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QUICKPHLO-C™: RECENT DEVELOPMENTS IN CONTROLLED, SLOW GENERATION OF PHOSPHINE

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ABSTRACT

Recent developments in phosphine generation based on a wax block formulation of aluminium phosphide that delivers controlled rates of phosphine production are described. Use of a dual reactor design with a single control panel provides rates of 5, 10, 15 and 20 gh^{-1}. These rates are maintained over sixteen days to service active fumigation techniques, supplying a relatively constant flow of fumigant in air. The equipment consists of dual reactors a control panel and related accessories to handle controlled on-site generation of phosphine with safe shut-down in the event of extended power failure. Air is drawn through the reactors to safely displace the generated phosphine into the storage to maintain a uniform effective concentration of phosphine throughout the fumigation. Trial results are presented of controlled phosphine generation at the higher rate of 20 gh^{-1}. A trailer mounted design matched to a portable manifolded SIROFLO® application system for two bins is also described.

INTRODUCTION

Phosphine remains the most important insect control measure for stored durables. With the longer exposure times recommended by active application processes, such as SIROFLO®, (Winks and Russell 1994) the development of methods to generate the relatively low rates over sixteen days was reported in Waterford and Asher 2003.

Threats to the continued use of phosphine include insect resistance/tolerance, occupational health and safety (OH&S) concerns, and environmental issues on ventilation, ineffective application techniques and lack of alternatives leading to over reliance on phosphine. Controlled on-site generation provides some possible solutions including control of application and no need to enter stores with ground level application, easy retrieval and disposal of spent residue after fumigation and safer transport and storage of formulation.

Issues identified for further development included a higher average rate of production leading to a need for transportability. OH&S concerns led to a requirement for scrubbing of the generator output during an unscheduled shutdown. This paper reports these improvements in design and trial data for a twin-pot version capable of delivering 5, 10 15 or 20 gh^{-1} over sixteen days.

RECENT DEVELOPMENTS

UPL Ltd developed a generator capable of generating up to 20 gh^{-1} generator. The Pot size and block size were determined as the design constraints. The most efficient solution was to use two pots each fitted with either a 5 or 10 gh^{-1} block controlled by a single set of control hardware to deliver the reaction moisture to the blocks. In this way the fumigator can select rates between 5 and 20 gh^{-1}. This design was developed and tested at UPL Ltd Vapi and is shown being tested in laboratory trials in figure 1.

The trial conditions for the twin-pot design at the maximum rate

- Phosphine generation rate 20 g h^{-1}
- Airflow rate 280 L min^{-1}
- Weight of block 11.7 kg
- Size of block Diameter=415mm Depth=61mm
- Two pots each fitted with a 10 g h^{-1} block
- AlP content of blocks 56%

Typical results at the maximum rate for the twin-pot design are shown in figure 2. At the completion of the fumigation the residue remaining in the reacted block is approximately 0.8% - low enough to be ready for immediate disposal.

Ausbulk Ltd developed a transportable rig, shown in figure 4, to carry the generator and safety equipment designed to handle intermittent power failure described in Waterford and Asher 2003 and a small scrubber designed by UPL Ltd to remove generated phosphine during an unscheduled shutdown, shown in figure 3.

The higher rate of 20 g h^{-1} PH_3 would require a redesign of the trailer to mount the two pots shown in figure one side by side in the trailer with provision made for the extra water and emergency shutdown paraffin described in Waterford and Asher 2003.

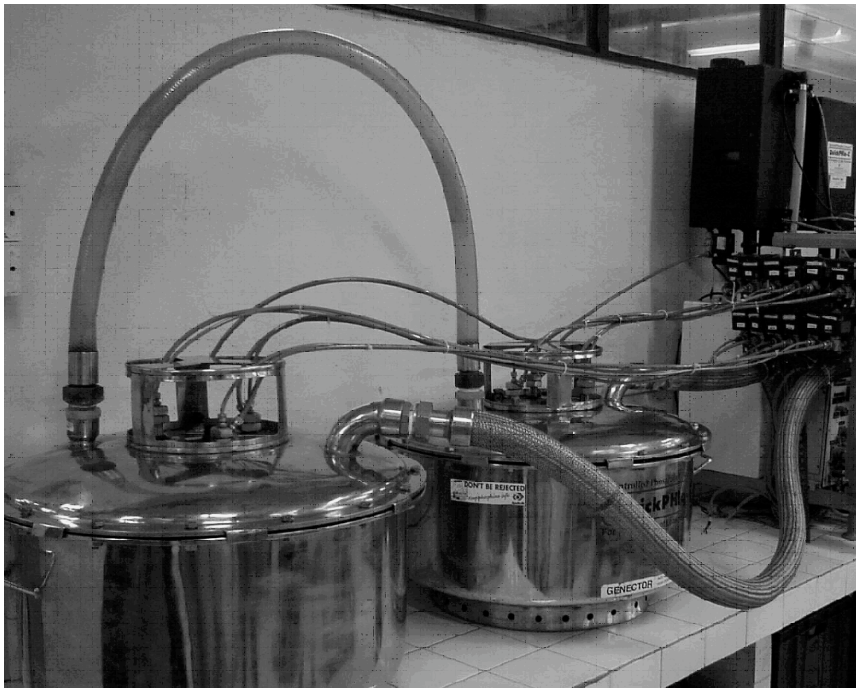

Figure 1. Trial of twin-pot generator fitted with two blocks generating 20 gh^{-1} over 16 days.

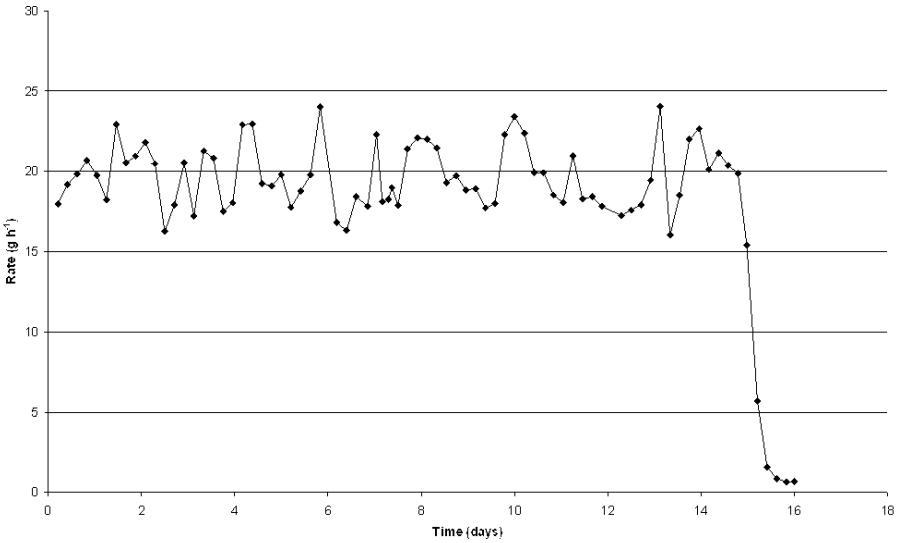

Figure 2. Typical output over 16 days for a twin-pot generator each fitted with an 11.7 kg block and an air flow rate of 280 Lm^{-1} to carry the generated gas from the generator to the fumigation.

Figure 3. Charcoal scrubber designed to safely remove residual production of phosphine during an unscheduled shutdown of the generator.

Figure 4. Trailer mounted version of the 10 gh^{-1} single pot generator.

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