 1), followed by subsequent significant reduction in H2S (Fig. 1). The water spray treatment was consistently effective in all trials, reducing the H2S levels by 87% relative to initial values, which is 23% lower than the Control tests. However, the spray with additive treatment did not help in reducing H2S levels.

Table 1. Summary of H_2S Values determined using the GC system and H_2S Monitor

	H_2S concentration (ppm)	
	GC method (reference)	H_2S monitor
Mean (n = 131)	341.2 a	345.7 a
Standard Error	19.3	20.0
Minimum	4.0	2.0
Maximum	905.2	985.0
95% Confidence interval	38.2	39.6

[a] indicates no significant difference between means at α=0.05.

Conclusion

Spraying water over the agitated manure surface can control the rate of release of H2S gas. Once fully investigated, incorporating this technology in swine barns can help prevent worker and animal exposure to high levels of H2S when emptying manure pits.

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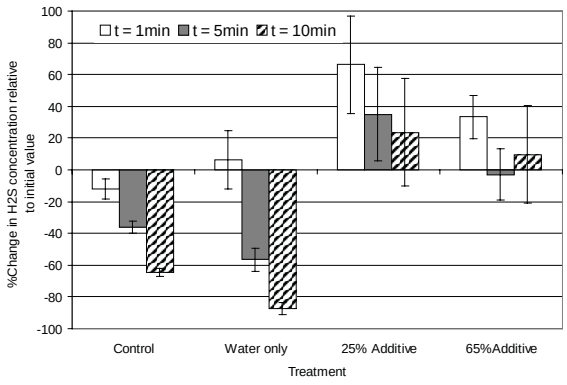

Figure 1. Average percent change in H2S levels relative to initial concentration (at t=0) as influenced by the treatments applied