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Study on using synthetic amorphous silica (SAS) as phosphine resistance breaker

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ABSTRACT

Phosphine resistance has occurred in most grain production countries that rely on the phosphine fumigation for management of stored grain insect pests. Inert dusts, such as diatomaceous earth (DE) dust is a kind of physical treatment, has long been used as a non-chemical method for pest control purpose. Particularly, food grade synthetic amorphous silica (SAS), one of the most effective powders, was evaluated for control of phosphine resistant stored grain insects. The mortalities of primary and secondary stored product insects of phosphine susceptible and resistant lesser grain borer, *Rhyzopertha dominica* (F.), and red flour beetle, *Tribolium castaneum* (Herbst) were compared under the SAS treatment. The complete control was achieved after 3 d treatment with 50 g SAS dust per tonne of grain. The dead adult insects were analysed. The results showed that sugars and amino acids were completely exhausted, which indicated the SAS could induce further energy exhaustion by deteriorating energy metabolic chain. Therefore, the SAS offered equally fatal to both phosphine susceptible and resistant stored grain insects. This study showed that SAS product could be an alternative to provide a solution to solve phosphine resistant issues and offer industry a non-chemical alternative for management of phosphine resistant insects in stored grain.

Keywords: Synthetic amorphous silica, Phosphine resistance, Metabolites, Stored grain insects, Lesser grain borer (*Rhyzopertha dominica*), Red flour beetle (*Tribolium castaneum*)